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Joint Egypt/United States Report on Egypt/United States Cooperative Energy Assessment

Volume 5 of 5 Vols.
Annexes 11-13

April 1979

U.S. Department of Energy
Assistant Secretary for
International Affairs

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Prepared collaboratively by representatives of the Government
of Egypt and the United States Department of Energy with the
assistance of the United States Department of State.

U.S. Department of Energy

Assistant Secretary for
International Affairs
Washington, D.C. 20585

VOLUME V

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1.0 EXECUTIVE SUMMARY

As part of the Egypt-U.S. Cooperative Energy Assessment, the principal features of the existing environment of Egypt have been characterized and the main problem areas identified. This, together with predictive descriptions of the impacts that would be associated with the development of each energy technology, can provide guidance in the choice between energy options and in the siting and control of new energy facilities.

Approximately 96 percent of the population of Egypt lives in the Nile valley, the delta and the two cities of Cairo and Alexandria. Since industry and agriculture are also concentrated in this small part (about 5 percent) of the land area of Egypt, it is not surprising that most man-made pollution is also found here.

Except for the wells in the desert which draw from a large aquifer underlying much of Egypt, the Nile River is the only source of fresh water for the country. With the completion of the Aswan High Dam, the flow of the river has become much more reliable but the final long-term effects on the ecosystems dependent on the river are not yet understood. Changes have occurred due to the dam. Most noticeable of these changes is the lack of silt which used to be carried to the delta by the annual flood. This has had obvious impacts on agriculture and has also adversely affected the fish population because of increased transparency of the water throughout the year. Preliminary investigations indicate that while the substantial reductions in fish populations are now probably stabilizing, there has been a significant decrease in biological diversity. In addition, the marked reduction of silt deposition at the mouth of the delta has allowed the erosional forces of the Mediterranean Sea to encroach on the land, causing a regression of the ocean front.

Because of its large and fairly steady flow, the Nile keeps itself relatively clean throughout most of its length. Although there are local water pollution problems near Cairo where industrial plants are concentrated and sewage treatment plants are overloaded, as well as on the Damietta branch where the water becomes almost stagnant due to low flow, Nile water-quality generally compares well with other great rivers of the world.

There is a serious water pollution problem in Lake Maryut, southwest of Alexandria, due to the direct discharge of liquid wastes from nearby industrial plants. To the northwest of the city, parts of the Bay of Alexandria are also highly polluted due to discharges of liquid industrial wastes and untreated sewage, and discharges of bilge and other wastes from ships anchored off shore.

The major air pollution areas of Egypt include Greater Cairo and the Western portion of Alexandria, with lesser problems in Suez and between Tanta and Kafr El Zaiyat in the Nile delta. Industry without air pollution controls, streets overloaded with automobile and truck

traffic, and the open burning of trash all add to the large natural background of dust to create conditions which probably lead to serious health effects.

The options which are open to Egypt for increasing the energy supply of the country can be considered generally relatively benign, so far as environmental impacts are concerned, if appropriate environmental control measures are included in the energy development design for each option. The secondary industries which are likely to grow as more energy becomes available may be of equal or greater concern.

Normal operation of most modern energy facilities with environmental controls does not result in large impacts on the environment. However, accidents or abnormal operational modes can cause extensive damage to ecosystems which sometimes cannot easily be repaired. For example, effluent releases from a nuclear reactor are small and generally have insignificant impact. In case of a major accident, however, land area and water could be extensively contaminated. Oil drilling facilities and refineries do release some harmful effluents, but the potential for widespread damage is much greater when blowouts or fires occur.

It is important when planning an energy facility to take both normal operating effluents and accident conditions into account. This can best be done by considering a combination of general siting guidelines together with site specific environmental assessments prior to the development of new energy resources or the construction of any energy plant.

Both energy development and the quality of the environment are important to the future of the people of Egypt. There is no need to sacrifice one for the other. With proper assessment and planning prior to the development of new energy resources and the construction and operation of energy facilities, and the employment of measurements and controls afterwards, Egyptian energy development can proceed without imperilling the environment or the quality of life of the Egyptian people.

2.0 INTRODUCTION

This report will identify and describe the environmental, health, and associated social issues that must be considered in choosing from among the options available to Egypt for meeting projected future energy needs. The environmental impacts associated with these options will be discussed and observations will be made of alternative ways to minimize environmental insults.

The environment of Egypt has certain features and problems common to many of the industrial countries of the West. It also has characteristics particular to an older civilization caused by conditions such as overcrowding, underemployment, lack of capital, lack of economic opportunity, decayed housing, and overloaded public transportation systems.

These socioeconomic problems affect the quality of life just as the air and water affect the health of the people. All are problems associated with the environment and must be handled in some integrated way. Thus, as new housing and transportation systems are built, their effect on air and water pollution must be considered. As new industries and new cities are developed, consideration must be given to their effect on other factors important to the overall environment.

Therefore, as a preliminary step toward projecting the environmental consequences of new energy-resource development, the authors have characterized the present base environment of Egypt's major development sectors. This includes a discussion of water availability and water quality, urban air quality, present land use patterns, distribution of sensitive ecological systems, and archeological and historical sites that must be protected.

The result of this baseline characterization will be the identification of present or potential environmental problems or constraints. This will indicate sites where the environmental carrying capacity has already been exceeded and where new facilities should not be sited without considerable environmental evaluation and control. Finally, environmental issues associated with each energy resource within the nation will be identified. This will include residuals for the types of plants and facilities being considered and a discussion of the potential impacts of these additional residuals. This will lead to a series of conclusions that emphasize energy development while protecting and enhancing the environment and human health.

Because at present no governmental ministry has been designated to have responsibility for environmental protection in Egypt, the authors' principal contacts in gathering data for their analyses were individuals in the Academy of Scientific Research and Technology, the National Research Center, the High Institute of Public Health in Alexandria, and the universities and other environmentalists. The information in this report has been obtained through discussions with these officials and scientists and by a search of available reports. A complete list of persons contacted, sites visited, and reports exchanged is included in the Appendix.

This report is organized in six major sections, followed by two appendices. An Executive Summary (section 1) precedes this introduction (section 2). Following this there will be a discussion of the baseline environment of Egypt (section 3), which will be divided, for convenience, into four natural regions, i.e.:

- o The Nile System - Lakes Nasser and Nubia, the Nile, Cairo, and the Nile Delta
- o The Mediterranean - the Mediterranean Coast and Alexandria
- o The Red Sea, Gulf System - including Suez, Port Said, and Ismailia

- o The Desert System - including the Western Desert, Eastern Desert, and Sinai

The fourth section of the report will describe the major environmental problem areas. This will include areas where conditions of air, water, or noise pollution can or do have impact on health, agriculture, or social values. It will also include a short discussion of institutional problems.

The fifth section will discuss the additional impacts to be expected from the future energy options open to Egypt. Because the final form of these options cannot, at present, be accurately sited and scaled, it will be necessary to discuss the environmental aspects in somewhat general terms. Residuals associated with the fuel cycles will be described, and the factors and issues that must be carefully considered and controlled will be indicated.

The final section of the report will summarize conclusions drawn from the previous sections and offer some general recommendations on environmental policy issues. The latter will restate many of the recommendations previously made in reports and documents by Egyptian environmentalists and consultants, but modified to apply specifically to the development of energy resources to the year 2000.

3.0 BASELINE ENVIRONMENT OF EGYPT

3.1 The Nile System

The Nile River is the lifeline of Egypt, as it has been for millenia, since man first took up the plow along its shores and in the Delta. The system to be described here includes the Nile and the river valley, the Delta with its town and villages, the City of Cairo (El Qahira) and Lakes Nasser and Nubia. It will exclude Alexandria and the Mediterranean Coast, which generally have a significantly different environment. Since El Faiyum (El Fayyum) is watered by the Nile, it too will be considered a part of the Nile system.

Approximately 85-90 percent of Egypt's population live within this system, and almost all of its food crops are grown here. Both Lake Nasser and the Nile are important sources of fish, and the river itself has been an important means of transportation for thousands of years. This is by far the region of most socioeconomic importance to Egypt and that part of the environment which must be protected at all costs.

3.1.1 Lakes Nasser and Nubia: The Aswan High Dam, which was completed in 1967, has formed the 300-mile (mi) long reservoir called Lake Nasser north of the Egyptian/Sudanese border and Lake Nubia to the south, in the Sudan (figure 1). Because the lake resulted from the artificial impoundment of a major river, it retains features intermediate between a riverine and a lacustrine system. The filling process is

Fig. 1

Lakes Nasser and Nubia

still under way, which results in new environmental changes being superimposed on the regular seasonal variations resulting from climatic changes and seasonal flooding. Because of these variations, it is not yet possible to know the final steady-state conditions that the Lake will assume. As is expected, many of the Khors (see figure 1) are exchanging very slowly with the main part of the Lake and are already more or less independent.

One of the effects expected from the positioning of the High Dam at Aswan has been the considerable decrease in the amount of silt carried into the Nile during the annual flooding. Estimates made in 1939 indicated that as much as 100 million metric tons (t) of sediment were carried annually into the Nile in upper Egypt. Most of this suspended matter originated in the Ethiopian highlands, which are drained by the Blue Nile and the Atbara River.

Among the detrimental effects of the High Dam which had been predicted were the following:

- o Lack of silt would decrease the productivity of land in the delta.
- o Lack of silt would deepen the channel, undermining the bridges on the Nile.
- o Lack of silt and flooding would not replace delta land eroded by the Mediterranean.
- o Sediment would fall out behind the dam, causing the introduction of islands, and eventually a delta, in the Lakes Nasser-Nubia system.

Although these impacts are occurring to a greater or lesser extent, the rate at which change is taking place seems sufficiently slow so that action to repair the impacts can be initiated where necessary.

Deposition of sediment in the lake behind the High Dam is governed principally by the sudden decrease in velocity of the water as it reaches the lake about 500 kilometers (km) upstream from the Aswan. The deposition should be greatest here, but the pattern which is actually seen is more complex. Evidence of the predicted delta forming is seen in shallow mudbanks occurring between Attiri and Murshad in Sudan just south of the Egyptian border. The mudbanks disappear entirely north of Abu Simbel in Egypt. Thus the major part of the sediment falls out before it reaches the Egyptian border and Lake Nasser. The formation of new islands and a new delta is occurring principally in Lake Nubia.

The prospects for the development of fishing in Lake Nasser-Nubia are good. The reasons for this include high shoreline development; low mean depth of the Khors, where most fish are taken; high incidence of

phytoplankton blooms, macrophytes, and periphyton; and strongly established zooplankton and benthic populations. Factors acting against food fish production include low transparency of the water during flood; large seasonal variation in water temperature; and, most importantly, low diversity of species.

It has been predicted that between 21,000 and 30,000 (t) of fish eventually may be taken once conditions are stabilized and proper fishing methods are used. A total of 12,256 (t) of fish were caught in the reservoir during 1974, but the rate of increase seems to be slowing down.

3.1.2 The River Nile: The Nile as a whole is the dominant feature of northeastern Africa. It may be the longest river in the world, traversing about 7,400 km from Lake Victoria in Central Africa to its mouths in the Egyptian Delta.

North of Aswan the river has been divided, for sampling purposes, into four segments. Figure 2 shows the segments where measurements are being made and the barrages, and table 1 shows some of the physicochemical characteristics of these segments for four different months during 1976. These data indicate that the river is relatively healthy throughout most of the year.

The Assiut segment is about 17 km long, beginning upstream from Wasta Island and ending downstream in front of Sallan Village. Along this stretch of the river, a power plant, a water treatment plant, and a fertilizer factory discharge waste material. There is also considerable shipping activity along the river.

The Cairo segment extends for about 60 km from just south of the iron and steel plant at Helwan to approximately the point where the river divides into two branches. This segment is characterized by low water velocity due to the Delta Barrage, some rather large islands in the middle of the Nile with dense aquatic vegetation in the water, and a large number of factories, power plants, and water treatment plants discharging liquid wastes directly into the river.

The El Mansoura segment starts at the Zifta Barrage, about 70 km north of Cairo on the Damietta branch, and extends to the Fariskur impoundment. The water is almost stagnant here, and dense aquatic plants cover the river bottom and reach nearly to the water's surface. At Talkha, a fertilizer plant discharges liquid effluents directly into the river while further towards Fariskur sewage discharges greatly affect the water quality.

Table 2 shows some of the physical and chemical parameters of the Mansoura segment of the Nile during various seasons of the year, and table 3 gives some of the bacteriological measurements.

Finally, the Kafr el Zaiyat segment is on the Rosetta branch and extends north from the city of Kafr el Zaiyat to Edfine Barrage. A soap factory and salt and soda works are in Kafr el Zaiyat and discharge

Fig. 2

River Monitoring Segments

TABLE 1

SOME PHYSICOCHEMICAL CHARACTERISTICS OF THE RIVER NILE DURING 1976

Season	Segment	Seechi-Disc. Readings (cm)		Conductivity		pH		Chlorosity mg/l		Dissolved Oxygen p.p.m.		O ₂ Saturation		Total Alkalinity mg/l	
		Range	Avg.	Range	Avg.	Range	Avg.	Range	Avg.	Range	Avg.	Range	Avg.	Range	Avg.
April 76	Assiut	-	-	-	-	-	-	-	-	-	-	-	-	-	-
July 76		72-80	76.00	42-48x10 ⁻⁵	45-2x10 ⁻⁵	7.1-7.2	7.15	0.4-0.05	0.047	6.5-7	6.8	70-85	77.5	576-612	594
Sept. 76		90-92	91.00	40-42x10 ⁻⁵	41-0x10 ⁻⁵	7.1	7.1	0.05	0.05	6.7-7.1	6.9	63.9-82	77.9	460-462	461
Dec. 76		82-95	88.00	19x10 ⁻⁵	19x10 ⁻⁵	7.8	7.8	0.04-0.048	0.044	8.5-9.2	7.8	86.0	86.0	390-450	420
April 76	Cairo	77-125	91.6	21-32x10 ⁻⁵	26.5x10 ⁻⁵	7.1-7.2	7.2	0.010-0.03	0.025	8-8.5	8.3	77-93	86.0	127-129	128
July 76		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sept. 76		88-120	106.0	23-32x10 ⁻⁵	28x10 ⁻⁵	7-7.2	7.1	0.03-0.05	0.04	6-7.3	6.6	72-90	77.5	515	515
Dec. 76		55-60	58.5	24-28x10 ⁻⁵	25-10 ⁻⁵	7.1-7.8	7.42	0.04-0.06	0.05	6.1-7	6.5	65-90	75.0	570-900	668
April 76	Damietta El Mansoura	125	125	27-1x10 ⁻⁵	27-1x10 ⁻⁵	6.7	7.2	0.01	0.01	8.7	8.7	102	102	131	131
July 76		91-140	95	35-39x10 ⁻⁵	37x10 ⁻⁵	7.2-7.4	7.3	0.02-0.07	0.04	7.3-8.2	7.7	77-93	89.5	534-550	509
Sept. 76		100-140	120	35-41x10 ⁻⁵	38x10 ⁻⁵	7.1-7.2	7.17	0.03-0.07	0.05	6.9-7.1	7.0	82	82.0	545-550	547.5
Dec. 76		60-172	110	24-42x10 ⁻⁵	31x10 ⁻⁵	6.9-7.8	7.3	0.06-0.19	0.09	7-9.5	8.2	72-86	80.0	550-560	575
April 76	Rosetta	110-130	116	27-30x10 ⁻⁵	29x10 ⁻⁵	7.3-7.7	7.35	0.01-0.09	0.048	7-9	8.0	78-100	87.0	135-200	165.8
July 76		81-88	84	38x10 ⁻⁵	38x10 ⁻⁵	7.2-7.4	7.3	0.04	0.04	6.5-9.5	8.0	82-95	88.5	421-536	478.0
Sept. 76		60-112	70	29-48x10 ⁻⁵	41x10 ⁻⁵	7-7.2	7.1	0.06-0.14	0.09	6.7-7	79.0	78-83	79.0	520-605	563.0
Dec. 76		65-97	75	24-28x10 ⁻⁵	26x10 ⁻⁵	7.2-7.8	7.4	0.05-0.08	0.069	6.5-8.2	7.1	68-80	73.3	590-612	601.0

TABLE 2

PHYSICAL AND CHEMICAL PARAMETERS OF THE
MANSOURA SEGMENT OF THE NILE

Parameters	April 1976			July 1976			October 1976			December 1976		
	I	III	V	I	III	V	I	III	V	I	III	V
A. FIELD MEASUREMENTS												
Temperature (°C) -Air	22	26	21	30	31	28	29	27	27.5	19	19	19
-Water	20	21	20	29	28	28.5	25	24.5	25.5	16	16	16
Dissolved Oxygen (mg/l)												
-Surface	4.22	5.27	4.43	6.65	6.56	6.43	6.1	6.16	4.22	9.32	8.84	8.62
-Bottom	3.29	4.0	6.91	6.17	6.43	5.89	5.7	5.49	3.03	9.24	8.62	7.63
B. LABORATORY ANALYSES												
pH	7.9	7.8	8.8	8.0	8.1	8.3	8.35	8.3	7.9	8.2	8.0	8.0
Specific conductance (umho/cm)	326	329	552	317	326	458	382	413	528	331	338	478
Solids (mg/L)												
-Total	316	314	448	216	229	294	263	335	381	309	285	395
-Filterable	195	201	316	163	158	226	215	231	305	218	218	309
-Non-filterable	17	17	17	20	28	17	21	83	41	21	21	38
-Volatile	22	22	40	34	31	39	39	60	83	33	18	77
Alkalinity (mg/l, CaCO ₃)												
-Ph.Ph.	2	6	4	3.0	6	7	7.0	5	5	10.0	9	6
-Total	147	146	180	102	123	137	146	145	148	158	157	165
Hardness (mg/l)												
-Total	112	111	156	106	106	118	128	130	145	139	137	165
-Calcium	65	64	89	71	68	68	81	80	86	86	86	97
-Magnesium	47	47	68	35	38	50	53	50	59	53	51	68
Turbidity	2.5	3.5	2.0	3	7.0	7.5	5.5	6.5	6.5	7.5	6.0	7.0
Chlorides (mg/l)	14.4	13.5	40.8	15.0	16.8	38.4	32.4	36.0	63.0	28.8	30.6	39.0
Nitrites (mg/l)	0.015	nil	0.06	0.003	nil	0.009	nil	0.01	0.13	nil	nil	0.076
Silica (mg. SiO ₂ /l)	8.6	7.3	8.9	10.65	10.32	2.66	3.7	4.5	6.2	3.0	3.33	5.99
Orthophosphates (mg/l)	0.101	0.133	0.026	0.293	0.293	0.179	0.13	0.16	0.13	0.137	0.169	0.193
Total phosphates (mg/l)	0.127	0.140	0.048	0.329	0.329	0.228	0.22	0.36	0.29	0.25	0.313	0.29
Ammonia (mg NH ₃ /l)	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil
C.O.D. (mg/l)	3.2	3.6	3.7	3.4	3.8	6.5	4.5	6.0	4.1	3.6	4.5	3.8
B.O.D. (mg/l)	1.7	2.0	2.4	1.6	1.7	3.0	3.2	3.7	1.3	5.0	4.4	2.3
Sodium (mg/l)	31.9	34.1	42.2	35.5	23.5	42.5	20.8	21.72	37.1	35.6	37.1	54.9
Potassium (mg/l)	5.2	5.2	6.4	5.7	5.7	5.5	4.21	4.2	5.6	3.4	3.4	6.6
Total Organic Nitrogen (mg/l)	2.3	3.4	4.25	1.23	1.68	1.12	0.962	0.62	1.87	0.26	0.56	1.68
Nitrites	0.007	0.018	0.033	0.011	0.014	0.018	0.088	0.056	0.29	0.79	0.079	0.61

TABLE 3

BACTERIOLOGICAL MEASUREMENT SAMPLINGS FROM
THE MANSOURA SEGMENT

Measurements	April 1976			July 1976			October 1976			December 1976		
	I	III	V	I	III	V	I	III	V	I	III	V
Poured Plate (count x 10 ³ /100 ml)												
a) at 22° C	200	100	220	250	140	140	18	20	9	31	26	23
b) at 37° C	100	500	200	380	21	230	340	24	14	43	33	29
Coliform MPN/100 ml	550	900	325	65	20	45	225	225	110	550	550	225
E. coli I	1	1	0	0	1	0	0	0	1	0	0	1
E. coli II	2	0	1	1	0	1	0	0	0	2	0	0
E. coli III	0	1	2	0	0	0	1	2	0	0	1	0
Citr. Freundi I	1	0	4	1	1	0	0	0	1	1	2	5
Citr. Freundi II	0	0	1	1	2	2	0	1	1	6	0	1
K. aeroginus I	2	4	3	0	1	2	1	1	0	7	0	0
K. aeroginus II	3	2	0	3	2	1	2	0	0	5	3	0
MPN Faecal Strepto. (cocci/100 ml)	61	61	78	66.6	36.6	60	64	69	64	70	81.8	81.8

Note: These analyses were carried out by Dr. R.A. Mahfouz, Head of Bacteriology Department, Faculty of Medicine, Mansoura University, Mansoura, Egypt

liquid effluents into this segment of the river. The water along this segment is renewed once a year during the winter when the water is partially discharged into the Mediterranean resulting in the main stream being nearly clear of bottom vegetation.

In order to compare measurements being made in the Nile with some of the water quality standards in use in the U.S., table 4 lists the American drinking water standards and criteria; and table 5 shows standards, criteria, and objectives for protection of aquatic life in Lake Michigan, one of the largest of the U.S. Great Lakes.

In general, the Nile is considered a relatively clean river. Although industrial discharges and untreated sewage threaten the river at certain points, the large flow throughout most of its path renews it and makes it an acceptable habitat for fish.

It is well known that the presence of fish in an aquatic environment is a guarantee of acceptable water quality because of the interdependence between water quality and aquatic organisms. Fish depend on the aquatic ecosystem for their food, shelter, and areas for reproduction, and the smaller aquatic organisms are themselves very dependent on the characteristics of the water surrounding them.

At present, the Nile contributes about 20 percent of the total annual fish production in Egypt. Since the closure of the High Dam, both the productivity and the diversity of the Nile fish has been changing,¹ but it is still too early to predict the final results of these changes.

It was estimated by Karam in 1940 that about 47 species of fish inhabited the Nile. Recent measurements in the Assuit segment indicate that not more than 25 species were identifiable from the catch, and of these only about 15 species would be usable for commercial production. Similar results were found in the Cairo segment, where only 14 species were identified in the catch.

In the segment of the Damietta branch between the Zifta Barrage and the Fariskur impoundment, which is the most polluted and unhealthy part of the river, 11 species were found in the catch before the Zifta Barrage, and only 2 species were found in front of the Fariskur dam.

It is clear also that the average length of the fish caught in the Nile during the last few years has decreased in comparison with those caught in 1940. Figure 3 shows a comparison of the average length of a number of fish species in 1940 and again the four segments of the Nile after completion of the High Dam.

There are not yet sufficient data from which to determine the final impacts of the Aswan High Dam on fish production in the Nile. A decrease in average size and a decrease in the number of species indicates

¹H.M. El-Sedfy, "Survey of Nile Fish," in Some Studies on River Nile Ecosystems, Academy of Scientific Research and Technology, 1976.

TABLE 4

DRINKING WATER STANDARDS AND CRITERIA

Values expressed in mg/l except turbidity (JTU or TU), color (platinum-cobalt units), threshold odor number (units), and pH (units). Values are maximum permissible concentrations except dissolved oxygen which is minimum permissible concentration. N.R. indicates parameter considered but no recommendation offered; hyphen indicates parameter not considered. Ess. absent = essentially absent.

Parameter	USPHS Drinking Water Standards 1962		EPA Int. Prim. Drinking Water Stds.	NAS-NAE Water Quality Criteria	Drinking Water Standards			
	Recom- mended	Manda- tory	1975	1972	Illinois	Indiana	Michigan	Wisconsin
Turbidity	5		1	N.R.	5	5	N.R.	5
Color	15		-	75	15	15	75	15
Odor	-		-	Ess. absent	-	-	Ess. absent	-
Threshold odor number	3		-	-	3	3	-	3
Total dissolved solids (monthly average)	500		-	N.R.	500	750	500	750
Dissolved O ₂ (monthly average)	-		-	N.R.	-	-	≥3 ≥4	
pH range	-		-	5.0-9.0	-	-	6.0-8.5	6.0-9.0
Alkalinity	-		-	N.R.	-	-	-	-
Hardness	-		-	N.R.	-	-	-	-
Chloride (monthly average)	250		250	250	250	250	50	250
Oil (hexane-solubles or equivalent)	-		-	-	0.1	-	-	-
Oil and grease	-		-	Ess. absent	-	-	Ess. absent	-

TABLE 5

STANDARDS, CRITERIA AND OBJECTIVES FOR THE PROTECTION OF AQUATIC LIFE IN LAKE MICHIGAN

Values expressed in mg/l except color (platinum-cobalt units), threshold odor number (units), pH (units), and oxygen (mg/l or % saturation). Values are maximum permissible concentrations except dissolved oxygen and alkalinity which are minimum permissible concentrations. N.R. indicates parameter considered but no recommendation offered; hyphen indicates parameter not considered. Subst. absent = substantially absent; Virt. absent = virtually absent.

Parameter	NAS-NAE Water Quality Criteria 1972	U.S.-Canada Great Lakes Water Quality Agreement 1972	Water Quality Standards			
			Illinois	Indiana	Michigan	Wisconsin
Turbidity (suspended solids)	25	a	a	a	a	-
Color (monthly average)	-	-	a	15	a	-
				5		
Odor	-	Subst. absent	a	a	a	-
Threshold odor number	-	-	-	8	-	-
(daily average)				4		
Total dissolved solids	-	200	180	200	750	-
(monthly average)				172	500	
Dissolved O ₂ (daily average)	-	6.0	90%	80%	6.0	5.0
				90%		
pH range	6.5-8.5	6.7-8.5	7.0-9.0	7.5-8.5	6.7-8.5	6.0-9.0
Free CO ₂	N.R.	-	-	-	25	-
Alkalinity	-	-	-	-	-	-
Hardness	N.R.	-	-	-	-	-
Chloride (monthly average)	-	-	12.0	15	-	-
				10		
Oil	b	Subst. absent	b	b	-	-
Oil (hexane-solubles or equivalent)	-	-	0.1	-	-	-

a - None other than of natural origin.

b - No visible oil on surface.

Sources: National Academy of Sciences . . . , 1973; U.S. Treaties, etc., 1972; Illinois Pollution Control Board, 1974; Indiana Stream Pollution Control Board, 1973; Michigan Water Resources Commission, 1973; Wisconsin Administrative Code, 1973.

**AVERAGE SIZE OF DIFFERENT NILE FISH
BEFORE AND AFTER HIGH DAM ACCORDING TO DIFFERENT SEGMENTS**

Fig. 3

Average Size Of Different Nile Fish
Before And After High Dam According To Different Segments

that this system is not as healthy as it should be. The introduction of further pollutants into the river can only make matters worse.

3.1.3 Greater Cairo: Cairo is the capital of Egypt and its major city with a population of about 7.5 million persons. It is an old city with serious social problems due to a very rapid increase in population. The city has major air pollution problems related to industry in Helwan and Shubra El Kheima and to automobile and truck traffic in the central part of the city. In addition, the sewage system is heavily overloaded, resulting in some cases in raw sewage being dumped into the Nile. Finally, by Western standards at least, there is a major noise pollution problem from the traffic in the central part of the city.

The most noticeable air pollutant in and near Cairo is the dust which comes, at least in part, from unpaved roads and broken sidewalks. Other important sources of dust and smoke include a large cement plant in Helwan and the open burning of trash in the central part of Cairo. These sources and others result in levels of particulates which often exceed normal U.S. standards.

In the central part of the city, the major source of gaseous pollutants are the automobiles and trucks. Table 6 shows some of the measurements of carbon monoxide, aldehyde, and smoke made at five different sites in and near Cairo. Other unpublished data of Dr. M. Sami Abdel-Salam and Dr. M. Nasralla, of the National Research Center, indicate that gaseous pollutants at 1.8 m above street level in many parts of Cairo normally exceed U.S. ambient air quality standards. The U.S. standards are shown in table 7 and some typical measurements of gaseous pollutants measured in Central Cairo are shown in table 8. These values have not yet been published by Drs. Nasralla and Abdel-Salam, and are therefore not definitive; they are given here to indicate the order of magnitude of the air pollution problem.

Air pollution has been recognized as a problem in Cairo and studied since 1957. In 1969 a Supreme Committee for Protection of the Air was formed, with the Minister of Health as chairman and members from all ministries whose jurisdiction included agents of air impact. This committee initially had power to approve or disapprove industrial plants and developments based on the effect they would have on the air quality. With changes of government and ministers, this committee no longer meets.

One other pollutant which causes a problem in greater Cairo, at least by U.S. standards, is noise. Most of this noise is due to automobile and truck traffic and construction activities. The noise levels are generally not high enough to cause physiological effects, but such subjective effects as annoyance, nuisance, and disturbance are probably common. A study of noise in Cairo has been proposed but not yet carried out.

3.1.4 The Delta System: The final part of the Nile System to be discussed here is the Delta: the main agricultural area of Egypt. Although strong efforts are being made by the government to expand

TABLE 6
MEASUREMENT OF AIR POLLUTANT LEVELS
AT FIVE SITES IN AND NEAR CAIRO

	Sites					
	1	2	3	4	5	Av
<u>CO--1 hr average, ppm</u>						
Jan.		12.4	0.8	27.8	5.0	9.2
April		22.0	0.5	23.0	6.3	10.3
July		25.7	2.7	29.3	8.0	13.1
Oct.	0.1	22.8	1.3	32.1	7.1	12.7
<u>Aldehyde -- 5 min average</u>						
Jan.	0.3	1.6	1.7	2.0	2.0	1.3
April	0.6	1.5	1.2	1.1	1.4	1.2
July	0.8	1.3	1.2	1.0	1.6	1.2
Oct.	0.5	1.1	0.9	0.6	1.6	0.9
<u>Smoke--COH/1000 linear ft</u>						
Jan.	9.5	10.0	7.5	7.4	12.4	9.4
April	8.1	6.8	7.4	6.0	9.6	7.6
July	9.3	6.7	6.7	6.8	13.8	8.7
Oct.	9.4	11.1	9.1	7.1	16.7	10.9

- 1 - Nile Bank St.
- 2 - Ramses Sq.
- 3 - Ataba Sq.
- 4 - Talaat Harb St.
- 5 - Giza Sq.

TABLE 7

NATIONAL AMBIENT AIR QUALITY STANDARDS: U.S.A.^a

Pollutant	Primary Standard ^b			Secondary Standard ^c		
	Parts Per Million	Milligram Per Cubic Meter	Microgram Per Cubic Meter	Parts Per Million	Milligram Per Meter	Microgram Per Meter
<u>Carbon Monoxide</u>						
Maximum 8 hour Concentration ^d	9	10		9	10	
Maximum 1 hour Concentration ^d	35	40		35	40	
<u>Hydrocarbons</u>						
Maximum 3 hour Concentration ^d	0.24		160	0.24		160
<u>Nitrogen Oxides</u>						
Annual Arithmetic Average	0.05		100	0.05		100
<u>Photochemical Oxidants</u>						
1 hour maximum ^d	0.08		160	0.08		160
<u>Particulates</u>						
Annual Geometric Mean			75			60
Maximum 24 hour Concentration ^d			260			150
<u>Sulfur Oxides</u>						
Annual Arithmetic Mean	0.03		80			
Maximum 24 hour Concentration ^d	0.14		365			
Maximum 3 hour Concentration ^d				0.05		1300

^a Source: 40 Codes of Federal Regulations 50; 36 Federal Register 22384 (November 25, 1971); 36 Federal Register 25678 (September 14, 1973).

^b Primary = "levels of air quality which the Administrator judges are necessary, with an adequate margin of safety, to protect the public health."

^c Secondary = "levels . . . necessary to protect the public welfare from any known or anticipated adverse affects of a pollutant."

^d Not to be exceeded more than once a year.

TABLE 8
AIR POLLUTION LEVELS IN CAIRO

Pollutant	Level	Remarks
CO	25 ppm	1.8 m above street
SO _x	0.05 ppm 0.2	average Maximum
NO _x	0.15	Near Nile
Photochemical Oxidants	0.2 ppm	only few measurements
Cyclic Hydrocarbons	10 g/100m ³	benzopyrene
Lead	2 g/m ³	5 m above ground

irrigation and bring more land into production, the Delta will continue to be the main source of food for Egypt well into the next century.

The Aswan High Dam has caused a number of changes in Egyptian agriculture, some of which will improve productivity while others will tend to damage the environment. Among these changes are the following:

- o Waterlogging and salinization of the soil are increasing.
- o There is a potassium and trace element deficiency in the soil.
- o Absence of silt has caused a decrease in soil fertility.
- o Some complex diseases of plants have appeared caused by fungus, bacteria, and nematodes.

In addition to the water pollution problems, there are two industrial areas of air pollution concern in the Delta region. One of these is Shubra el Kheima, which is part of greater Cairo and has already been mentioned; the other is an area of industrialization between Tanta and Kafr el Zaiyat. Near Tanta, landowners are going to court to protect agricultural land from further intrusion by industry.

3.2 The Mediterranean System

The Mediterranean System extends from the Libyan border on the west to the Sinai peninsula and Israeli border on the east. Even though this area contains desert, Delta, and several cities, it is considered here as a single system because of the large modifying influence of the Mediterranean on the environment and because of common coastal zone problems. Little or no fresh water is available along the entire coastline so, in general, the region is sparsely populated. The area supports one large city, Alexandria, two other Delta cities, Damietta and Port Said, and several smaller urban centers in the Western Desert and in the Sinai. The larger cities are supplied with water from the Nile, often through very long canals. In addition, a very long aqueduct feeds water from the Nile system to the coastal cities in the Western Desert. Thus, although the climate is principally influenced by the Mediterranean, it is still basically a desert region.

Alexandria. Alexandria is the second largest city in Egypt (with a population greater than 2.5 million). The city was founded by Alexander the Great in 332 BC and has been the major port city of Africa for thousands of years. Because most of Egypt's transportation lines converge here, it is an active commercial center and contains about one-third of the total industry in Egypt.

The city has grown up along the Mediterranean in a strip about 70 km long and 3 to 4 km wide. Most of the city is only a few meters above sea level and is bounded on the south by the brackish, shallow Lake Maryut. The climate is generally hot in the summer and warm in the winter, with the prevailing wind direction being west to north at less than 10 km/hr.

In general terms, the city can be divided into three regions. Most of the industrial activity, including paper and textile mills, a cement factory, chemical industries, petroleum refineries, and power plants, are located in the western part of the city. The central region has attracted most commercial activities, and the eastern portion is principally residential. This pattern of activity results in the concentration of most industrial pollution in the west and most automotive pollution in the central part of the city.

Water for both domestic and industrial use comes by way of a canal from the Rossetta branch of the Nile. Drinking water is brought from Damanhur.

Liquid wastes from the industrial plants are discharged directly into Lake Maryut, usually without treatment. This has resulted in a very serious pollution problem in the lake.

Lake Maryut is the vestige of the ancient Lake Mareotis whose history goes back to Pharaonic times. The lake nearly dried up during the Middle Ages but was flooded by sea water in 1801 during the fighting between the English and French. The present area of the lake is about 17,000 feddans (1 feddan = 1.06 acres); it is divided into four basins and is only about one m deep. Table 9 gives the chemical analyses of the four drains discharging into the lake.

The lake is a complex body of water and its condition varies from one region to another and with the seasons. The main basin of about 6,000 feddans has been deteriorating over the last decade because of the uncontrolled discharge of sewage and industrial waste. This has resulted in a lowering of fish production, the formation of floating scums and offensive odors, and incidence of diseases in fishermen. The western part of the lake is recovering and is characterized by low organic load and an adequate level of dissolved oxygen. The latest measurements on the lake indicate a general improvement of conditions as compared to a few years ago. For example, fish production increased by a factor of five between 1971 and 1973. This may be due to acclimatization and the survival of larger percentages of fish that can withstand relatively polluted water.

Because Alexandria and the nearby beaches are major tourist attractions, the city has made an attempt to protect the beaches from sewage. In 1954, an outfall 735 m long and 16 m deep was built into the sea. Only the central part of the city discharges sewage into the sea through this outfall, while both the eastern and western zones use sewage treatment plants that discharge into Lake Maryut.

The air quality of Alexandria is characterized by large regional differences. Industrial effluents are concentrated in the western part of the city, while products from automobiles and trucks are found more in the central commercial zone and the eastern residential district.

Table 10 lists the industries located in Alexandria (primarily in the suburb of El Mex) and the approximate number of people employed. Table 11 lists the yearly average concentrations of SO_2 , NO_2 , and CO

TABLE 9

CHEMICAL ANALYSES OF THE FOUR DRAINS DISCHARGING INTO THE LAKE

Drain	Conductivity	pH	Total Solids mg/l	Chlorides mg/l	T. Hardness mg/l CaCO_3	BOD mg/l	COD mg/l	COD/BOD	SO_4^{-2} mg/l	S^{-2} mg/l
Industrial	7,200	7.2	6,349	2,498	988	868	1,623	1,884	508	15.8
Kheit-El Enab	2,279	7.5	2,919	443	282	1,423	2,235	1,540	126	14.5
Kabry	2,618	7	2,379	698	402	784	1,055	1,346	138	8.8
El Kalaa	3,023	6.9	2,236	931	583	72	78	1,492	215	6.4

TABLE 10
INDUSTRIES IN ALEXANDRIA

<u>Industries</u>	<u>No.</u>	<u>Employees</u>
Metal and Machinery	11	13,189
Rubber	4	7,047
Transportation equipment	15	7,797
Food	53	32,037
Petroleum Refineries	6	8,973
Minerals (stone, clay, glass)	17	8,540
Textiles	23	26,558
Furniture	3	1,630
Chemicals	11	8,814
Paper	8	10,266
Other	6	12,316

TABLE 11

YEARLY AVERAGE CONCENTRATION (PPM) OF
THREE AIR POLLUTANTS IN AND NEAR ALEXANDRIA, 1975

City Sector	SO ₂	NO ₂	CO
Industrial Western	0.017	0.006	-
Middle	0.059	0.014	5.3
Residential Eastern	0.038	0.008	3.5
Alexandria	0.038	0.009	4.4

in the three sectors of Alexandria, Table 12 shows the variation of trace elements in the air with season.

As in Cairo, dust is one of Alexandria's major air pollution problems. In the center of the city, an average of 104 t/mi²-month is deposited. The rate of deposition varies with the time of year, being heaviest during the rainy season in the spring. Dust deposition in the industrial section of the city is more than twice that in the residential section. Analysis of the dust's composition indicates 5 to 10 percent sulfates and about 1 percent nitrates. The dust over the industrial section is between 9 percent and 12 percent sulfates.

In order to improve the air quality of Alexandria, a number of recommendations have been made. These include the following:

- o No industrial siting in Eastern section.
- o New industry should be located at Amriah (El Amiriyah), south of Alexandria.
- o Air cleaners should be used on dust producers.
- o Control measures should be used on impaired vehicles.
- o Increase the number of trees, parks, and gardens.
- o Introduce a public educational program regarding pollution.
- o Expand the training program of the High Institute of Public Health.

3.3 The Red Sea, Gulf System

The northern part of the Red Sea-Gulf System is shown in the regional development strategy map in figure 4. The system being considered here includes the three cities of Port Said, Ismailia, and Suez, the Red Sea, the Gulf of Suez, the Suez Canal, and the Ismailia Canal, which brings fresh water into the three cities. The region is characterized by a long coastline bordering on salt water. The major economic emphasis is on ship transportation through the canal and on oil resources.

The three cities have a combined population of about 700,000 people. Suez is more industrialized than Ismailia or Port Said, with existing industries in mineral oil, petroleum, detergents, plant oils, marble, and chemicals. Table 13 gives the population of the three cities in 1966 and the estimated population in the year 2000, together with the water consumption rate in 1962/63. By the year 2000 these cities will be major population and industrial centers.

As both industrial and domestic freshwater for these cities comes through the Ismailia canal, it is very important that the quality of

TABLE 12

SEASONAL AVERAGE OF TRACE ELEMENTS IN
ALEXANDRIA, 1975 (MG/M³)

Season	Cu	Pb	Zn	Mn	Mg	Fe	Na	K	Ca
Winter	0.04	0.15	5.0	0.1	5.4	1.35	24.5	20.9	17.1
Spring	0.04	0.11	1.1	0.036	3.7	1.31	10.8	8.3	9.0
Summer	0.026	0.13	0.86	0.08	2.9	2.11	18.1	17.8	16.5
Autumn	0.02	0.116	1.7	0.11	3.0	1.6	11.2	14.6	18.0

Fig. 4

TABLE 13

POPULATION DENSITY AND WATER CONSUMPTION IN THE SUEZ CANAL REGION

City	Population density (thousands)				Consumption of water (1962/63) million m ³ /yr			
	1966		% of Total Egypt	2000	Domestic Use	Public Services	Industrial Uses	Total
	Urban	Rural						
Port Said	282.9	-	0.9	300	8.7	5.7	0.4	17.6
Ismailia	182.4	162.4	1.1	600	2.2	1.0	0.9	4.4
Suez	264.0	-	0.8	800	4.0	1.9	1.5	8.1

this water is protected. At present a number of factories and industrial plants discharge pollutants directly into the canal. Table 14 lists four of these plants and physicochemical data on their discharges. Although these discharges are generally not serious, except for the acidic wastes from the fertilizer factory, the addition of further energy and industrial plants that would discharge into this canal could be of serious concern.

The City of Suez is known to have a minor air pollution problem at present. This is due to its geographical location (with hills on several sides) and the local meteorology. New industrial plants being planned for Suez should consider carefully the air pollution control requirements.

The Red Sea, the Gulf of Suez, and the Great Bitter Lake (Buheinat Murrat el Kubra) are all important recreation and fishing facilities. The protection of these bodies of water for such purposes requires that consideration be given to environmental protection as any new plants are planned and built. Because oil and gas resources appear to exist in this region, and ships transporting these fuels will be moving through these waters, particular care should be given to oil and gas pollution problems.

3.4 The Desert System

The desert system in Egypt can be conveniently divided into three parts, each with its own characteristics which differentiate it from the others. The Western or Libyan Desert is directly connected and a part of the vast Sahara which dominates the northern part of Africa. It is arid, flat, and in general has very few wadis (dry river beds which carry off seasonal rains). The Eastern Desert which lies between the Nile and the Red Sea-Gulf of Suez has a fringe of mountains in the east and a large number of wadis which lead back towards the Nile. The Sinai Peninsula lying to the east of Suez is generally open desert with isolated hills and small mountains, particularly in the south.

The Western Desert is the largest of the three and roughly comprises 3/4 of Egypt. It is a rocky, low plateau with almost no plant life of any kind. Only along the Mediterranean coast in spring are found an abundance of grasses and perennials. South of the Qattara Depression, a large salt marsh area lying well below sea level, there are great ridges of blown sand interspersed by areas of stone.

The population of the Western Desert was estimated in 1966 to be about 125,000 persons.

TABLE 14
IMPACT OF WASTE WATER DISCHARGE
PHYSICOCHEMICAL DATA

Date 26/12/1976

Parameter	Mobil Oil Co.	Refinery Oil Co.	Ceramics Factory	Fertilizer Factory
Turbidity NTU	7	7	9.5	15
pH-Value	8	7.9	8.04	3.5
BOD ₅ mg O ₂ /l	26.4	8.4	4.8	12.2
COD, mg O ₂ /l	24.8	41.6	20	28
K ₂ Cr ₂ O ₇				
Total Residue (105°C) mg/l	268	548	532	496
Total Residue (550°C) mg/l	130	458	478	432
Suspended Solids (105°C) mg/l	56	52	44	124
Suspended Solids (550°C)	48	32	28	116
Nitrate mg N/l	0.16	0.7	0.1	0.15
Total Phosphate g P/l	37.5	87.5	175	1,750

A variety of animals are found in the desert including the Egyptian jackal, the dorcas gazelle, the mountain goat, the desert fox, and a number of rodents. The largest wild animal is the mountain sheep found in the southern part of the Western Desert. Scorpions are common and many insects are found including the Egyptian locust.

The Eastern Desert is much smaller than the Western with a surface area of about 222,000 km² (85,000 mi²) comprising 22 percent of Egypt's land area. The northern third is a limestone plateau while the southern portion is made up of a coastal plain and Red Sea Hills.

Since the Eastern Desert receives a small rainfall, mostly originating from the Red Sea, it is able to support a varied plant community. This includes tamarisk, acacia, markh (a leafless tree), and a number of thorny shrubs, small succulents and aromatic herbs.

The total population of the Eastern Desert in 1966 was about 38,000 people with about one fourth of them living in Ras Gharib.

The third part of the Egyptian desert system is the Sinai Peninsula with a total area of about 59,600 km² (23,000 mi²). Because of its geographic location, lying between Egypt and Israel, this desert has been fought over in several recent wars and is still partially occupied by Israel's army.

The annual rainfall over this region is less than 10 cm and is highly variable. The wind is very dry, so the physiological effects on man, plants, and animals are extreme. Because of this dryness, plant and animal life is minimal and the humus content of the soil is very low.

The population of this peninsula in 1966 was estimated to be about 130,000 people with about 50,000 who were nomads or semi-nomads. Most of the inhabitants of this region are of a different racial type than the people who live in the Western Desert, being fairly recent immigrants from Arabia.

The deserts of Egypt are not a good environment for man. Official government policy is to create new settlements in the desert to grow agricultural products where soil and water are adequate and to create new industries in other areas. Although the present ecosystems may be destroyed in certain local areas in this process, the total benefit to the people should be much greater.

4.0 MAJOR ENVIRONMENTAL PROBLEM AREAS

4.1 Greater Cairo

Because of the rapid movement of the rural population into urban areas during the last two or three decades, the total number and density of people in Cairo has increased dramatically. It is estimated that approximately 8 million people now reside in the city proper. In

addition, since the labor was available, industrial plants were built to the south of the city at Helwan and to the north at Shubra El Kheima. Here, the population has been increased by those workers who operate the facilities, but do not commute from Cairo, as well as by secondary immigrants. The numbers and use of motor vehicles (including private cars, taxis and motorcycles) is rapidly increasing in greater Cairo. To a significant extent, this is due to the inadequacy of the existing public transportation system. The result is the overloading and crowding of almost all primary, and many secondary streets, from the early morning hours to late in the evening; attendant to this condition, traffic moves slowly and erratically, resulting in the release of more combustion pollutants per vehicle-mile than would be the case on less crowded traffic arteries. Releases of these pollutants to the environment are aggravated by the low level of maintenance afforded to many motor vehicles, principally due to economics, but also the lack of enforced vehicle pollution ordinances. In addition to these man-induced environmental problems, the particulate (dust) content of ambient air sweeping into Cairo from the deserts is quite high, particularly during the Khamsin season in spring and early summer. Furthermore, the open burning of trash and garbage is practiced throughout the area. These factors occurring together result in conditions of air-quality that, at times, constitute a hazard to the public health of the residents of Greater Cairo.

In the center of the city, the major source of air pollution is vehicular traffic. Here, traffic policemen, motorists, pedestrians, merchants, residents or others who spend a large percentage of their time in or near the streets are exposed to large amounts of lead, nitrogen oxides, carbon monoxide, and other vehicle-generated pollutants.

The population density near the industrial sections of greater Cairo is, at present, not too large, since many of the workers commute from central Cairo. Housing facilities for 10,000 people are being built near the iron and steel plant at Helwan. This will be exposed to air pollution impacts from the industries located nearby.

Prior to locating any new large energy facility in Greater Cairo, an assessment should be made of the additional impacts that will result from the construction and operation of the facility, and the environmental controls needed to make the impacts acceptable.

4.2 Alexandria

Alexandria, located on the Mediterranean Sea, is the major seaport of Egypt. It is also highly industrialized. In addition, its oceanfront location on the Bay of Alexandria contributes heavily to its importance as a major center for tourism. The environment of the city and oceanfront has been substantially degraded by port and industrial activities, and by discharges of untreated sewage into the Bay of Alexandria. This has already caused a decline in tourism. The environment must be improved and made attractive or tourism will continue to decline.

Industry is concentrated in the western part of the city, and it is here that the greatest air and water pollution problems are found. Efforts are being made to control discharges into nearby Lake Maryut and to insure adequate treatment of sewage.

Recommendations have been made that new industrial plants be located at El Amiriya to the southwest of the city or further to the west along the Mediterranean. Although the beaches are important tourist attractions, there is no shortage of open land between Alexandria and Libya.

Bilge and other discharges from ships anchored in the Bay of Alexandria contribute heavily to the decline of water-quality along the Alexandrian seashore. If this area is to regain its former attractiveness to the tourist trade, water-pollution from this source must be controlled.

4.3 Institutional Problems

Appendix B summarizes Egyptian environmental legislation germane to the present report. To be effective, the legislation must be enforced; it is here that institutional changes could make the largest immediate contribution to the status of the Egyptian environment. There is at present no organization within the Government of Egypt that has the responsibility for protection of the environment. Thus, compliance with environmental legislation is almost universally ignored. Any institutional mechanism which could enforce compliance with existing environmental law would have a beneficial, remedial effect on the quality of life of the Egyptian population residing in greater Cairo, Alexandria, and other impacted areas. In addition, such a body could require environmental planning prior to the development of new energy resources and facilities and could require monitoring to assure compliance with environmental regulations. Movement in this direction would pave the way toward full development of new energy resources, but at minimal environmental cost to the population.

5.0 IMPACT OF ENERGY SYSTEMS

5.1 Fossil Energy Systems - Coal

Egyptian coal deposits surveyed to date are too thin, discontinuous, and deep to be economically mined. Only the Maghara reserves in Sinai might be economically recovered. About 300,000 tons of exploitable coal may be present in the Sinai Peninsula. Although this coal is non-coking, it could be blended with coke at the Helwan steel mills and used there. For this reason, a detailed discussion of the environmental impacts of coal extraction, processing, transportation, and use is beyond the scope of the present study. Even if economic coal deposits were discovered in the distant future, it is not likely that a coal-based energy economy could be developed by the year 2000, the chronological limit of this report. Nevertheless, a brief general description of coal-cycle impacts is presented here that could be considered if economic deposits were found.

Figure 5 illustrates the coal cycle. Coal-use commences to the right of the descriptor, "Transportation." The major impact of coal extraction by strip mining is upon the land and land use. The amount of land that is disturbed in mining is extremely variable and depends on factors such as the depth of overburden, the thickness and continuity of the deposits, the thickness of materials between the deposits, the extent of the deposits, and the stripping technique employed. In view of the fact that 96 percent of Egypt's land area is desert² and the locations of discoveries of uneconomic deposits have been in desert areas, it is quite likely that if coal deposits are discovered in the future they would be found there. The Egyptian deserts are characterized by very low productivity and are considered by the Egyptians to be of little value to man. While coal stripping has the potential to disrupt relatively large land areas and their associate ecosystems, and would result in adverse esthetic impressions for anyone who would view the mining areas, these impacts would probably be found acceptable, especially within a desert area, if balanced against the energy value of the extracted coal and the benefit it would confer on the Egyptian economy. The amount of land disturbance associated with underground mining is generally much less than for strip mining.

Disposal of mine water is a problem in both underground and strip mines due to the contained pollutants (8000 ppm of dissolved solids). It is not known if mine water would be a problem in any Egyptian mines that might be discovered and developed, but adequate means of disposal could be found in the vast desert wastelands where coal would likely be found.

Water of high salinity would be harmful to many components of the desert ecosystem. It could also affect any fresh groundwater to which it would be hydraulically connected. The mine water could be efficiently disposed of in evaporation ponds, thus protecting the desert habitats from unregulated discharges. Development of the Sinai coal deposits should be preceded by a study of the area's potentially potable groundwater, so that any water resources present could be protected. The mine discharge waters would be too high in salinity for use in agriculture.

In addition to the release of aqueous pollutants, atmospheric pollution can accompany mining operations. Atmospheric pollutants released from Egyptian mines would be of little environmental consequence in the desert because of the extremely low population densities that characterize these areas.

The processing of coal (i.e., particle size reduction and other contaminants) is another source of residuals. Table 15 gives typical values for pollutants that are contained in processing effluents. As above, there should be no difficulty in finding disposal areas compatible with the desert environment.

² R. F. Nyrop, et al., "Area Handbook for Egypt," 3rd ed., DA Pam 550-43, Foreign Area Studies, The American University, Washington, D.C., 1976. (Available from U.S. Government Printing Office)

Fig. 5
Coal Fuel Cycle

TABLE 15

WATER RESIDUALS COAL CLEANING PLANT PROCESS WATER

Residual	Raw Discharge (mg/l)	Raw Discharge (tons/10 ¹² Btu)
Total Iron	47.8	4.042
Suspended Iron	46.88	3.964
Dissolved Iron	0.92	0.078
Manganese	1.67	0.141
Aluminum	10.62	0.898
Zinc	0.56	0.047
Nickel	0.15	0.013
TDS	1,433.0	121.170
TSS	62,448.0	5,180.600
Hardness	1,540.0	130.220
Sulfates	1,004.0	84.898
Ammonia	2.01	.170

After coal is processed it is used either near the mining area (e.g., in a "mine-mouth" electric generation station) or transported for use elsewhere. If economically valuable coal were found in Egypt, and some of the Egyptian population was moved to the source of energy consistent with the government's diasporization policy, then it is likely that mine-mouth facilities would be used. In this case, because coal transport would be by conveyor or by short pipeline, transportation impacts would not be important. If, on the other hand, the coal were to be transported for use elsewhere, pipelines, trucks, unit trains, mixed trains, barges (on the Nile), or other means of transportation would be used.

Typical U.S. land use coefficients are given below:

<u>Land Use</u>	<u>Acres/10¹² Btu</u>
Trains (unit and conventional)	34
Trucks	1.6
Pipelines	20
Barges	-

Land use associated with moving Egyptian coal would be of little consequence as most of such activity would be across desert wastelands.

Coal mining is among the most dangerous of occupations in the United States. Fatal accidents in some states were as high as 0.05 per 10¹² Btu and non-fatal accidents were as high as 3 for the same amount of energy. There is no way to estimate what safety regulations and practices would be instituted in Egyptian mines if economically important coal were found; thus, no parallels with the U.S. occupational injury rates can be estimated.

Detailed information concerning the gaseous emissions from coal-fired electric plants is abundant and can be found in other documents. Table 16 gives typical emissions from A-rated U.S. coal; not shown is mercury vapor, the content of which is highly variable. Lower-rating coal would be characterized by different emission values. The operation of coal-fired units would be of little consequence in the Egyptian deserts; however, if such units were to be installed near population centers, pollutant removal technology should be part of the planning. This is particularly true in the environs of Alexandria and Cairo, where air pollution is already a problem and detracts from the quality of human life.

About 1.6 hectares (ha) of land are required for coal-fired electric generation facilities, not including the coal storage-pad areas. Again, this land use commitment would be of no consequence in desert areas, but could cause impacts in urban and suburban areas.

TABLE 16
POUNDS OF EMISSIONS PER UNIT OF FUEL BURNED

	Bituminous Coal (per ton)	Oil (per 10 ³ gal)	Natural Gas (per 10 ⁶ ft ³)
Particulates	16 x % Ash	8	15
Sulfur Oxides	38 x % Sulfur	159 x % Sulfur	0.6
Carbon Monoxide	1	5	17
Hydrocarbons	0.3	1	1
Nitrogen Oxides	18	105	700
Aldehydes	0.005	1	-

Oil and Gas. As discussed previously, Egypt is projecting the extraction of about one million barrels of oil per year by the year 1985, plus any natural gas found in conjunction with oil exploration. Most reserves appear to be offshore in the the Gulf of Suez, but some terrestrial sites will be exploited also. In addition, more oil refinery capacity will be needed to meet Egypt's needs in the near future and to refine the new oil that will be extracted later. The environmental impacts associated with terrestrial and offshore exploration and extraction differ, as do problems related to refineries; thus, each category will be discussed separately.

The extraction, gathering, and distribution of petroleum can affect land use, air quality, and water quality, and produce solid wastes that must be disposed of. Typical land drilling rigs such as the Failing 2500-S, Failing 3500, Ingersoll-Rand T-5 Drillmaster, and Emsco GA250 involve the use of about 0.4 ha/well during exploration, and about 0.1 ha/rig for wells in production. A coefficient derived from 25 years of U.S. experience averages about 0.2 ha/10⁶ Btu. These figures include associated and support equipment such as doghouses, mud tanks, boilers, and trucks. It is not possible to quantify how much Egyptian land will be occupied during exploration and production drilling, because the numbers, locations, and success ratios of bore holes are not yet known. However, because over 96 percent of the country is desert, and most terrestrial wells will be in extremely remote areas (e.g., near the Gulf of Suez and in Sinai), land use impacts will be trivial in relation to the economic

benefits conferred by new oil. Much of the fragile desert ecosystem will be disturbed or destroyed in the vicinity of the exploration and production activities, but vast amounts of similar undisturbed habitat will remain; thus, general impacts to the desert ecosystem will not be significant.

Under normal circumstances there is virtually no air pollution risk from particulates, NO_x , SO_x , hydrocarbons, or carbon monoxide parameters associated with oil^x exploration and production in the United States. However, this is not true under circumstances of blowouts, mechanical failure, human error, and failure to observe environmental or safety regulations. At such times various pollutants can be released to the atmosphere in varying degrees, depending on the seriousness of the problems and the duration. Because of their episodic nature, it is not possible to quantify the degree of environmental impact that would result from such problems. Nevertheless, it can be stated in general terms that atmospheric releases due to terrestrial oil and gas well exploration and extraction will not be a problem in Egypt because most sites will be in remote desert or plateau areas characterized by very low human population densities. The dilution properties of air will render atmospheric emissions harmless before any discharges reach existing human settlements of any size.

Of greater, but probably still insignificant consequence, is contamination of the land by petroleum and/or saline solutions during unforeseen releases. Petroleum contains organic substances that are noxious, toxic, mutagenic, or carcinogenic; strong saline solutions are destructive to all floral components and some faunal components of most terrestrial ecosystems. Petroleum or saline release would destroy almost all habitats in their zones of influence. In spite of this, no general adverse impacts are expected, particularly if releases are controlled in a timely fashion, because the ecosystems characterizing the areas likely to be explored are very low in primary productivity and are considered by the Egyptians to be of little value to man. Although surface water does not exist in such areas, it is possible that groundwater with existing or potential use could be contaminated by oil or saline releases. It is important that there be an evaluation of groundwater resources in exploration areas before drilling begins, so that adequate measures can be taken to protect these resources.

Solid wastes are produced as a by-product of drilling for oil and gas. About $104 \text{ t}/10^{12} \text{ Btu}$ are produced during production drilling, and about $146 \text{ t}/10^{12} \text{ Btu}$ during exploration. This comes to about $54 \text{ t}/304 \text{ m}$ drilled, an amount that easily could be disposed of on small land areas adjacent to the drill rigs. Again, precautions should be taken to protect freshwater resources from liquid and solid components of the solid wastes if such resources exist in the vicinity of drilling activities.

Collected gas and petroleum will be transported from production fields to end-use sites such as industries or refineries. Pipelines will be used. For example, parallel gas and oil pipelines will be routed from the Gulf of Suez terrestrial and offshore production areas to both Suez and Cairo. Expansion of refinery capacity at the El Emeria refinery at Alexandria or the construction of a new refinery in Alexandria could be accompanied by a new oil pipeline(s) to the Mediterranean environs of Alexandria. The principal environmental impacts would be withdrawal of land from general use during construction and the impacts that could occur as a consequence of rupture or leakage. Except for pipeline routes in or near Suez, Cairo, and Alexandria, land disturbance will not be a problem because of the small value of the land that will be involved in pipeline construction and operation activities. Construction activities near urban areas can temporarily interfere with housing, recreation, commerce, and industry during pipeline installation. Any such impacts must be considered as part of the socioeconomic costs of new pipeline facilities. Expenditure of funds for the return of affected areas to pre-construction usage will also be part of such costs. The area occupied by pipeline corridors in urban settings will be precluded from other land use, but the impacts will be justified in relation to the benefits that the oil will confer on the Egyptian economy.

Rupture or leakage of gas pipelines can be serious in populated areas because of the possibilities of fire, explosion, and air pollution. It is assumed that controls will be provided to interrupt the flow of gas in a timely fashion if rupture or leakage occurs. Such events will not be a serious concern along most of the gas pipeline corridors that will be located in the Egyptian desert, far from populated areas.

The rupture of, or leakage from, petroleum pipelines can be serious because petroleum will be deposited on the ground. Petroleum is inimical to most forms of terrestrial life and will destroy terrestrial habitats. Because such spills are episodic in nature, it is not possible to estimate the amount of habitat that will be affected as a result of the operation of petroleum pipelines in Egypt; however, because most pipeline corridors will be in desert terrain, the impacts should not be serious if control measures are incorporated to stem the flow of oil in a timely fashion. Spillage of oil in urban or industrial areas will produce socioeconomic impacts related to the facilities affected. Such impacts can continue until the spilled product is removed and previous uses of the affected areas are restored.

The exploration and production of offshore Egyptian oil will have impact on uses of submerged land and water, and can result in various degrees of impact on the aquatic environment. Because most Egyptian oil reserves are believed to be located in the Gulf of Suez, impact to the waters of the Gulf can be expected.

Offshore drilling is accomplished with devices such as drilling platforms that can range from less than 30 m to several hundred m in length and width, or drillships that can be several hundred m long. It

has been assumed elsewhere³ that drilling platforms disturb* or occupy about 1,215 ha each, or about 80 ha/10¹² Btu. The number of sites for drilling rigs in the Gulf of Suez is not predictable at this time; therefore, it is not possible to estimate what the actual impacts on fishing and navigation will be. While it may not be possible to mitigate impacts on fishing if the Egyptian Government elects to explore for oil in productive fishing areas, the Gulf is sufficiently wide that most affected navigation can be rerouted, mitigating impacts on navigation.

Although it is possible to limit petroleum releases during routine offshore oil exploration and development (if modern technology is employed), the potential for large releases always exists under the circumstances of blowouts, mechanical failure, and human error; and failure to control the environmental consequences of petroleum release can be grave. As little as 15 ml of oil, spread over 100 m² of water, can produce an oil slick.⁴ This is equivalent to about 100 U.S. gallons/mi², at about 0.15 microns thick.

When petroleum is introduced into a marine environment, a number of problems can result. Some impacts result from oil coating and asphyxiation. Oil coatings on water reduce the transmission of light, leading to a decrease in photosynthesis in marine plants, including algae. The films reduce gaseous exchange at the water surface, thus reducing dissolved-oxygen levels; this can lead to the retardation of organic waste decomposition, to anaerobic conditions and attendant odors, and to the production of toxic substances such as H₂S. When waterfowl alight on oil-covered water, the buoyancy of their plumage is affected; the birds are unable to stay afloat, and they sink and drown (e.g., perhaps hundreds of thousands of birds died as a result of the Torrey Canyon oil tanker incident off the coast of Cornwall, England, in 1967). Even if the birds do not drown, the body temperature of affected birds may decrease, leading to pneumonia and death. Oil that washes ashore may also produce environmental impacts by coating shoreline flora and fauna. Preening birds also may ingest enough oil to be affected by its toxic components. Hydrocarbon components of petroleum can cause anesthesia; narcosis; cell, tissue, and organ damage; cardiovascular effects; carcinogenesis; or death in all forms of marine organisms - larval, juvenile, and adults. Toxic levels range from parts per billion to parts per thousand, depending on the organism, its life stage, and the pollutant.

* The word "disturb" is used here in a special sense; it means that the water column and surface are removed from alternative uses such as fishing and navigation.

³ "Annual Environmental Analysis Report," Vol. II, " Report MTR-7626, prepared for the Assistant Administration for Environment and Safety, Energy Research and Development Administration, by MITRE Corp./METREK Division, September, 1977.

⁴ S. L. Dilgart and G. R. Higgins, "Oil and Gas Drilling in Lake Erie," Ohio State University paper in Environmental Law, mimeograph, Columbus, Ohio, (U.S.A.), 90 pp. (unpublished).

Long-term or chronic effects also occur, but these are not understood as well as the acute effects. Oil reaching the benthos can remain for very long periods of time, affecting benthic communities, and, through changing sedimentary patterns and changes in bottom currents, can possibly re-enter the water column, re-exposing pelagic organisms at some future time.

The release of highly saline brines from offshore oil exploration and development activities can also adversely affect the marine ecosystem. These impacts can range from small changes in species composition and numbers to a virtual sterilization of the affected benthos.

Because environmental releases of oil and brine from exploration and development are episodic in nature, their occurrences cannot be predicted, nor can the extent of possible damage. The potential adverse environmental impact to marine and shoreline ecosystems should be made part of any cost-benefit analysis of offshore petroleum resource development conducted by the Egyptian authorities.

Solid wastes are produced during drilling activities. It has been estimated⁵ that 18×10^6 t/ 10^{12} Btu are produced during production, and 5.6×10^6 t/ 10^{12} Btu during exploration. If solid wastes are disposed of in the water, additional adverse impacts will be delivered to the pelagic, but especially to the benthic, life forms in the vicinity of the drilling stations.

In summary, the exploration and development of terrestrial and offshore oil resources involve environmental risks that should be considered before exploration activities are begun, so that appropriate preventive and mitigative measures can be employed.

The construction of petroleum refineries produces land use impacts. The operation of refineries involves the release of atmospheric and liquid emissions, both containing pollutants.

One likely site for construction of one or two new oil refineries would be at Ras Shukheir, about 320 km downcoast from Suez on the west side of the body of water. Another possible location for a refinery would be in the vicinity of the El Emeria refinery at Alexandria. El Emeria, itself, could be given expanded capacity.

Except for a lighthouse and a small human settlement, Ras Shukheir is relatively unpopulated. The land disturbance associated with refinery construction depends to a large extent upon the planned capacity and type of process(es) that will be designed; because this information is not currently available for Ras Shukheir, quantitative estimates cannot be given. However, because of the relatively low primary productivity value of the Gulf of Suez coastal lands, the few foreseeable impacts on future land use for other potential purposes, and the minimal habitat destruction that will accompany the land disturbance, it is likely that

⁵ MITRE, Vol. IV, p. 304.

the environmental impacts will be considered acceptable by the Egyptian authorities when compared to the benefits the refineries will confer to Egyptian energy demand and economy.

Construction of a new refinery at Alexandria or expansion of the El Emeria facility will preclude the use of the affected industrial land for other industrial purposes. The land associated with Alexandria's industrial district is already in a highly disturbed condition; thus, no additional adverse environmental impacts of any importance are foreseen.

The principal atmospheric emissions from oil refineries include particulates, SO_x , NO_x , hydrocarbons (HC), and CO. Within the United States, removal of 77 percent of the particulates, 83 percent of SO_x , and 99 percent of CO from catalytic refineries by 1985 is recommended. Certain emissions from refineries using catalytic cracking processes are somewhat greater than from those using non-catalytic methods; however, information concerning the refinery process (and capacities) to be employed in Egypt is not yet available. Thus, accurate estimates of refinery emissions cannot be made at the present time. But, whereas air pollution from Ras Shukheir should be of little consequence due to the small human population in the area, this will not be the case in Alexandria, the second largest concentration of population in Egypt, where air quality is already poor. Additional pollution loading would be likely to increase adverse health effects.

For this reason, any new refineries planned for Alexandria should be equipped with anti-pollution hardware. Table 13 is included as an example of recommendations for pollutant removal efficiencies for U.S. petroleum refineries. If efficiencies comparable to U.S. plants could be included in Egyptian designs, the net effect would be a mitigation of public health impacts that could occur if new refinery capacities are added to population centers such as Alexandria.

Discharges from petroleum refineries contain pollutants that can degrade water quality --biological oxygen demand (BOD), chemical oxygen demand (COD), suspended solids, hydrocarbons, phenols, salts, heavy metals, and other pollutants. It is not known presently whether the final disposition of liquid wastes at Ras Shukheir will be land disposal or discharge into the Gulf of Suez. Land disposal in evaporation ponds may be preferable to discharge into the Gulf. The environmental consequences of both methods should be considered by the Egyptian authorities.

No untreated effluents from new refinery capacity at Alexandria should be discharged into the Bay of Alexandria or Lake Maryut. The bay is already polluted from industrial wastes, untreated sewage, and discharges from ships awaiting loading or unloading* to an extent that the Governor of the Governorate of Alexandria has stated that tourism is being affected and that he will institute control measures. Lake Maryut

* During their stay in Egypt in April 1978, the authors observed, from an elevated position, that the blue-green color that characterizes the rest of the Mediterranean is not present in the Bay of Alexandria. The bay water is gray and brown.

has serious ecological problems; because of uncontrolled industrial and other discharges, one-third of the lake is anoxic and dead. The Lake Maryut fishing industry has been affected. No untreated discharges from new refinery capacity should be allowed to enter Lake Maryut.

Most pollutants that characterize petroleum refinery liquid effluents can be removed. Within the U.S. removal efficiencies of 96.88 percent for BOD, 93.66 percent for COD, 89 percent for suspended solids, and approximately 99 percent for oil, grease, and phenol are recommended for 1985. If Egyptian refinery liquid wastes were treated to the levels recommended for the U.S., this would increase the options for environmentally acceptable disposal of such wastes.

Treatment of refinery liquid effluent streams results in the generation of solid wastes. Refinery operation also results in the generation of other wastes. Table 15 lists the major wastes that are produced by both water treatment and other operations. In areas where water pollution is of environmental concern, land disposal of refinery-operation solids and solids extracted from liquid effluent streams should be preferred to discharge into waters.

In summary, the installation of additional refinery capacity in Egypt will be accompanied by land-use and pollution impacts. Technology exists to mitigate the pollution impacts.

5.2 Nuclear Energy

Although the development of nuclear-electric power in Egypt involves political and technological considerations, the Egyptians believe that nuclear power plant construction will begin before 1985 and that 12,000 MWe of capacity will be installed by the year 2000. For this reason, the impacts of both the construction and operation of light-water reactors (LWR's) will be discussed. Because the development of Egyptian uranium resources would probably accompany nuclear energy development, the impacts of uranium mining and milling will also be briefly discussed.

The most likely place for siting the first nuclear power plant is in the Western Desert in an area approximately 30 km west of Alexandria, south of the Mediterranean shore. The scarcity of fresh water in this area indicates that cooling would be accomplished with sea water in a once-through design.

The construction of a typical nuclear power plant involves the disturbance of several hundred hectares of land, much of which is graded early in the construction phase. Land will be needed for the foundations of the primary and secondary structures, ancillary facilities, laydown and other storage areas, shops and construction offices, roads, railroad trackage, and other features typical of any large earthmoving and building activity.

Construction will physically disturb the land; raise dust; generate noise; result in the spillage of petroleum, cement, and chemical products; and release emissions from fossil-fuel engines and steam generators. Many of these disturbances will also accompany the construction of water channels or pipelines from the plant site to water intake and discharge areas on the Mediterranean Sea.

The effects of construction will disturb the local ecosystem. The ecosystem in the area is very fragile; once disturbed, scores or hundreds of years are required for return to normalcy by natural succession. Although nuclear plant construction will severely impact the ecosystem in a localized area, vast amounts of similar habitat will remain undisturbed; thus, no overall impact to the desert ecosystem is expected. Furthermore, the ecosystem of the Western Desert is very low in primary productivity; and few Egyptians value the undeveloped Western Desert.

Three classes of releases from LWR's that are of potential environmental concern are (1) waste heat, (2) radionuclides, and (3) non-radioactive chemicals. In a once-through system, almost all waste heat and non-radioactive chemicals are removed by the stream of cooling water. Radionuclides are released both to the cooling water and to the air.

Approximately two-thirds of the power generated by a seacoast LWR will be rejected to the cooling water and will be conveyed by channel or pipeline to an offshore discharge system in the Mediterranean. A thermal plume will result, the temperature of which will exceed that of the surrounding waters at the point of discharge. The heated plume can affect the pelagic, near-shore, or benthic marine environments, or all three, depending on the design of the discharge structure, its distance from the shoreline, and the characteristics of the local ecosystem. Changes in species composition and density are typical within the influence of thermal plumes. However, not all impacts are adverse. Increases in mean water temperature can enhance productivity; for example, the maturation of shellfish is known to be enhanced by thermal additions. It is important that the marine environment be assessed so that appropriate discharge sites can be chosen.

Most radionuclides released by LWR's originate from the small percentage of faulty fuel elements that are always present, but some arise from neutron activation of impurities in the cooling water, chemical additives in the cooling water, and corrosion products. These radionuclides are present in gases and waters that leak or are withdrawn from the reactor systems and must be treated before being released to the environment. If the remaining radionuclides do not exceed acceptable levels, they will not directly pose a health hazard to man or to marine species, especially after dilution in the sea. However, concentrations of radionuclides in the biota in the vicinity of a nuclear power plant could result in levels of radioactivity that would pose a health hazard to man if such species entered the food chain. Environmental monitoring of food species and prey should thus be a part of the monitoring program during the operational phase of the facility. A listing of radionuclide releases typical of LWR's is found in table 17.

TABLE 17

LWR GENERATION PLANT RESIDUALS

Residual	Residual Component	Gross ton/ 10^{12} Btu	Gross curies/ 10^{12} Btu
Air Residuals	Kr-85		1.2×10^{-3}
	I-131		1.6×10^{-2}
	Xe-133		7.1×10^2
	Fission Products		2.0×10^2
	Tritium		4.2×10^{-1}
Liquid Residuals	BOD	3.1×10^{-2}	
	Chlorine	3.5×10^{-1}	
	Phosphate	5.5×10^{-1}	
	Boron	4.4	
	Chromates	3.1×10^{-2}	
	Acids	1.1	
	Organics	8.8×10^{-1}	
	Co-60		5×10^{-6}
	Tritium		3.4
	Sr-90		7×10^{-6}
	Ru-106		2×10^{-6}
	I-131		1.1×10^{-4}
	Cs-134		4.3×10^{-4}
	Cs-137		3.1×10^{-4}
	Ce-144		5×10^{-6}
	Fission Products		2.8×10^{-2}
Solid Residuals	Low Level		4.1
	High Level		6.2

A number of non-radioactive water additives and corrosion products are also discharged from LWRs. These additives, for the most part, are used for the inhibition, prevention, or removal of corrosion products and include inhibitors of biofouling, such as chlorine. All such substances are present in the cooling water in relatively low concentrations and should not pose a hazard to marine species or man, especially after dilution with seawater. Table 17 lists the concentrations of typical non-radioactive corrosion products and water additives.

It is possible that some Egyptian nuclear power plants would eventually be sited inland close to other load centers. Here, once-through cooling might not be possible and the use of cooling towers would be an option. Some of the impacts of fresh-water cooling towers are esthetic (production of visible watervapor plumes), a concentration effect on dissolved solids contained in the intake water, shading of flora in the vicinity of the towers, increases in local relative humidity, increased land use, and deposition of salts (mostly sulfates, but some chlorides) contained in the cooling tower "drift."* Most U.S. Environmental Impact Statements concerned with nuclear power plants using cooling towers conclude that such towers do not produce a substantial degree of environmental impact. Therefore, it is not likely that the Egyptian environment will be subjected to unacceptable impacts.

Uranium Mining and Milling Impacts. Uranium deposits have been found near the Red Sea in the Eastern Desert, near Misikat, El Eradia, Kosia, and farther south. Other less-studied deposits are known to exist at Quatrimi, 60 km southwest of Cairo, between Aswan and Abu Simbel, and in the phosphate deposits adjacent to the Red Sea. It is not likely that uranium ore will be mined and uranium extracted prior to 1985, but such activity is highly likely before the year 2000; thus an impact assessment of the technologies falls within the scope of the present report.

The most explored deposits are close to the surface with friable soil, some with reported outcroppings; surface mining techniques will be used initially. The area is surveyed, cores are taken, overburden is removed with specialized heavy equipment, uranium deposits are located and marked, and the ore is removed and loaded into vehicles that convey it to the mill that is usually sited near the mines.

The major impact of uranium mining involves the disturbance of the land and its ecosystems. The area involved typically is about 14 ha per 1000 MWe-equivalents of uranium mined per year, or 5.9×10^{-1} gross acres/ 10^{12} Btu. The ecosystem in the excavation and overburden-deposition areas will be totally and permanently destroyed. Desert ecosystems are very fragile and it is likely that human activity, noise, vibration, dust, road building, spills, emissions, and off-road vehicle trackage will affect adjacent areas as well. Primary productivity in the Eastern Desert is low, and the desert ecosystem is considered to be of little value to man; thus, such impacts are acceptable. The areas

* Reported characteristics and discharges typical of cooling tower systems are available elsewhere.

with uranium-bearing potential are desolate, and visual impact is considered unimportant. Land contour restoration would seem to be economically unwarranted for the same reason; and land reclamation would be an unattainable goal in view of the dearth of precipitation.

Other impacts will be to the atmosphere including chemical emissions from fossil-fueled machinery, release of radon gas, and radioactive dusts. The chemical emissions include releases of SO_x (e.g., SO_2 and SO_3), NO_x , CO, and hydrocarbons. Small amounts of particulates are also released. The quantities involved are small in relation to the amounts released by point sources such as fossil-fueled power stations. They will produce no significant air pollution problems because the mines will be in very remote locations.

Radon, a gaseous radioactive decay product, will be released to the atmosphere as a consequence of mining. Because the gas is immediately released to the atmosphere in open-pit mining (not entrapped as in underground mining), miners will be exposed to only small concentrations in excess of ambient. It is not possible to predict what concentrations will actually be experienced, nor if any occupational health hazards will be encountered. Based on some experience in the U.S., it is expected that if any health hazard related to open-pit uranium mining is experienced in Egypt, it will be only marginal.

Radioactive dusts will be raised as a consequence of mining. These can represent an occupational health hazard to the miner; however, the extent of impact can be mitigated if a conscientious program of health physics is made part of the mining plans. The dusts can also be transported by wind to surface water supplies. If surface water supplies exist in the vicinity of the Egyptian mines, dust control measures and health physics controls can minimize the contamination of water resources.

If groundwaters are encountered during the mining of Egyptian uranium, as they frequently are elsewhere, they must be removed as part of the mining process. Such waters typically contain both radioactive and non-radioactive dissolved solids, as well as particulate matter. These substances can pollute existing or potential local water supplies unless the mine water is isolated from them. Not enough is presently known about the geohydrology of the Egyptian mining sites to assess if aquifers of potential value are present and could be contaminated by mining activities. If surveys show that such could occur, mining activities should be designed to isolate mine discharge waters from existing or potential water supplies.

Strip mining for uranium will destroy or alter small portions of the desert ecosystem, and will leave the land scarred. However, in view of the low productivity of the Egyptian desert ecosystem, its low value to man, and the remoteness of the potential mining area, these impacts are considered acceptable.

Because it is expected that average uranium values in Egyptian deposits will not be high, economics dictate that the uranium be extracted from the ore near the mining sites rather than be exported.

For this reason, the impacts of uranium milling require discussion. The U.S. has had several decades of uranium milling experience and this knowledge of mill operation provides part of the data base used to predict the impacts of uranium milling in Egypt.

In the following assessment, it is assumed that the acid leach milling process will be used. Approximately 80 percent of uranium ores processed elsewhere are amenable to the acid leach process. In this process, (1) the ore is mechanically reduced to a particle size favorable for efficient uranium extraction (ball or rod mills are typically used), (2) the pulverized ore is leached in open tanks with steam-heated sulfuric acid solution containing sodium chlorate, (3) the uranium-bearing leachate is separated from the spent "slimes" with organic solvents (sometimes with ion-exchange resins), (4) the uranium values are removed from the solvent, and (5) the uranium, now in the form of ammonium diuranate, is sintered and dried in ovens to produce a product termed "yellowcake," which is nominally U_3O_8 . In Egypt, this product would be drummed for export.

A number of chemical substances are released to the environment as a consequence of uranium milling including dust, hydrocarbons, oxides of sulfur and nitrogen, and other materials. At U.S. mills, the airborne releases of non-radioactive chemical effluents become very small after dilution in the ambient air and are generally considered to have negligible impacts on air quality at a short distance from their sources. The Egyptian mills will be located close to the mines in areas characterized by remoteness and extremely low population densities. For this reason, no impact is expected from airborne releases of non-radioactive chemicals.

Radon gas (Rn-222) is also released to the air as part of the milling operation. Here too, dilution and remoteness are factors that reduce the potential impacts of this radioactive gas to negligible proportions. Occupational exposures will also be acceptable, provided that the mill workers do not live directly adjacent to the mills. In this case, air monitoring should be made part of the mill monitoring program to assure that acceptable Rn-222 levels are not exceeded in the workers' residences.

The majority of noxious, poisonous, or radioactive waste materials are released from a mill in an aqueous effluent stream, about half of which is spent ore (tailings, slimes). In the U.S., it has been general operating practice to dispose of such tailings, either (1) in areas geohydrologically isolated from groundwater used for human or animal consumption or for irrigation, or (2) in lined pits (usually clay) that tend to isolate the tailings slurry from water resources. Insufficient hydrological information is currently available to assess whether existing or potential water supplies are located in areas of potential influence by future uranium mills. Such information should be gathered and assessed to assure that proper tailings-disposal methods are employed. If this is done, liquid effluents from Egyptian uranium mills should not pose a public health hazard to aquifers of current or future use.

Because of their remoteness, Egyptian uranium mills are likely to be self-sufficient in terms of support facilities such as laundry services, trash and garbage disposal, and sanitary systems. There will be adequate land available in the vicinity of the mill for proper disposal of wastes from such services. All uranium-containing wastes will very likely be returned to the mill circuit; thus no impacts from improper disposal are expected.

The pollutant loading of untreated sanitary waste water of a typical mill employing about 200 people includes several kg/day of suspended solids, dissolved solids, BOD, and other wastes. There will be no difficulty in designing satisfactory sanitary facilities to handle waste loadings of this magnitude in the spacious desert lands in the potential mining areas.

5.3 Hydroelectric Power

5.3.1 Qattara Depression: Qattara is an extensive topographical depression in the Western Desert. The lowest elevation of the depression, -133 ft MSL, occurs in an area that is roughly 50 km south of the city of Matruh on the Mediterranean Sea, 80 km west of El Faiyum. The Qattara Depression begins its descent from sea level at a point approximately 75 km south of the Mediterranean.

The initial hydroelectric power content of descending seawater would be about 700 MWe, as it flows into the depression by way of a channel cut to the Mediterranean. The exact location of the channel has not yet been chosen, but the channel will be approximately 70 km in length. In about ten years when the Depression would become completely filled, the hydroenergy content would drop to about 300 MWe but would be maintained at this level by the water inflow necessary to balance evaporation and infiltration. Although this amount of energy is considered relatively small in relation to the hydropower that exists in Egypt, the Egyptians believe that the development of Qattara would provide ancillary benefits -- including an inland seaport and an area that could foster industrialization, especially industries and services that involve foreign import and export, or access to large volumes of water. They believe that this kind of a development would also provide jobs and services necessary for decentralization and population expansion, long-range goals of the Egyptian Government.

For these reasons, both the authors and their Egyptian contacts* believe that work on the Qattara Depression canal will begin before the year 2000, regardless of what technological difficulties currently remain to be solved in digging the canal and whether nuclear excavation or conventional methods are employed. At the present time it is not possible to provide a detailed assessment of the environmental impacts

* Personal communication while in Egypt, April 1978, with Drs. Ahmed Hamza and Samni Saad, High Institute of Public Health, Alexandria University; Dr. Mohamed Younis, National Research Center; and Dale Whittington, Egyptian Academy of Scientific Research and Technology.

of canal construction since the location and dimensions of the canal and the excavation technology to be employed are not yet known.

If conventional excavation methods are employed, the impacts can be expected to be similar to those known to occur in any other large desert construction project. Manual and machine labor will be involved in earth moving, resulting in land disturbance, temporary or permanent disruption of the fragile desert ecosystem, dust, and noise. In view of the negligible productivity of the local ecosystem, and the capacity of the Western Desert to absorb pollutants, the authors expect no impacts of importance to man would occur as a result of conventional construction of the canal.

If nuclear excavation methods are employed to construct the canal, the environmental consequences could be severe. An understanding of the kinds of impacts that might result can be gained by consulting documents concerned with "Project Plowshare." To anticipate and mitigate the major environmental effects that can occur as a result of using nuclear explosives, a complete and detailed environmental assessment should be carried out and reviewed at the highest levels before this approach is approved.

Because it is not likely that the Qattara Depression project would be completed by the year 2000, a discussion of the operational phase is beyond the scope of the present report; however, four areas of possible impact that may eventually have to be addressed in detail are as follows:

Terrestrial. There will be a complete and irreversible loss of the terrestrial ecosystem in the Depression as it fills with seawater. The loss will be extensive, as the land area to be inundated will be about 19,500 km². This cannot be mitigated by the development of a marine resource in the basin because the salinity of the impounded water will rapidly increase after the basin is filled (after about ten years).

Marine. An adverse impact is likely to affect the marine ecosystem in the vicinity of the intake for the Qattara Depression canal because of the huge volume of water that will be taken. The degree of impact will be related to the characteristics of overall importance of the ecosystem in that area. Data characterizing inshore and offshore marine areas likely to be impacted should be gathered and analyzed, so that only those areas of least ecological importance may be considered for development.

Climate. Some agronomists cite concerns that filling of the Qattara Depression will raise the humidity in the Western Desert, resulting in fungal attack on food and other crops. Although the relative humidity in the near vicinity of the Depression will be elevated to some extent, it does not appear likely that this influence will extend to crop-growing regions such as at El Faiyum. However, a detailed climatological study is recommended to assess how far, and in what direction, the influence of elevated humidity will extend. Even in the

worst case, assuming that the humidity of some crop areas was elevated and that fungal problems began to develop, resistant seed stocks are available that might be substituted, if they can be adapted to grow in the affected areas.

Salt Water Intrusion. Contamination of fresh-water aquifers underlying the Qattara Depression by the pressure-head of the contained salt water may or may not occur. Some discussion of this may be found elsewhere in this report.

In conclusion, there are no relevant historical parallels against which the Qattara proposal can be examined, either in terms of the vastness of the land area to be involved or the basic concept. The environmental impacts may or may not be large, depending upon options not yet chosen. The use of nuclear explosives for canal building could have severe environmental consequences. A thorough, detailed assessment of potential environmental impacts should precede any decisions to go forward with the Qattara Project.

5.3.2 Other hydroelectric development: Most of Egypt's potential hydroelectric capacity is saturated. Four places where additional hydroelectric capacity could be installed include (1) a second generating station at Aswan, with a capacity of 160 MWe; (2) the Esna Barrage, 84 MWe; (3) the Nag Hamidi Barrage, 52 MWe; and (4) the Assiut Barrage, 48 MWe.

Construction of a hydroelectric facility at Aswan would not be unique, and would involve impacts typical of any other large construction project involving earthmoving: impacts to the land and terrestrial ecosystem; dust; noise; spillage of petroleum, concrete, and chemical products; and emissions of airborne effluents from fossil-fueled machinery. Releases of construction-associated silt into the Nile River could have short-term effect on the downstream water-borne and benthic river populations and possibly on irrigation; however, these effects would be reversible after construction ceases. Operation of the new power plant would only represent a reapportionment of the Nile River waters now controlled by existing facilities, thus no additional water impacts are to be expected.

Installation of hydroelectric capacity at the barrages would involve the redesign and rebuilding of the dams. All of the impacts typical of earthmoving projects, discussed above, would accompany facility construction, but the impacts would be on a greater scale due to the greater scale of the barrages. In addition, it is likely that some agricultural lands would be taken up by facility construction. Because irrigation waters are now totally controlled by the existing barrages, no additional agricultural impacts should result from hydroelectric station operation as long as releases are synchronous with irrigation needs.

In conclusion, no serious or irreversible environmental impacts are expected as a result of the development of electric capacity at Aswan or at the Esna, Nag Hamidi, and Assiut Barrages.

There are several places in Egypt where pumped storage facilities for electric power generation could be constructed and operated, such as at Galala el Bahariya and Gebel Ataquia, south of Suez on the Red Sea. Some of the impacts associated with the construction and operation of pumped storage facilities are similar to those accompanying hydroelectric power developments.

5.4 Solar

As discussed elsewhere in this report, insolation is favorable throughout Egypt for the development of solar power. While the most optimistic estimates indicate that some solar power (less than 1 percent of total energy use) will be utilized by 1985, it is estimated that from 1 percent to 10 percent of the facilities for Egypt's solar energy requirements could be installed by the year 2000, depending largely on the general status of solar technology development and the solar technology chosen for exploitation in Egypt. Thus, an assessment of the environmental impacts of constructing and operating solar facilities is within the scope of this report. The solar technologies that will be considered include individual roof-top water heaters, medium-scale (agricultural and industrial process) heat collectors, thermal-electric (photovoltaic) systems, and wind-powered devices.

5.4.1 Individual roof-top heaters: Based on observations of this technology in Israel where many roof-top water heaters have been in use for over twenty years, no environmental impacts of any consequence are foreseen if this technology is developed in Egypt. This technology could provide Egyptian families with hot water for cooking, washing, and personal hygiene, and would partially replace the use of butagas and animal dung as fuel. No effluents are released from roof-top heaters, and once installed they are reliable and require a minimum of cleaning and other maintenance. There is, however, one factor characteristic of rural Egypt, but not typical of Israel that could involve a minor environmental impact if solar roof-top heaters are installed. Much of the roof area in villages, agricultural communities, and farm houses is committed to the drying and storage of straw grasses and animal dung used for building, animal keeping, cooking, and heating. Installation of solar roof-top heaters on a large scale would reduce the total available roof area. One compensating factor, however, would be a small reduction in the need for dung for cooking (and hence reduction of roof storage area) if solar hot-water heaters were installed. Because of the considerable weight of water-filled, roof-top tanks, the weight-bearing characteristics of many roofs may require local strengthening, especially where the weight of the heaters is to be borne. Such construction activity may be accompanied by small economic, material-use, fuel-use, and environmental impacts that should be outweighed by the benefits conferred by the use of solar-heated hot water.

5.4.2 Medium-scale thermal heat collectors: It is conceivable that a few solar thermal systems could be installed in Egypt to provide relatively large amounts of hot water or low-grade (less than 350 F) steam prior to the year 2000. Water heated by this method could find application in uranium milling and industrial processing (such as in textile and paper making, can and bottle washing, rapid drying of agricultural products, plastic and concrete block curing, brick drying, and metal finishing). Solar energy captured by thermal collectors could also contribute to total energy systems that produce on-site electricity, while utilizing the rejected heat for hot water or low-grade steam uses such as those mentioned above.

Different types of solar collectors will be used for producing heated water as compared to steam because of differences in maximum temperatures that will be necessary, e.g., flat plate collector arrays for heated water and parabolic dish collectors for steam. While both systems will have the same basic, relatively conventional modules for the most part (plumbing, pumps, controls, valves, and heat exchangers), the production of steam requires higher temperatures that can be easily obtained by a concentration system such as the parabolic dish with energy collection devices at the focus (a cavity absorber where water is vaporized to steam by high temperatures). On the other hand, the production of heated water would likely be achieved by the use of stationary, single-glazed, selective-surface, copper, flat-plate collectors. In the following discussion, it is assumed that no collectors or other non-conventional hardware will be manufactured in Egypt; thus the environmental impacts associated with their manufacture are beyond the scope of the present report.

The major environmental impacts that will be associated with the use of flatplate collectors will involve land and water use. In a hypothetical example,⁶ that of a soup-canning operation envisioned in California (U.S.A.) that would require 302,800 liters of hot water per day, a flat-plate collector array of 13,900 m² surface area (about 1.4 ha) would be constructed to provide approximately 3.8×10^9 Btu/yr. A collector array of this size would require about 27,900 m² of total groundcover, or about 2.8 ha. It was assumed that the average yearly insolation at the California location, direct and diffuse, was approximately 6.4×10^5 Btu/ft²/yr. Since the insolation values for most parts of Egypt exceed this California value, the groundcover that would be required in Egypt would be less to varying degrees in almost all cases.

The degree of land-use impacts in Egypt would to a large extent depend upon the setting. For example, such impacts would be great if it was decided to site a collector array for an industry located or to be located in an urban or suburban setting. Here, the land that would be committed to the solar array would preclude use for housing, other industrial development, commercial facilities, or recreation. While the

⁶ See final item in Appendix A.

roofs of solar energy-supplied facilities could be committed to flat-plate collectors, the roof areas would constitute only a small percentage of the collection area required for most industrial purposes. Siting in agricultural districts (e.g., for grain drying) could preclude the use of land for agriculture. If, however, solar energy-supplied facilities were constructed in a remote, desert area -- a concept consistent with the Egyptian Government's diasporization policy planning -- land-use impacts would be minimal; Egyptian desert lands are very low in productivity, and are presently considered by the Egyptians to be of little use to man. Furthermore, flat-plate collector land requirements could easily be included in settlement planning, minimizing potential land-use impacts.

Collector array land requirements for parabolic dish collector systems are also considerable, particularly because direct insolation is a requirement; diffuse sunlight is of minimal value. In a hypothetical system, a metal fabrication plant in California, a collector array size of about 6,970 m² would be required to produce about 5.2×10^{10} Btu/yr at an average yearly direct insolation value² of about 9.7 x 10⁵ Btu/ft²/yr. Here, 370,000 ft² of land (34,370 m² or 3.4 ha) would be needed because about five times as much total land area than collector size is required. In this hypothetical example, heliostats are employed for concentration tracking of the solar rays.

The land-use impacts would be similar for parabolic collector systems as for flat-plate collectors except for scale. In view of the greater interspace requirement of parabolic systems, facility design should include a study to determine if the interspace can be put to use. One possibility is the culture of shade-tolerant food plants.

Water-use impacts are likely to accompany the maintenance of solar facilities because of the large surface areas of solar collectors. Solar collector efficiency is significantly decreased if dust is deposited upon the active surfaces, whether of the flat-plate or parabolic concentrator design. Dust deposition will be a problem almost anywhere in Egypt during its two annual windy seasons of the year, but particularly during the "khamsin" (translation: the fifty days of wind), which usually peaks in the month of April but has been known to come in March and May.⁸ During this period, a small but vigorous low-pressure area forms in the southwest corner of the Mediterranean and sweeps across the northern coast of Africa, drawing winds from the continent. In Egypt, where there are few terrain barriers to its passage, the khamsin winds from the south reach high velocities (as much as ninety mph) and carry great quantities of desert sand and dust, sometimes for days. During the authors' site visit in Egypt in April 1978, a minor khamsin event

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Ibid.

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R. F. Nyrop, et. al., Area Handbook for Egypt, 3rd ed., (DA Pam 550-43), Foreign Area Studies, The American University, 1976. Available from the U.S. Government Printing Office.

near Cairo deposited a visible layer of sand and dust on clean surfaces exposed to the weather for just a few seconds. Such dust must be removed from solar-collector surfaces if their efficiency is to be maintained. If water, either manually or mechanically applied, is to be used to wash or rinse the surfaces, impacts on water resources and water use will have to be considered by the Egyptian authorities. The impact would be the greatest in desert areas away from the Nile Delta where water is very scarce. If solar facilities are sited near the Mediterranean or the Red sea, it is possible that collectors could be engineered to withstand sea water so that it could be used for all or part of the wash water, but only if sea salt crystallization or deposition could be controlled.

In areas not as prone to dust deposition (e.g., near Alexandria on the Mediterranean), sea salt mobilized by ocean storms will fall upon collector surfaces and may require removal, as with dust, in order to maintain efficiency. Thus fresh-water availability and use would here be impacted unless sea water could be used for rinsing the collectors.

Solar facilities for Egypt should be designed so that the runoff from fresh-water rinsing can be collected and reused, e.g., for agriculture. Such designs would also confer an additional benefit: that of serving as rainwater collectors for the few centimeters of natural precipitation that fall each year. However, if solvents or detergents are found to be necessary for cleaning solar collectors, reuse of runoff water may not be acceptable. In such instances, operational release of contaminated wash-water effluents could produce impacts on the local ecosystem unless the effluents are collected and properly disposed of. Other possible releases include degradation products of the collection surfaces* and rejected heat from collectors. There is little experience that can be drawn upon to estimate the magnitude of these possible impacts or to suggest effective mitigation measures. Much depends upon the systems ultimately designed and installed.

Finally, makeup water will be required for the operation of solar thermal steam units. For the hypothetical metal fabrication plant discussed previously, from 1.6 to 3.2 ft/yr (1970-3,950 m³/yr) of cooling-tower makeup water and boiler blowdown would be required. Use of this much water may be considered a significant impact if siting occurs in a desert area where water is scarce.

5.4.3 Solar photovoltaic: Photovoltaic systems are basically more simple than the solar-collection systems previously described, because they can convert sunlight directly to electric current without the use of a working fluid and associated hardware. However, although the land-use impacts would be qualitatively similar to those described for

* For example, chromium oxide, black nickel, copper oxide, iron oxide, and paints of various compositions.

the solar thermal systems discussed above, the impacts would be on a somewhat greater scale because electric collection equipment and switchyards would necessarily accompany the photovoltaic collection array. The extent of such additional land area committed to each facility, and the attendant impact on affected ecosystems would be linked to facility design, and thus cannot be qualitatively discussed in this report. If direct current to alternating current conversion capabilities are to be part of facility design, land-use impacts would be greater than if the direct current that characterizes photovoltaic collectors is used or transmitted directly.

Water use and other potential impacts discussed for thermal systems would also apply to photovoltaic systems, except that losses due to boiler blowdown and cooling water makeup would not apply.

In summary, impacts on land and water use will characterize the installation of medium-sized solar power collection capability in Egypt. Some other potential impacts have been considered, but these seem to be of lesser importance. The design parameters of various facilities that could be designed and their probable locations are not known; thus, more detailed impact analyses must await the availability of more specific siting information.

5.4.4 Wind power: The average wind velocity of the Mediterranean coast is 10 to 12 mph, and on the Red Sea coast, 14 to 16 mph. Such wind velocities favor the development of wind-power resources in Egypt before the year 2000. Another sector where wind power could serve a need would be to replace animal (and fossil-fuel) powered irrigation pumps in agricultural areas along the Nile and in the Nile Delta. For these reasons, an assessment of environmental impacts that will be associated with the development of wind-related energy is within the scope of this report.

Installation of wind-driven pumps and electric generators can supply power in undeveloped areas, consistent with Egyptian development plans. For example, the expressed policy of relocating Bedouin tribes in new farming communities in remote areas along the Mediterranean Sea could be augmented by the positive benefits that would be conferred by wind power; if wind-powered pumps and electric generators were incorporated in village planning, most of a village's power needs would be self-contained. Similarly, plans for tourist developments along the Red Sea coast could include wind powered generated electricity, making such developments self-sufficient for power needs. During a site inspection of the Nile Delta agricultural areas in April 1978, it was observed that for the most part animal labor (water buffalo, donkey, horse, and camel) was used in wheel traces for pumping irrigation water to the fields; a few fossil fuel-powered engines were also observed. Discussions with Egyptian officials* revealed that the use of animal

* Dr. Ahmed Hamza and Dr. Sammi Saad, High Institute of Public Health, Alexandria University.

power provided a negative impact on the nutritional status of the Egyptian farmer, because the animals had to be fed consistently, whether they worked or not. The replacement of animals with small wind-driven pumps, similar to those that have been used on American farms in the past, could thus produce a positive health impact in Egypt.

The beneficial aspects of installing wind-power energy sources in Egypt would be somewhat offset by the environmental impacts that are discussed below. These include land-use constraints, electromagnetic wave interference, bird kills, esthetic impact, and chemical releases from associated electricity storage components.

Approximately 0.4 ha of land would be necessary to site each 3 MWe of wind power generating capability. This factor is relatively small as compared with permanent land commitments necessary for typical fossil-fuel and nuclear power plant sitings. Even where large arrays would be necessary to power self-contained farming centers or resort areas as discussed above, considerations of permanent land commitment should not be an important factor even when many hundreds of hectares* would be involved. This is because the land between the units would be available for many uses where noise would not be a factor (e.g., for agriculture). The amount of land permanently committed to the units themselves (the wind tower bases) would be trivial compared to that not occupied. Furthermore, the likely siting areas, as discussed previously, are desolate and arid, characterized by very low primary productivity, and not highly valued by the Egyptians. Damage or destruction of the ecosystem in the vicinity of the wind units during construction of the arrays would be of trivial impact in relation to the vast amount of similar habitat that would not be affected. Electricity collection and distribution switchyards would be a necessary part of the facility design. These switchyards would require additional land commitment and also contribute to land-use impacts. The land required to be committed will be a function of array design and thus cannot be quantitatively estimated here. Replacement of animal-powered pumps by individual wind-powered units in agricultural areas would actually confer a positive land-use benefit. The area occupied by the tower bases would be less than that currently committed to the wheel traces trod by animals, and the area committed to maintaining the animals would be reduced, freeing the land for other uses, such as agriculture.

Rotating rotor blades can "chop" and reflect electromagnetic waves and thus can affect radio, television, microwave, laser beam, and satellite communications. The influence of the rotating blades will probably be line-of-sight for most applications; interference should drop to acceptable levels within a few hundred yards of the arrays. Because the effects will be so localized, the Egyptians should not find it difficult to site the arrays at locations that will not interfere with communications. Individual wind towers on farms will not affect electromagnetic transmission to a significant extent.

* A minimum spacing of about 29 ha between units in an array is necessary to maintain power-generation efficiency.

Flying birds will be struck and killed by the rotating generator blades. There is no applicable previous experience upon which a quantitative assessment of such a kill can be based. Arrays should not be sited in locations on bird migration routes nor where rare or endangered birds are found. The height of the structures and heights of migrational flight patterns should be considered before array placement. If arrays must be sited along migration routes, the vortex generator design should be considered. In such units the blades would be enclosed and located at the base of the tower, where they would pose a hazard to only a few flying birds. Individual wind tower blades on farms will kill few birds because of their small diameters and low height.

For most viewers, wind tower arrays will produce an adverse esthetic impact, particularly because of the relatively large land areas that will be involved in siting arrays of a size sufficient to service an agricultural community or a resort area. However, because most areas likely to be developed for wind power facilities are in remote, almost unpopulated areas, adverse esthetic impacts will not be great. Tower arrays should not be sited in the visual sphere of resort developments, lest the esthetic value of the developments be decreased; electrical transmission lines could transmit power to such resorts from remotely placed tower arrays. Individual wind towers on farms will not be considered esthetically unacceptable by most observers and may be considered positive by some.

Because wind-power arrays are passive devices in which no fuels are oxidized, no pollutant releases are expected per se. However, since winds are not constant, electric storage capabilities will likely be a part of Egyptian facility design, especially where settlements will be self-sufficient in their power needs. Storage may involve battery banks of electrolysis units that may release dangerous substances such as acids, heavy metals, and hydrogen. Such releases would be episodic rather than constant; therefore it is not possible to quantitatively assess the degree or frequency of adverse impacts that could result. Storage facilities can be designed to minimize the release of unintended effluents. Individual wind towers on farms will not have associated power storage facilities. In summary, wind power technology can be sited in Egypt with a minimum of adverse environmental impacts.

5.5 Geothermal

Egypt presently has potential geothermal power sources in the New Valley of the Western Desert (El Kharga, Dakhla Oasis) where 42°C water is present. It appears also that a higher-temperature geothermal resource (as high as 150°C) may exist near the Gulf of Suez, where 75°C water has already been found. In addition, hot water surfaces at Hammam Pheroun (translation: Pharaoh's Bath) where it is used in spas in the resort area. However, because thorough exploration takes about two years and development five, it is not likely that geothermal space- or process-heating water could be available by 1985. Development is very likely by the year 2000, thus an assessment of the impacts of geothermal energy development and operation in Egypt is within the

scope of the present report. Other geothermal resource possibilities may exist to the east of Cairo and in the north of the Western Desert, but as almost no data are available about those sites, no impact assessment for these is possible at the present time.

For the purpose of impact assessment, the existing and potential geothermal resources of Egypt will be divided into two functional categories: (1) low-temperature (less than 90°C) deposits suitable for use in hot water space heating, as hot process water, and as waters suitable for recreational developments (spas, resorts); and (2) high-temperature (greater than 150°C) deposits suitable for electric power generation. It is not known if the higher-temperature Egyptian geothermal resources will be liquid or vapor dominated, but on the basis of the scant available data it appears that the systems might be liquid dominated. In the U.S., most geothermal reservoirs are believed to be liquid dominated. For the present report, it is assumed that most Egyptian geothermal resources that will be developed by the year 2000 will be liquid dominated. However, some impacts of vapor-dominated systems will be discussed where appropriate.

In addition to the gases and minerals that characterized both systems, such as boron, CO₂, H₂, CH₄, N₂, H₂S, mercury, radon, and ammonia, the hot water systems often yield hot mineralized or saline waters containing a wide variety of metallic salts and silica.⁹ In some cases, the hot waters are of sufficient purity to be used for irrigation and other purposes. For the present report, the worst case will be assumed for most assessment purposes -- i.e., that waters will be highly mineralized. The impacts of Egyptian geothermal resource development will be considered for four phases: exploration, testing, development, and operation. Abandonment (decommissioning) will not be assessed in this report.

Low-temperature Sources. Geothermal exploration at El Kharga, Dakhla Oasis, and Hamman Pheroun will involve the drilling of a number of small boreholes so that physical measurements and water samples may be taken. Such activities involve a minimum of land disturbances and disruptive practices; no impacts are expected. This is especially true because the sites of the low-temperature geothermal potential will be in the unproductive Western Desert, in areas of low population densities.

If exploration is promising, larger and deeper test wells will be drilled. While a somewhat greater land area will be required for such testing, again the impacts to the environment will be very small for the drilling operation itself. The drilling area typically covers about 190 m², set on a graded pad of less than 0.4 ha. A reserve water pit of about 92 m² and 2 to 2.5 m deep is often sited adjacent to the drilling pad. Although the fragile desert ecosystem will be destroyed in the active area, and will not return by natural succession for scores to hundreds of years, the area involved will be small compared to the

vast amounts of surrounding similar habitat. In the event of a "blow-out" (the uncontrolled escape of hot water, gases, and/or steam), the environmental hazard will be increased because of difficulty in handling the effluents. In addition to wasting the geothermal resource, blowouts can cause a noise nuisance, air pollution, pollution of terrestrial and aquatic resources, and danger to the health and safety of the drillers. Because of their episodic nature, it is not possible to quantify such impacts; however, in view of the probability that modern drilling techniques will be used and that blowout preventers will be part of the drilling apparatus, the likelihood of blowouts is not great. Another area of possible environmental impact would involve any well effluents purposely released for testing purposes. Except for danger to health and safety, the release of such effluents can pose threats similar to the blowouts discussed above. The control measures that would be necessary to mitigate the environmental impact of effluent releases would depend on the location and physical characteristics of the test-well locations as well as the composition of the issuing water, gases, and/or steam.

If the test wells prove the existence of economically exploitable hot water resources, well-field development would follow. This would involve the drilling of a number of additional wells to form a well field with a yield suitable for the desired end-use of the hot-water resource. The same type of environmental effects as described for test wells would be involved in the construction of well fields, except they would involve a greater scale; could last for many years (as the fields are expanded); and would involve effluent-transportation pipelines, new roads, and the construction of end-use facilities. At the Egyptian sites, likely end-uses would involve the space heating and cooling of new residences, factories, governmental, and commercial facilities in new communities that would be founded near the site of energy production in the spirit of the government's population diasporization plans. If the effluents are shown to meet criteria of purity for irrigation water, agricultural components could be added to the new communities. In addition, recreational developments are likely (spas, resorts) especially at Hammam Pheroun, where the waters were valued for therapeutic purposes during the time of the Pharaohs.

The large scale of well-field developments and end-use facilities will involve an obvious impact to the land and its resources. The Egyptian Government should consider the adverse environmental impacts as costs, in an analysis of the benefits of the new developments.

The control of both gaseous and liquid geothermal effluents will become much more critical as the population increases near the centers of production. Environmentally acceptable ways will have to be found to dispose of the spent hot water (e.g., reinjection into the ground, surface evaporation, and purification). If gaseous releases are shown to be an adjunct to resource use, human populations (and in some cases, agricultural areas) should be sited upwind of the well fields. These factors should be considered during the planning of resource development, before community building begins.

Finally, it is possible that land subsidence will occur as an adjunct to hot-water extraction at high volumes. This could have very serious impacts in agricultural areas where gravity-fed irrigation systems are in use. While not enough information is currently available to predict if this will occur in Egypt, such determinations should be a part of studies preceding well-field development, so that control measures can be integrated into planning, and ensuing facilities and populations can be properly sited.

High-temperature Sources. While high-temperature geothermal water can and probably will be used for the same purposes as the low-temperature waters discussed above, a principal use of waters over 150°C will be for the production of electricity. Although liquid-dominated systems are assumed, it is possible that potential resources in the Gulf of Suez could prove to have a substantial vapor phase as well, or it could even prove to be vapor-dominated. For this reason the environmental impacts of vapor-dominated geothermal resource development will also be discussed to some extent.

The environmental impacts of exploration for and testing of high water-temperature resources are similar to those that would be observed during the development of lower temperature reserves, except that the frequency and severity of blowouts would be greater if vapor-dominated systems are encountered. The resource-development phase would differ, however, in that electricity-generation facilities would be constructed in parallel to well-field development. Insulated pipelines would convey the geothermal resources to the electrical facilities. In addition, powerlines and switchyards would also be constructed; their lengths and numbers would strongly depend on whether the power would be used locally in new community developments or would be exported to distant grids.

The type, size, and numbers of electric power plants associated with Egyptian geothermal resources by the Gulf of Suez will depend on the yield and characteristics of the resources. This type of information must await further exploration and the drilling of test wells. However, there are assumptions available concerning liquid-dominated U.S. geothermal development that should be partially relevant to future Egyptian experience. A geothermal power complex with a capacity of 200 MWe would permanently occupy 11 ha, 1.6 ha of which would be committed to a power plant, and 0.4 ha to each permanent well. The land-use impacts to approximately 0.4 ha per 7 MWe will probably be considered cost-beneficial by Egyptian government planning officials, particularly in view of the fact that the plateaus in which the resource would be located are considered valueless wastelands. Even if permanent destruction of all of the associated terrestrial habitat occurred, this would be of little consequence, because vast, undisturbed areas of similar habitat would remain.

Of greater environmental concern, especially if a significant portion of the resources are found to be in the vapor/gas phase, is potential for air pollution and its effect on the public health of Egyptian citizens that would occupy new communities sited near the energy resources. Of the air pollutants associated with geothermal resources, H_2S , CH_4 , and NH_3 have known adverse effects on humans and animals. Also, SO_2 and SO_3 could be released

if the resource is in the oxidation state (preliminary data indicates that SO_2 is present in the Gulf of Suez potential resources); SO_2 and SO_3 can be biohazards to humans, animals, crops, other plants, and trees.² Hydrogen gas, while not considered a biohazard, can form explosive mixtures and can hence present hazards to humans. In addition, carbon monoxide and mercury vapor, both of which are biohazards, are also part of the gaseous component of some geothermal resources.

Of the air pollutants discussed above, H_2S is the most acutely toxic to humans. While a detailed discussion of toxicities is beyond the scope of this impact assessment, it should be noted that H_2S is present at 16 times the toxic levels in geothermal steam at the Geysers, and 25 times the toxic level at Larderello, Italy. After dilution with air, H_2S levels should be less than toxic, except under meteorological inversion conditions when levels would likely range from nuisance to mildly toxic. Community and facility development planning should include meteorological analysis to assure that siting will not be adverse to human populations. A discussion of human health effects of geothermal-associated pollutants is available.¹⁰

A final potential environmental impact that should be considered, particularly if a vapor phase will be present and new communities are to be sited, is that of noise. Noise levels ranging from nuisance to pain threshold are associated with geothermal resource development and use. This should be taken into consideration when considering the location and distance of human populations to be established at geothermal facilities.

In summary, Egyptian geothermal resource development can involve environmental impacts in the categories of land use, pollution, noise, and society. Aspects of these potential impacts should be considered during planning so that the impacts can be prevented or mitigated.

6.0 SUMMARY OF IMPACTS OF ALTERNATIVE STRATEGIES

6.1 Impacts of Alternative Energy Strategies

The environmental impacts of nine energy systems have been discussed in Section 5, including coal, oil, natural gas, nuclear, hydropower, solar (thermal, photo-voltaic, wind power) and geothermal.

Since it is unlikely that much coal will be burned in Egypt, one of the most potentially serious energy-related environmental problems is eliminated from consideration.

As discussed in Chapter 5, the production, refining, and combustion of oil and gas can be accompanied by significant environmental impacts, thus careful planning and control is necessary. If the oil has a high sulfur content, it should not be burned without sulfur controls. An increase in the use of natural gas can also increase existing air pollution problems if new gas supplies are high in sulfur, and are burned without pollution controls. Accidents associated with the exploration and production development of oil and gas wells, and the transportation and use of these fuels, can cause great

¹⁰ Ibid., pp III-11 through III-23

environmental damage and even loss of life. It is, therefore, vital that adequate environmental and safety controls be incorporated in plans for the development of these resources.

Nuclear power plants under normal operating conditions do not have a large impact on the environment. Possible accidents and social problems associated with nuclear power are more important considerations. Siting guidelines, such as those used in the United States, should be employed where possible.

Except for certain long-term aquatic impacts, hydropower is generally associated with minimal impacts to the environment.

Except for certain long-term land-use commitments and water-use impacts, the development and use of solar energy is expected to be characterized by minimal impacts to the environment.

The development and use of Egyptian geothermal resources can produce atmospheric and terrestrial pollution impacts, thus the establishment of populations in new, nearby villages and the use of adequate control technology should be important considerations.

For existing Egyptian energy resource use, increased efficiency and the institution of effective environmental controls would be the most beneficial step for the solution of near-term environmental problems.

6.2 Conclusions

From the data and information available, the environment of Egypt appears to be relatively undamaged except in areas where large numbers of people and industrial facilities are crowded together. In greater Cairo, Alexandria, and in some smaller industrial cities, the ability of the air and water to carry away pollutants without introducing unacceptable health and environmental impacts is reaching its limit. New plants and facilities must be sited in other parts of the country or must include pollution controls to strongly limit emissions.

New institutional mechanisms are needed within the government to protect the health of the population, and the environment, from industrial and energy-associated pollutants. A need has been identified to assess possible health and environmental impacts prior to the development of new energy resources and the siting and building of plants. There is a continuing need to upgrade existing pollution control. Finally, there is a need to monitor facilities after they are in place to insure compliance with environmental laws and regulations.

7.0 APPENDICES

7.1 Appendix A: List of People Contacted, Sites Visited, and Reports Exchanged

1. The authors acknowledge the assistance of the following people who were contacted during the period between March 27, 1978 and April 18, 1978:

- o Dr. Mohiz Elden Abdel-Samie - National Research Center
- o Dr. M. Sami Abdel-Salam - Head, Air Pollution and Environmental Health, National Research Center
- o Dr. Ragaa El Gazzar - High Institute of Public Health, Alexandria
- o Dr. Christine E. Gischler - Hydrologist, UNESCO
- o Dr. Fatma El Gohar - Professor, National Research Center
- o Dr. Mostafa M. Hafez - Academy of Scientific Research and Technology, Head of the Environmental Research Council
- o Dr. Ahmed Hamza - High Institute of Public Health, Alexandria
- o Mr. Tawakol El Maghrabi - Vice Chairman, Egyptian Iron and Steel Company
- o Mr. Roushdy Malek - National Council of YMCAs
- o Mr. Ahmed M. El Mofti - General Director for Power Stations, Alexandria
- o Dr. M. Nasralla - National Research Center
- o Dr. Samia Golal Saad - High Institute of Public Health, Alexandria
- o Mr. Dale Whittington - Lake Nasser, Nile River Project
- o Dr. Mohamed T. Younis - Research Associate Professor, National Research Center

2. The following sites were visited during the time the authors were in Egypt:

- o Desert Road between Alexandria and Cairo
- o Egyptian Iron and Steel Company, Helwan

- o Lake Maryut, near Alexandria
- o Suef Power Station, Alexandria
- o Tanta and Delta agricultural sites

3. The following reports were exchanged during the time in-country:

Reports Received

- o A. Abdel-Shakour, "Studies on Motor Vehicle Exhaust Gases," M.S.Thesis, Cairo University, 1976. (loaned)
- o E. M. Fead, "Water Quality Studies on the River Nile and Lake Nasser, Limnology of Lake Nasser-Nubia," June 1977, University of Michigan Report. (loaned)
- o Fatma A. El Gohary, "Assessment of the Impacts of Organic and Inorganic Pollutants on the Water Quality of the Ismailia Canal," National Research Center Report, January 1978. (loaned)
- o M. M. Ishak, et al., "Some Studies on the River Nile Ecosystems 1976," Lake Nasser and River Nile project. (loaned)
- o Ahmed Ibrahim Issa, "Air Pollution in Alexandria," M.P.H. Thesis, Ain Shams University, January 1977. (loaned)
- o Madbuli H. Noweir, "Safe Level Criteria for Air Contaminants for Developing Countries," Bulletin of the High Institute of Public Health of Alexandria, Vol. V, No. 1, 1975
- o "Report of a Seminar on Environmental Action for Quality of Human Life. Alexandria, March 25-28, 1976." Academy of Scientific Research and Technology and YMCA.
- o "Summary of Environmental Laws and Regulations" (in Arabic).

Reports Given

- o Annual Environmental Analysis Report, Volume IV: Simulation Data Base, MTR 7626, prepared by the MITRE Corp/METREK Div., et al., for U.S. Energy Research and Development Administration, (now the U.S. Department of Energy), September 1977.

7.2 Appendix B: Egyptian Environmental Legislation

7.2.1 Legislation concerning air pollution: Many countries in the world have become aware of problems resulting from air pollution, especially in the last ten years due to the tremendous industrial progress and the resulting substantial increase in consumption of energy resources. The main reason for air pollution is fuel combustion, in its different forms, to produce energy necessary to operate factories, run vehicles, generate electricity, etc. This is in addition to pollution resulting from industry sectors such as cement factories and others.

For many years, Egypt has had an interest in establishing regulations to protect against air pollution. Regulation #453, 1954 concerning industrial and commercial installations (replaced by regulation #358, 1956), dealt with the problem of fumes and dust escaping from those sites and causing pollution in neighboring areas. The Ministry of Labor issued regulation #452, 1956 (replaced by regulation #48, 1967) which set the maximum limits on the concentration of dust allowed during an industrial process, limits aimed at protecting the workers. Direct concern about air pollution, however, started in 1969 with executive order #864, 1969, establishing the Committee on the Prevention of Air Pollution, which has since met many times to study the problem. The Minister of Health issued regulation #470, 1971, setting criteria for air pollution at industrial sites and installations and in the outside air. The maximum limits of pollutants present in the air, both inside the industrial site and outside, were tabulated. In spite of the fact that this regulation states that any industrial site or installation causing air pollution may be closed, it is apparent that this regulation is not enforced. Moreover, no responsibility for control and supervision was assigned to a specific branch of government.

Regulation #470 might be valid in determining the scientific amounts of pollutants, but a revision may be necessary in view of recent data. In addition, this regulation does not deal with automobile exhaust, an issue to which many modern laws have devoted special sections. Finally, the legislative sections of regulation #470, 1971, need a general revision so that one branch of the government becomes responsible for control and survey and has the authority to set penalties for offenders.

Executive Order From the Minister of Health #470, 1971 Concerning Specifications on Air Pollution for Industrial Institutions of Their Subsidiary Units. After reviewing Act #453, 1954 concerning industrial and commercial sites and other noise-generating sites, (later modified by Act #359, 1956) and after review of presidential order #864, 1969 establishing the "Committee on Prevention of Air Pollution," and the order from the Ministry of Labor #452, 1959 (later modified by order #48, 1967 concerning the maximum permissible concentrations of air pollutants during industrial processes), and the decision of the "Committee on Prevention of Air Pollution" in its meeting of May 5, 1971, the following is to be enforced:

Article 1: The concentration of air pollutants in an industrial site and the outside air should not exceed the levels shown in Appendix B: table 1.

Article 2: All government and public administrations and institutions have to take the necessary steps to prevent air pollution (resulting from its operations) from exceeding the levels in table 1.

Article 3: Any institution or industrial unit whose operation results in unacceptable air pollution levels inside the site or in the outside air may be shut down by an executive order.

7.2.2 Egyptian legislation to offer protection against water pollution. Many regulations have been issued in Egypt to control the discharge into waterways of waste water from industrial, commercial, or municipal origin.

These regulations can be summarized as follows:

1. Regulation #35, 1946
2. Regulation #47, 1948
3. Regulation #96, 1950
4. Regulation #45, 1954
5. Regulation #196, 1953
6. Regulation #33, 1954
7. Regulation #93, 1962

The most important of these regulations, from the scientific viewpoint and in terms of limiting pollution, are regulation #196, 1963, and regulation #93, 1952.

APPENDIX B: TABLE B-1

MAXIMUM PERMISSIBLE LIMITS IN THE INSIDE AND OUTSIDE AIR

I. Gases and Vapors

Element	Inside air of the Site: Exposure for 8 hours		Outside air: Exposure for an average of 24 hours	
	ppm	mg/mt ³ air	ppm	mg/mt ³ air
Acetyldehydes	200	350	7	12
Acetone	1000	2500	33	80
Achrogen	0.50	1.18	0.07	0.15
Ammonia	100	70	3.25	2.50
Ethane	5	1.90	0.165	0.065
Arsenite	0.05	0.165	-	-
Benzole	25	80	1	2
Bromine	1	6	-	-
Carbon Monoxide	50	60	2.50	2.90
Chlorine	1	2.90	0.03	0.09
Chlorobenzene	75	350	3	14
Chloroform	50	250	107	8
Crisole	5	22	0.20	0.90
Cyclohexane	400	1400	13	46
Cyclohexanol	100	400	3	15
Cyclohexion	50	200	1.50	6
Ethyl Alcohol	1000	1900	40	75
Ether	400	1200	15	50
Formaldehyde	5	6	0.20	25
Fluorine	0.50	1	0.002	0.01
Gasoline	500	-	20	-
Haptin	500	2000	20	85
Hexane	500	1800	20	70
Iodine	0.01	1	0.003	0.04
Nitrobenzene	1	5	0.03	0.15
Nitroglycerine	0.50	5	0.015	0.15
Octane	500	-	20	-
Ozone	0.10	0.20	0.003	0.01
Benzene	1000	3000	33	100
Phenol	5	20	0.01	0.02
Phosgene	1	4	0.03	0.15
Phosphine	0.30	0.50	0.01	0.02
Sulfur Chloride	1	5.50	-	-
Toluene	200	800	6	25
Orthotoluidine	5	22	0.17	0.75
Turpentine	100	-	4	-
Methyl Alcohol	200	250	2	2.50
Carbon Dioxide	5000	9000	500	900
Carbon Disulfide	20	60	0.02	0.06
Dichloroethane	50	200	5	25

Nitrogen Dioxide	5	10	0.10	0.20
Sulfur Dioxide	5	13	0.075	0.20
Phosphorus Trichloride	0.5	2.50	0.02	0.10
Acetic Acid	10	25	0.35	0.85
Nitric Acid	10	25	0.20	0.50
Ethyl Acetate	400	1500	15	60
Hydrogen Cyanide	10	11	0.35	0.40
Carbon Tetrachloride	25	160	1	6
Hydrogen Chloride	3	2.50	0.10	0.09
Naphthalene	500	-	15	-
Coal Tar	200	-	7	-
Hydrogen Sulfide	20	28	0.02	0.003

II. Dust and Suspended Particles in Air

Element	Exposure for 8 hours	Exposure for an average of 24 hours
	mg/mt ³ air	mg/mt ³ air
Smoke	-	0.15
Cyanides	5	0.17
Orthobenzocreol	0.20	0.006
Fluorides	2.50	0.08
Iron Oxide	15	0.50
Lead	0.20	0.14
Magnesium Oxide	15	0.50
Manganese	6	0.20
Mercury	0.10	0.003
Phosphorus	0.10	0.005
Selenium	0.10	0.005
Zinc Oxide	15	0.50
Barium	0.50	0.005
T.N.T.	1.50	-
Naphtha Trichlorine	0.50	0.17
Chromic Acid and Chromates	0.10	0.005
Sulfuric Acid	1	0.10
Phosphorus Pentasulfide	1	0.03
Naphtha Pentachlorine	0.50	0.02
D.D.T.	1	-
Lead Tetraethylen	1	-
Arsenic	0.50	0.05
Cadmium	0.10	0.005
Phenol Dichloride	1	0.03

III. Natural Particles Suspended in Air

	Exposure for 8 hours million particles per mt ³ of air	Exposure for 24 hours average; million par- ticles per mt ³ air
Asbestos	180	-
Dust not containing free silica	1800	60
Mica	700	-
Portland cement	1800	60
Talc powder	700	-
Silica: more than 50% free silica	180	6
more than 5% free silica	700	35
less than 5% free silica	1800	60
Cleaning dust	700	-

These amounts all apply to particles of less than 10 microns in diameter.

IV. Dust and Settling Particles

- 1: In populated and commercial areas, these should not exceed 20 tons per square mile per month.
- 2: In industrial areas, these should not exceed 40 tons per square mile per month.

Regulations #196, 1953 set the general specifications for waste that can be discharged into bodies of water so that organic oxygen content or suspended substances in it do not exceed more than 60 parts per million, and so that it will not contain any toxic materials or hydrogen sulphate. This regulation, however, is not accurate from a scientific viewpoint, because of the following:

- (1) It is important to distinguish between sewage waste and industrial waste, and to divide the latter according to the nature of the industry, since industrial waste differs in its organic and inorganic composition from one industry to the other.
- (2) It is necessary to establish a correlation between the nature and capacity of the body of water and the kind and volume of waste that are discharged into this area (whether it is sewage waste or industrial waste).

Regulation #93, 1962, however, has tried to deal with some of the deficiencies that existed in regulation #196, 1953 (see article #64, 1962 in the administrative charter of regulation #93, 1962). It specified those shops and factories which cannot discharge their wastes into the sewers without a permit: grain mills, breweries, and wineries, macaroni factories, tile factories, soap factories, oil and chemical manufacturers, thread and textile mills, steel mills, dairies, and factories using radioactive materials. It has also determined the specific characteristics of industrial waste that can be discharged into the Nile River and its tributaries and in drainage channels. It has also specified that no sewage waste can be discharged into the Nile, but allowed for its discharge in drainage channels following certain specifications. As for the seas and lakes, the regulation has allowed for liquid waste, irrespective of the origin, to be discharged there on the condition that it does not affect swimming beaches or marine installations, or fish and marine life. In specifying the controlled amounts of industrial waste that can be discharged into the Nile or the drainage channels, the regulation stressed the following items: organic oxygen, chemical oxygen, suspended matter, the pH level, sulphates, oil and grease, temperature, insecticides, and radioactive materials harmful to the marine environment.

Although these specifications were more effective than those which were cited in regulation #196, 1953, regulation #64, 1962 did not establish a classification of industrial wastes (according to industry type) which can vary widely in their physical, chemical, and biological properties. Moreover, it did not correlate the nature and capacity of the water areas and the kind and volume of wastes that are discharged into the area.

Therefore, in view of the tremendous scientific progress that has been made and the concern to protect water sources and waterways from pollution, the time has come to formulate clearer and more effective Egyptian laws concerning water pollution. Many countries, advanced as well as developing nations, have reconsidered their laws and have updated them to meet modern requirements.

Because Egypt is concerned with the protection of its marine environment (either in the Mediterranean or the Red Sea), the government signed a treaty against pollution with oil in 1963, established a permanent committee on protection against pollution of sea water with oil, will recommend the necessary steps to implement the related international conventions, and will set its programs in cooperation with the universities and other centers. That order, #1948, 1965, was later modified by executive order #691 in 1972. Egypt has also contributed and participated in the International Convention on the Seas, the Barcelona meeting on the Mediterranean, and the Jeddah meeting on the Red Sea.

7.2.3 Excerpt - Act #93, 1962, concerning disposal of liquid wastes:

Liquid Waste Disposal in the River Nile and Its Tributaries.

- A. Industrial Wastes: It is prohibited to dispose of industrial wastes in the Nile and its tributaries unless the following criteria are satisfied:
 - a. Nascent oxygen may not exceed 20 ppm.
 - b. Absorbed chemical oxygen may not exceed 15 ppm.
 - c. Suspended particles may not exceed one ppm.
 - d. The pH number is no less than 6 and no more than 9.
 - e. Sulfides (based on the element S) may not exceed one ppm.
 - f. Cyanides may not exceed 1 ppm.
 - g. Oils and grease may not exceed 10 ppm.
 - h. The temperature may not exceed 35°C.
 - i. May not contain any other substance which may be harmful to fish or creatures living in natural waterways, or may affect the quality of water for drinking or use for domestic purposes.
- B. Sewage Wastes: Sewage may not be disposed of in the River Nile or its tributaries under any condition.

Liquid Waste Disposal in Drainage Channels.

- A. Industrial Wastes: It is prohibited to dispose of industrial wastes in drainage channels unless the following criteria are satisfied:
 - a. Nascent oxygen may not exceed 60 ppm.
 - b. Absorbed chemical oxygen may not exceed 40 ppm.
 - c. Suspended particles may not exceed 80 ppm.
 - d. pH number should not be less than 7, or more than 9.
 - e. Sulfides (based on the element S) may not exceed one ppm.
 - f. Cyanides may not exceed 1 ppm.
 - g. Oils and grease may not exceed 10 ppm.
 - h. Phenols may not exceed 1 ppm.
 - i. Chlorine may not exceed 1 ppm.
 - j. Chrome, arsenic, silver, copper, mercury, cadmium, barium, selenium, lead, and nickel should not exceed totally or individually more than one ppm.

- k. Dissolved substances should not exceed 35°C.
- l. Dissolved substances should not exceed 5000 ppm.
- m. Its temperature should not exceed 35°C.
- n. Coloring materials (computed based on transparency after one hour of precipitation) should not exceed 10 cm.
- o. May not contain insecticides or radioactive materials.

B. Sewage Wastes: Liquid sewage waste may not be disposed of in drainage channels, unless the following criteria are satisfied:

- a. Nascent oxygen may not exceed 40 ppm.
- b. Dissolved chemical oxygen may not exceed 30 ppm.
- c. Suspended particles may not exceed 50 ppm.

These wastes must be treated with chlorine as a disinfectant before disposal, so that the amount of chlorine remaining 20 minutes after its addition to the wastes does not exceed .5 ppm.

Liquid waste disposal in seas and lakes. Liquid waste of any kind may be disposed of in seas or lake waters on the condition that it does not harmfully affect swimming beaches, marine installations, sea shells, fish, and marine life in its natural habitat.

Cooling Water: Water used for cooling of machines may not be discharged in a waterway, unless it was originally taken from the waterway or a similar one and on condition that the cooling cycle was closed and the water was not mixed with any industrial waste. Then this water may not be required to meet the specifications and criteria mentioned above in items 3 or 4, except for the temperature and the oil and grease content.

7.2.4 Legislation concerning the disposal of solid waste:

In Egypt, concern about disposal of solid wastes goes back to the beginning of this century when an order was issued on January 19, 1898 to regulate transportation and the sale of rubbish. Another order was issued on October 16, 1912, to regulate garbage transportation. More recently, many laws and ministerial orders were issued to regulate garbage collection and the transportation of garbage (for example, the act #159, 1953 dealing with public health and the order of the Minister of Municipalities #1317, 1960, dealing with rubbish and trash dumps, and the act #38, 1967 dealing with public health etc.).

There is no doubt that these laws and regulations need a new evaluation, in view of the technological progress in the processes of transportation and disposal of solid wastes, so that they constitute a unified and specific law that can be applied throughout Egypt.

MANPOWER

BY

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U. S. EGYPT COOPERATIVE ENERGY ASSESSMENT

September, 1978

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1.0 OBSERVATIONS

1.1 Introduction

The assignment of the manpower specialist was as follows:

1. To survey the existing and proposed manpower development resources of Egypt.
2. To assess the existing manpower resources of Egypt.
3. To determine the manpower needs of the energy strategies developed in the Egypt/U.S. Cooperative Energy Assessment.
4. To compare the existing manpower resources (Item 2) with the needs (Item 3) and determine the manpower shortfalls versus time for strategy enactment.
5. To identify the additional manpower development requirements for Egyptian energy development.

The following are the observations obtained during the execution of the above items.

1.2 Manpower Development Resources

The universities of Egypt are well established and generally producing more graduates than the economy can absorb. This is particularly true in the non-technical and non-scientific fields, and generally true in the scientific and technical fields. Exceptions are the fields (e.g., civil engineering, architecture, petroleum engineering) that are utilized in the few aggressively pursued programs where major activity is in process (e.g., housing and construction, petroleum production). College and higher institute engineering graduates for the 1975-1976 school year totaled 4,230. The College of Technology graduated 2,006. The College of Electronics graduated 291.

Assignment of the surplus graduates by the Ministry of Manpower and Training under the government program of guaranteed employment of secondary, higher institute, and university graduates continues to intensify the existing situations of overstaffing and underemployment. The universities are highly overpopulated with students, have generally poor facilities and equipment, and are staffed by teachers who often must take second jobs to secure adequate livelihoods. The short-comings of the university system are reflections of the serious financial situations of Egypt rather than apathy on the part of the government or ineptitude on the part of the university administrations.

The technical institutes, of which there are 2-year and 5-year schools (both of which terminate at grade level 14) are presently engaged in active programs of expansion. The number of technical

graduates presently produced by these institutes, 2,641 in the 1976-77 school year, is less than the demand and will probably continue to be so for 6 to 8 years, at which time the proposed expansion program should balance the supply/demand situation. The energy facility expansion program could encounter difficulties during the early period in securing a sufficient quantity of graduates from these institutes (e.g., technicians, designers, draftsmen), because the supply of such graduates is considerably less than the demands. The demands which must be satisfied by the expansion program include the demand from the oil-producing Arab states (emigration), the private sector demand, the quasi-public sector demand (e.g., the companies of Egyptian ministries), and the government employment demand. Due to the substantially lower wages prevailing in government service, the government manpower demands are usually the last demands satisfied.

The training centers of the various ministries of Egypt are specifically designed to train ministry employees to perform the tasks of the ministry. These centers, like the technical institutes, suffer the ill-effects of inadequate investment and operating capital. If or when the energy facility expansion program accelerates, the centers of the various energy ministries will face a formidable task in training the skilled and semi-skilled craftsmen. They will need to enact accelerated training programs. During the early stages of the expansion program the centers will have an extremely difficult task in trying to meet the manpower demands. The difficulty will primarily be caused by the fragmented or sporadic nature of the development program, which will undoubtedly be enacted on a project by project basis because of the lack of capital to underwrite a long-term, integrated program.

1.3 Existing Manpower Resources

The inaccessability, poor quality, and lack of definition of information on existing manpower resources largely precluded the quantitative assessment of manpower resources. Several agencies, both Egyptian and foreign, are actively working to develop the desired information base, but political and reputed military restrictions encountered during the attempted collection of the needed information virtually negates the production of a meaningful data base. Any attempt to formulate such a data base will prove fruitless until the restrictions are removed and better data become available.

In-country discussions with both Egyptian and non-Egyptian individuals, and general observations by the staff, did allow formulation of qualitative information regarding manpower resources. The driving forces of Egyptian manpower are financial reward, opportunity for promotion to positions of authority and responsibility, and job satisfaction. Though these forces are not unlike forces existing in most countries, the means to the end are different in the Egypt.

The desire to earn money is best satisfied by emigrating to another country, particularly the oil-producing Arab countries. Primary opportunities for attaining positions of authority and responsibility are

through government service, where a university degree, political and social connections, and ability become all important. Because most government offices are overstaffed, those positions tend to lack challenge as well as financial reward.

The manpower resource conditions which do exist, therefore, vary, and depend largely upon the type of manpower. Non-technical university graduates have a great deal of difficulty finding employment that relates to their field of study and will provide a reasonable living wage. These non-technical graduates are a substantial surplus. Technical university and higher institute graduates have a somewhat better situation than the non-technical graduates, but are also a surplus commodity because of a shortage of capital for meaningful programs requiring their developed talents. If and when development projects now being planned are executed, demand for technical graduates should increase. Whether or not the demand will increase enough to substantially reduce the existing surplus cannot be determined from existing information, but it is unlikely that enough capital will become available to appreciably accelerate the present development programs; the surplus situation for technical graduates will persist for many years. The situation is severe enough now that many non-technical graduates enter the private sector (e.g., as shopkeepers, taxi drivers, waiters, tour guides) in order to make a living. The technical graduates either can enter the private service sector as tile setters, plumbers, etc., or can join the government ministries where the financial rewards are less by a factor of two to five. These graduates will function as technicians, but the potential for future positions of authority and responsibility are not assured.

Technical graduates from vocational training institutes or vocational training centers of various ministries are generally in great demand. If these individuals choose to work in government service, however, there is virtually no possibility they will ever attain positions of authority and responsibility. Wages there are lower than in the private sector, and much lower than possible by emigration to oil-producing Arab countries. Wages roughly comparable to private sector wages are available from quasi-public companies operated by various government ministries. Job satisfaction for those workers is generally better than that of university graduates but comes from prosaic accomplishments rather than challenging or exciting work.

High quality, experienced technical laborers both skilled and semi-skilled, (e.g., machinists, pipefitters, welders) are in short supply. These individuals can easily earn more money than middle managers in government service, such as experienced engineers and technicians. These laborers are seldom found in direct government service and generally work for the quasi-public companies or as private contractors. They usually make substantial amounts of money, have the same job satisfaction as that of any skilled worker, and often can parlay their extra capital into positions of wealth and influence (as opposed to authority and responsibility) by investing their surplus wages into private businesses.

The last class of workers who will play an important role in assuring the success of future energy development plans are the existing middle and senior-level personnel in energy related ministries. The middle-level personnel are too inexperienced to fill the positions they will be required to fill if and when an accelerated energy expansion program is initiated. The reason for this is the paucity of significant activity for them from the late 1960's to the present. The senior-level personnel are somewhat better equipped to fill their positions since they generally have benefitted from the development efforts of the 1950's and early to middle 1960's. However, they have not been exposed adequately to the newest or most advanced technologies and are not equipped to approach modern energy expansion programs in a knowledgeable and assured manner.

The preceding were the staff's observations regarding the status of the existing manpower resources of Egypt resources which will play a key role in the future of Egyptian energy programs. Though quantitatively lacking in definition, the qualitative assessment should, in the final analysis, prove adequate for the needs of this assessment.

1.4 Manpower Needs of the Energy Strategies

Manpower needs for 1976 were calculated to be as follows:

Engineers	450
Designers and Draftsmen	143
Supervisors and Managers,	
Other Technical	479
Other Technical, Non-Manual	
Workers	75
Non-technical, Non-Manual	
Workers	570
Skilled Manual Workers	4,587
Unskilled Manual Workers	5,322
Total Manpower	11,626

If the Comparison Case strategy is followed to 2000, this manpower requirement will increase to the following levels:

Engineers	3,152
Designers and Draftsmen	1,082
Supervisors and Managers	2,101
Other Technical, Non-Manual	
Workers	477
Non-technical, Non-Manual	
Workers	5,142
Skilled Manual Workers	30,181
Unskilled Manual Workers	23,495
Total Manpower	65,630

Observations regarding the implications of such increased manpower requirements are contained in the following section.

1.5 Comparison of Manpower Resources with Manpower Needs

The increased need for engineers from 1976 to 2000 is less than 3 percent of the engineers that will be trained during that period, assuming that the same number of engineers are graduated per year as were graduated during the 1975/76 school year. This is not an unreasonable demand considering the manpower needed is for all the Egyptian basic energy supply sectors; and, adjustments in the number of graduates could be made in the intervening period.

The increased need for designers and draftsmen during the 1985-2000 period, on the other hand, comprises 28 percent of the designers and draftsmen that would be trained during that period, assuming the number of Technical Institute graduates per year does not increase during the intervening period. Although the proposed doubling of Technical Institute capacity would reduce the 28 percent to 14 percent, the increased training capacity is still inadequate to supply the needs of the energy expansion program along with all other Egyptian demands. The same condition prevails for most of the other non-manual, non-professional, technical personnel required to carry out the hypothesized Comparison Case. There is need to both increase the number of technical graduates from the Technical Institutes, as well as to improve the quality of training and exposure to latest technology.

The increased need for supervisors, managers, and other technical personnel can probably be filled, once the program is underway, from the ranks of tenured engineers (in the case of supervisors and managers), and from the ranks of available new university engineering and science graduates (in the case of the other technical personnel). However, in the initial phase of the expansion program, few junior and middle managers with pertinent experience will be available to assume the necessary positions of authority and responsibility. Overcoming this deficiency will require especially designed, practically oriented training courses and on-the-job training assignments to facilities where modern technology exists (probably in one of the developed countries).

The increased need for non-manual, non-technical personnel should be easily filled from the ranks of secondary school graduates, university dropouts, commercial graduates of the Technical Institutes, and others.

The increased need for skilled and semi-skilled craftsmen will probably present the largest challenge to the manpower planners. Such personnel are normally trained as apprentices. If the expansion program is well organized and reasonably paced, opportunities might exist during the early phases of the program to train sufficient personnel for later phases. This is potentially the most critical manpower training problem of the energy expansion program, and could, under a highly accelerated program, become a limit to the program. Fortunately for the manpower trainers, but unfortunately for society, such highly accelerated expansion is improbable because of the lack of adequate capital to finance such activity.

Unskilled labor should be available to satisfy the increasing personnel requirement even under the most ambitious expansion program.

1.6 Manpower Development Requirements

The following items have been identified in the previous section as specific manpower development requirements of the energy expansion program:

1. The Technical (as opposed to the commercial) programs of Technical Institutes would need to be expanded if the Comparison Case strategy were enacted. Courses presented would need to be reviewed and modified to insure that current technology is taught. New courses would be required to cover the newer and state-of-the-art technologies which would be enacted if alternative energy options are selected.
2. Technical Institutes (Ministry of Education and Higher Education) and Technical Center (energy-related ministries) laboratory equipment, training text, audio-visual aid materials, etc., should be evaluated to assure pertinent practical technology transfer to the trainees. Training aids should be upgraded and course curriculum and content should be evaluated and revised where required.
3. Technician teachers should be trained in the latest training techniques and modern technologies. This is necessary to improve the effectiveness and efficiency of the training, and to insure that the latest technology is provided to the institute trainees.
4. Middle and senior technical management personnel should receive upgrading training in the latest operating, construction, design, startup and maintenance technologies, management techniques, and management principles. A select few, who will be assigned authority and responsibility in areas of critical decision making or state-of-the-art technology, should receive on-the-job training prior to assumption of their assignments. Since the latest techniques, technologies, management principles, etc., will probably not be found in Egypt, bilateral agreements with developed countries and/or commercially contracted training may be required.
5. Careful planning and execution of apprenticeship training programs at each stage of the expansion program will be required to insure that adequate numbers of skilled and semi-skilled workers are produced. Unless this is done, the shortage of such personnel could become the limiting resource in successive projects.

2.0 INTRODUCTION

One of the primary resources required for any set of energy options or strategies is manpower. A deficiency of adequately trained and experienced scientific, engineering, managerial, and/or technical (technician, craft or semi-skilled) manpower can easily negate the effectiveness of the energy facility expansion program. Manpower deficiencies can be in either or both of two aspects--quantity or quality. If the quantity of required manpower is insufficient or it is unavailable when needed, schedules will slip, interest costs will rise, energy demands will not be met, and planned activities, which will require the energy to be produced, will be delayed. If the quality of the manpower is inadequate, inferior facilities will be created. Such facilities will eventually prove to be unreliable and, thus, unsatisfactory and overly expensive because of their poor performance.

In analyzing the energy related manpower situation of Egypt, an attempt was made to consider the quantity, quality and scheduled need for manpower. A lack of information on the quantity of the existing manpower in Egypt has adversely affected the quantitative phase of this analysis.

The quality of manpower can only be inferred by viewing the products presently produced and speculating about the capacity to do better when required. Quality depends not only on the possession of adequate equipment and skills to perform a task, but also upon psychological desire to produce high quality and financial support to pay the added price which improved quality will require.

Manpower, often unavailable when needed, can never perform the desired function. In such a case, the projects must either be deferred until the manpower becomes available or the needed manpower must be obtained from alternative (usually outside) sources. Although the latter solution is possible, financial considerations (generally higher costs and adverse affects on national balance of payments) make this solution undesirable, particularly, in long-term programs.

Adequate training, to efficiently and expertly perform, requires management and technical functions. This presupposes that existing middle-level personnel have had meaningful past experience on which to base a role of authority and accountability. Likewise, senior personnel are expected to have had meaningful past experience at the middle level for its base of increased authority and responsibility.

The manpower planning and development tasks in Egypt will be formidable as the country attempts to change direction and enact the measures necessary to improve its social and economic conditions. Even if one assumes that the existing education and training facilities perform their tasks in the most exemplary manner, the initial phases of the hoped for expansion and modernization of energy facilities will be hectic, demanding, and, in all probability, beyond the capability of the country to perform without outside assistance. The added sophistication of modern energy technology and accelerated rates of enactment of new

energy projects will promote increasing need for outside assistance, both technological and financial. Manpower development is only one of the factors for which accurate and realistic planning in the early stages of the energy facility expansion program will produce large returns as the program expands to the year 2000 and beyond.

3.0. MANPOWER EDUCATION AND TRAINING RESOURCES OF EGYPT

The types of manpower which are of interest in this assessment are those which will be required to enact future programs of energy facility design, construction, startup operation, and maintenance. Although unskilled labor, clerical and other office personnel, janitors, truck drivers, etc., will be required, such personnel need little if any training and should be readily available when required. Therefore, this type of manpower has been ignored in this analysis. Other labor types -- namely, scientists, engineers, technical managers, technicians, craftsmen, and semi-skilled laborers--however, may not be as readily available. The availability of these labor types would be crucial to enactment of any proposed energy projects or program. The commonality of these labor types is that each requires an extra degree of education (academic instruction) and/or practical experience (vocational practice) to perform its task.

The basic training for such personnel is--and will continue to be--the task of the formal academic institutions and vocational training facilities of the country itself. For proper analysis of the manpower production capabilities of Egypt, therefore, it is important to examine the educational institutions to determine their capability to produce trained manpower, and the types and quality of the product (manpower) which is produced.

The formal educational system of Egypt is well established. It is government sponsored, government-controlled, and available to any Egyptian at no cost on the basis of ability as determined by periodic examinations throughout his educational career. One of Egypt's universities is among the oldest (if not the oldest) universities in the world. That university has just recently celebrated the 1,000th year since its founding. Egypt prides itself as being the educator of the Arab world and, probably, has the largest educational system on the African continent. In spite of this long history in education, approximately 56.5 percent of Egypt's population, age 10 years or older, is illiterate. This high illiteracy rate indicates that most Egyptians have not attained the basic vestige of education and that this is a primary task for the education system. The problem is being addressed vigorously within Egypt with outside assistance being already provided.

The structure of the academic educational system consists of primary school (grades 1 to 6 inclusive, age 6 to 11), preparatory school (grades 7 to 9 inclusive, age 12 to 14), general secondary school (grades 10 to 12 inclusive, age 15 to 17), and the universities. The primary, preparatory, and general secondary schools are administered by the Education Division of the Ministry of Education and Higher Education.

Universities are administered by the Higher Education Division of the same ministry. Private universities, of which there are a few, are controlled in some respects by the same Higher Education Division.

Following graduation from the preparatory school, students who pass the required examinations can proceed into the 3-year general secondary school (grades 10, 11, and 12). A small percentage of preparatory school graduates can elect to attend one of the 5-year technical institutes which presently exist.

Relatively few socially conscious or academically strong preparatory school graduates elect to enter the 5-year technical institutes. Obviously, the number of persons completing the general secondary and 5-year training institutes is reduced due to dropouts.

The precise dropout rate, number of general secondary school graduates, and number of 5-year technical institute graduates in recent years was not identified in the published information obtained during the incountry visit. The data received merely indicates the number of illiterates, the number who can read and write, the number having qualifications below a high degree (undefined), and the number having high qualifications (again undefined). Documents requested by the manpower specialist of Egyptian officials before leaving Egypt should have provided the needed information. These documents were not received. Graduates of general secondary schools, who pass the qualifying examinations, can continue their education in the universities. Those who fail the examinations usually enter the labor market directly in whatever capacity they can find. They can, however, apply for admission to one of several 2-year technical institutes. Because these applicants have already failed the university screening process and are well aware that they will never attain the much sought after university degree, they are often poorly motivated and discouraged. This is reflected by a significant dropout rate for 2-year technical institutes. Surprisingly, the same high dropout rate does not occur in the 5-year technical institutes.

There are 10 universities in Egypt. The university curriculums offered are many and include almost any discipline one might wish to take, including all major engineering and scientific disciplines. Bachelor degrees are awarded in all university curriculums. Curriculums offering master degrees and doctorate degrees are many and varied. The educational system is patterned after those of Western Europe. Academic standards appear to be on a par with the average standards of Western Europe or the United States. Classroom facilities, audiovisual material and equipment, and laboratories, however, are generally old, obsolete or non-existent and would be considered substandard in most developed countries. This aspect reflects the poor financial condition of the country rather than the apathy of the educators. The better students of the Egyptian educational system do not, however, appear to have unusual difficulty getting accepted to foreign universities for advanced study.

The number of students using existing facilities and the student-to-teacher ratios are generally high. Teacher's wages are fair to good compared to the Government wage scale. Since Government wages are unrealistically low compared to the desirable money requirements in the country, many teachers (including major professors) expend a significant portion of their effort in outside activities which produce supplemental income.

Because of the inadequate laboratory facilities and the lack of the opportunity for meaningful work experience with modern, sophisticated equipment after graduation, most graduates lack the practical experience after 5 or 10 years of work to assume positions of real responsibility and authority in modern day technical activities. (The exception to this statement are those graduates with foreign job or fellowship experience). It is particularly true in the newest or state-of-the-art sciences and technologies. This situation has prevailed in Egypt since the late 1960's and, thus, many middle--but fewer senior--technical management personnel also display the same weakness. The relative absence of opportunity to work with the latest, most modern equipment and techniques is somewhat compensated for by the tendency of staff personnel to concentrate more deeply on the theoretical aspects of technology. This is most noticeable in the fields of science and engineering.

Attainment of a university degree is of paramount importance in establishment of social status and for consideration for a Government staff position. Government staff positions are still actively sought since they usually provide job security, pensions, positions of real power and authority (being a socialist government, the Government sector does direct the economy), and formerly wages. The latter feature, however, is rapidly changing. Wages paid in the private sector are presently two to five times the wages paid in the Government sector for similar work. Because of the overall desirability of a university degree, university education is in great demand and is actively supported by the Government as the limited funds will allow. Under the present method of operation, all students have an equal opportunity for advancement through the Government-sponsored, free educational system. Continuation of the educational opportunity is based solely on the ability of the student to pass admission tests at his entrance to each succeeding level of the system. Those students who perform best in admission tests for the university are given first choice of curriculums. The lower the test score the later the choice. Since the number of university openings is limited, some students who pass the examination but have lower scores do not get admitted to the universities. These students may attempt to enter the university by taking the course examinations. After the individual establishes his ability to satisfactorily perform, he may apply for admission and course credits.

The production capacity of the Egyptian educational system for degreed persons exceeds the country's ability to absorb this personnel except in a few very specialized fields where active on-going programs exist (e.g., architects, petroleum engineering, civil engineering). Because of the anticipated lack of capital in the near term for development, this oversupply condition will undoubtedly persist. Generally

speaking, the government is and has been, since the cessation of hostilities with Israel, preparing for the brighter future it wants to realize. Part of the preparation is the training of its most intelligent citizens. The training is in place. All that is lacking are the funds for projects that would make use of the trained persons.

Table 1 below shows the number of engineering degrees awarded in the 1971-1972 school year. Although the data are well defined, it should be noted that this information is dated. It is, however, in general agreement with the data of the 1977 Statistical Yearbook (published by the Central Agency for Public Mobilization and Statistics) which shows a total of 4,230 engineering graduates for that year. In the 1975/1976 school year, engineering graduates totalled 4,230.

Those individuals who are not admitted to the university usually enter the labor force in any capacity they find which is satisfactory to them. Such individuals may, however, seek admission to one of several technical institutes which are also administered by the Higher Education Division of the Ministry of Education and Higher Education. After completion of technical institute training, the graduate may apply for university admission. If his institute grades are good enough, he may be admitted and given partial credit toward his desired university degree.

TABLE 1
ENGINEERING DEGREES AWARDED
1971-1972 School Year

Curriculum	No. of Degrees Awarded		
	Bachelor	Master	Doctorate
Chemical Engineering	114	11	
Civil Engineering	1,132	10	1
Electrical Engineering	995	81	3
Mechanical Engineering	1,562	75	2
Mining Engineering	128	6	
Nuclear	8	4	
Petroleum	64		
Other	244	18	3
Total	4,247	205	9

Source: Directory of Engineering Education Institutions, UNESCO Press, 1976.

The technical institutes are 2-year schools which offer a wide range of technical, commercial, and business curriculums. Total enrollment in the technical institutes is approximately 33,000 persons. Most of the participants, however, are in the business and commercial curriculums. The total number of graduates receiving technical diplomas in

the 1976-1977 school year was 2,641. Courses presently taught, which are of particular interest to the energy development programs, and the number of graduates in the 1976-1977 school year, are shown in table 2.

Other technical courses have been proposed for addition in the near future. These courses will include production technology and control, industrial electrical systems, instrumentation and process control, technical design and site technology.

Two-year institutes take educationally produced students and provide them with specialized vocational training. Five-year institutes, on the other hand, are primarily vocational rather than educational facilities. Support of the technical institutes by the Egyptian Government is about as good as one could expect considering the poor financial condition of the country, which is to say it is barely adequate for the task that is being performed. The International Bank for Reconstruction and Development (World Bank) is presently funding and considering projects to finance the doubling of the technical institute enrollments (60,000 students).

TABLE 2
TECHNICAL INSTITUTE GRADUATES
1976-1977 SCHOOL YEAR

Curriculum	No. of Graduates
Electronics	173
Electric Machines (Electro-Mechanical Tech.)	209
Electrical Transmission & Distribution	290
Mechanical Power	42
Refrigeration & Air Conditioning	287
Electrical Safety & Controls	104
Design & Engineering Drawing	154
Quality Assurance	212
Precision Apparatus	12
Chemical Analysis	74
Biological Laboratory(environmental)	16
Survey	278
Civil Construction	93
Metal Cutting	11
Mechanical & Electrical Laboratory	35
Data Processing	<u>44</u>
Total	2,034

In addition to the Ministry of Education and Higher Education Technical Institutes, there also exist several technical training centers. The centers are administered and controlled by various ministries. Their primary function is to produce the basically trained,

technically specialized manpower needed to carry out the ministry tasks. The programs of these centers generally consist of a formal training activity of 6 to 12 months duration followed by an apprenticeship activity of 1 to 2 years. Admission requirements vary with the course offered. Semi-skilled labor training for carpenters, plumbers, etc., may only require that the applicant be literate, whereas training centers for the vocational training of engineers may require that the participant have a college degree in science or engineering.

At the end of the apprenticeship training period, the participant is free to change jobs within the Government system with the approval of his supervisor or to quit Government employment. Government agencies involved in meaningful on-going programs do not usually have difficulty keeping the trained employees but must use added inducements to do so. Those which don't have meaningful on-going tasks or tasks with adequate financial support tend to have large turnover rates of such trained personnel. Wages in the pocket, future potential for a position of leadership and authority, and job satisfaction are the real things that count.

Many foreign governments (e.g., the United States, Britain, East Germany, Sweden), international agencies (e.g., UNDP, Gulf Organization of Arab States), and other organizations (e.g., International Bank for Reconstruction and Development) have on-going projects or proposals to improve existing technical institutes and some technical training centers.

4.0 THE EXISTING MANPOWER BASE OF EGYPT

The primary source of manpower resource data in Egypt is the Central Agency for Public Mobilization and Statistics (CAPMAS). Besides being the Agency which administers the general census and amasses, compiles, and analyzes the data from all other Government agencies, CAPMAS also serves the manpower mobilization function for the Egyptian military establishment. Consequently, access to this most important source of information and data is restricted (many Egyptian Government officials expressed dissatisfaction over their inability to get information and data from this source). For this reason only limited and fragmented CAPMAS information regarding the existing manpower resources in Egypt was obtained (none directly from CAPMAS), and little current information of real significance or definition on existing manpower resources was obtained from other agencies contacted.

From discussions held during the visit to Egypt with many individuals (both Egyptians and non-Egyptians), it was determined that the overall manpower resource picture is variable. There generally are enough--and in some specialties (primarily non-technical) a surplus of--university graduates. Trained technical, skilled craft, and semi-skilled labor, on the other hand, is reputed to be in short supply. Unskilled labor is plentiful. Management personnel, although in place and identified, appears to lack meaningful past experience.

Due to Government guarantee of employment of university graduates, technical institute graduates, and secondary school graduates, overstaffing of Government offices is common. Because of the lack of capital and overstaffing, there is a paucity of meaningful work for Government-employed, junior level, and most middle level personnel. Senior level personnel are usually quite busy planning programs for the future which, unfortunately, will often be realized only through the influx of foreign capital.

The situation for trained technicians, skilled craftsmen, and semi-skilled laborers is just the reverse. Artificially low and outdated Government pay scales, if rigidly followed, make it virtually impossible to hire these workers for direct Government employment. For important jobs where such labor is essential, the work is subcontracted to quasi-public companies where adequate wages can be paid by contracting the work at high enough fees to cover the higher wage rates which prevail for these workers.

Typically, a technically skilled worker can easily find employment in the private sector or as a self-employed contractor and make two to five times the government rate of pay. If he elects to look for and finds employment in any of the several oil-producing Arab countries or developed countries (emigration), he may make 10 times the Government rate of pay. Pay differentials of 2,000 percent between Government employment in Egypt versus employment doing similar tasks in foreign countries are not unknown.

Experienced middle managers are in short supply in the Government. The centralized planning system used in Egypt (at least in the Government sector) serves to move decision-making authority to higher-than-usual levels. Capital shortage serves to reduce the actual performed and thus the amount of decision making. Both situations greatly reduce opportunities for decision making experience in the lower levels of management where such experience would normally be gained.

Unskilled labor is plentiful and relatively cheap. This is due to the very large supply of such labor relative to demand. The supply/demand situation for unskilled laborers is kept in a surplus condition by the rural to urban migration of the young adults seeking the more active and less primitive life style which can be found in the city but is totally lacking in the rural environment.

The following data were extracted from the documents "Preliminary Results of the 1976 Population and Housing Census-Tables 10, 12, 17, 18, 19, and 20", Central Agency for Public Mobilization and Statistics, Egypt.

1. Total population	38,228,180
2. Total male population (excluding 4 below)	18,698,904
3. Total female population (excluding 4 below)	17,957,000

4.	Population abroad or in occupied zone of Sinai	1,572,000
5.	Number in occupied zone of Sinai	147,000
6.	Population 10 yr. or older (excluding 4 above)	27,616,404
7.	Illiterates (10 yrs. or older excluding 4 above)	15,611,162
8.	Classified as able to read and write (excluding 4 above)	6,923,675
9.	Qualifications below grade 12 level certificates (excluding 4 above)	4,475,199
10.	High (possessing grade 12 or higher) qualifications (excluding 4 above)	606,368
11.	Population under 12 yrs.	12,080,105
12.	Population 65 yrs. or older	1,108,617
13.	Population between 12 yrs. and 65 yrs. of age (from 1, 11, and 12 above)	25,039,458

Sketchy as it is, this is the only pertinent CAPMAS data the staff had access to. It is based on the latest (1976) census. From a Labor Force Sample Survey - May 1974 performed by the General Department of Statistics of the Ministry of Manpower and Vocational Training, one can obtain an estimate for total 1974 manpower between 12 years and 65 years of age. This figure (23,185,100) for 1974 compares favorably with Figure 13 above (25,039,458). Since the data of the 1974 survey is more definitive and useful for this analysis, the staff has attempted to derive estimates for the 1976 manpower numbers by extending the 1974 data to 1976. To accomplish this, the 1974 data were each multiplied by the factor $25,039,458/23,185,100$ or 1.08. When this is done, one obtains the following derived estimates for 1976:

1.	Population (total manpower) age 12-65	25,127,388
2.	Urban male population age 12-65	5,501,088
3.	Rural male population age 12-65	6,873,876
4.	Urban female population age 12-65	5,545,044
5.	Rural female population age 12-65	7,207,380
6.	Total employed males age 12-65	9,031,176
7.	Total unemployed males age 12-65	153,036

8.	Total males age 12-65 outside labor force	3,190,752
9.	Total employed females age 12-65	545,508
10.	Total unemployed females age 12-65	72,252
11.	Total females ages 12-65 outside labor force	12,134,664
12.	Labor force age 12-65 in Mining and Quarrying	21,816
13.	Labor force age 12-65 in Electricity, Gas and Water	43,632
14.	Labor force age 12-65 in Construction	251,532
15.	Labor force age 12-65 in Professional Technical and Related work	563,436
16.	Labor force age 12-65 in Administrative and Managerial work	98,604
17.	Labor force age 12-65 in Service Work	892,512
18.	Labor force age 12-65 who are illiterate	5,874,366
19.	Labor force age 12-65 who can read and write	2,455,488
20.	Labor force age 12-65 qualified (undefined) below intermediate certificate	182,520
21.	Labor force age 12-65 with intermediate certificates	744,120
22.	Labor force age 12-65 above intermediate certificates	159,516
23.	Labor force age 12-65 with university certificates	354,240
24.	Labor force age 12-65 with post-graduate certificates	19,656
25.	Labor force not indicated in 18 - 24	12,096

Since the above data are the best estimates and most definitive data the staff has, it is the data with which the manpower needs of the following section will be compared.

The Egyptian Government formally announced its great concern about the manpower problem in 1976 when it established the Higher Council of Manpower Planning and Vocational Training, a ministerial council chaired by the prime minister. Advising the High Council is a joint committee chaired by the Minister of Manpower and Training, and composed of undersecretaries from each ministry that has a prime interest in the manpower situation.

The Ministry of Manpower and Training is the principle Egyptian manpower planning and manpower coordinating agency. Cooperation between this and other ministries is quite strained, however. Execution of its assignment to administer the official Government policy of guaranteed employment (after 1 year of military service and 1 year of attempting to find a job on their own) for all secondary, technical institute, and university students coupled with the prevailing oversupply of such persons (except for technicians) causes directed overstaffing in the other ministries. This overstaffing results in dilution of work which promotes loss of dedication, poor morale, laxity, and disinterest among employees. The managers of the other ministries who daily deal with these problems within their ministries do not, to say the least, appreciate the overstaffing that presently exists and oppose each new assignment of unneeded personnel.

There is a widely reputed belief in Egypt that severe shortages of technicians, craftsmen, and semi-skilled laborers exist in the Government sector. Although the statement is probably true, the shortages are not primarily due to the lack of production of such personnel by the education system. Shortages of this type of manpower in Government service is primarily due to the low Government wages paid to such personnel. The demand for technical personnel in the private and quasi-public sectors is probably sufficient to absorb a large part of the present output of the technical institutes. Emigration, particularly to the oil-producing Arab countries, represents another large demand for such personnel. Because of the very high wages paid in these Arab countries, the emigration demand is usually the first demand satisfied. The demand of the private and quasi-public sectors are satisfied next. Satisfaction of the Government sector demand is, therefore, last. Even under these conditions, however, Government placement requests and appointments reported in the Ministry of Manpower and Training Quarterly Report for October-December 1976 gives the following figures:

1. Technical labor registered for job placement	11,889
2. Technical labor not registered	7,832
3. Appointments to technical labor	6,273
4. Technical and Scientific professional registered	121
5. Technical and Scientific professional appointments	41

6.	Unemployed technical laborers registered	2,970
7.	Unemployed technical laborers appointed	1,840
8.	Unemployed technical and scientific professional registered	33
9.	Unemployed technical and scientific professionals appointed	12

The differences in the numbers 1 and 6, 3 and 7, 4 and 8, and 5 and 9 reflect the number of persons who already have jobs but actively sought or found new jobs. The same patterns of oversupply were found in the previous two quarterly reports.

Rather than stem the emigration flow, the Government encourages it, particularly to the oil-producing Arab countries. The net effect of such emigration is a flow of additional foreign capital into Egypt. That is the primary reason the Government is anxious to supply the emigrant laborers and is making extra efforts to supply this demand.

In order to insure that the Egyptian Government can solve its own problems if and when the time arrives that it needs personnel for its own programs, the Government must saturate the other two demands. By design, the present Ministry of Education and Higher Education programs are directed toward this end. Estimates are that the supply-demand relationship for non-degreed technical manpower will be in balance in about 6 to 8 years. This is being done with the aid of World Bank loans, foreign government assistance, and the assistance of various international organizations (e.g., UNDP, the Gulf Organization of Arab States). Financial assistance from the oil-producing Arab States for the educational system of Egypt has been increasing at a rapid rate and now appears to exceed the assistance of any other and possibly all other external sources.

5.0 MANPOWER NEEDS OF THE ENERGY STRATEGIES

The method used to determine manpower needs of the energy strategies developed in this assessment employed the use of the Bechtel Corporation computer program, Energy Supply Planning Model (ESPM). This program contains, among other information, the manpower resource requirements for the design, construction, startup, operation, and maintenance of the energy supply facilities identified in the strategies of the assessment. Computer runs of the Comparison Case produced the following manpower requirement information of tables 3 and 4.

TABLE 3

MANPOWER REQUIREMENTS (MAN YEARS)
FOR DESIGN, CONSTRUCTION, AND STARTUP* - COMPARISON CASE

Category	Annual Requirements			
	1976 Calculated	2000	1976-2000 Avg.	Peak (Year)
Chemical Engineers	0	18	22	39 (1987)
Civil Engineers	96	945	540	945 (2000)
Electrical Engineers	87	740	473	740 (2000)
Mechanical Engineers	62	563	340	589 (1999)
Mining Engineers	0	4	2	5 (1994)
Nuclear Engineers	0	77	37	77 (2000)
Geological Engineers	29	41	34	41 (2000)
Petroleum Engineers	29	25	26	32 (1978)
Other Engineers	1	12	14	24 (1991)
Engineers Total	304	2,425	1,488	2,442 (1999)
Designers & Draftsmen	115	936	606	993 (1999)
Supervisors & Managers	96	520	302	520 (1999)
Nonmanual, Tech. Total	515	3,881	2,396	3,955 (1999)
Nonmanual, Nontech.	346	3,732	2,079	3,732 (2000)
Nonmanual Total	861	7,613	4,476	7,613 (2000)
Pipefitters	748	5,026	2,605	5,026 (2000)
Pipefitter/welders	391	2,186	1,155	2,186 (2000)
Electricians	356	4,928	2,514	4,928 (2000)
Boilmakers	309	616	391	616 (2000)
Boilmaker/welders	103	437	258	437 (2000)
Ironworkers	148	2,579	1,763	4,496 (1993)
Carpenters	160	3,430	1,687	3,430 (2000)
Equipment Operators	546	2,709	1,616	2,709 (2000)
Lineman	167	1,004	1,121	3,123 (1993)
Teamsters & Laborers	1,014	5,713	3,244	5,713 (2000)
Other	978	2,075	1,473	2,075 (2000)
Manual Total	4,920	30,703	17,827	30,703 (2000)
Manpower Total	5,781	38,316	20,223	38,316 (2000)

*Includes requirements for energy supply and transportation facilities.

TABLE 4

MANPOWER REQUIREMENTS (MAN YEARS)
FOR OPERATION AND MAINTENANCE* - COMPARISON CASE

Category	Annual Requirements			
	1976 Calculated	2000	1976-2000 Avg.	Peak (Year)
Chemical Engineers	30	78	51	81 (1998)
Civil Engineers	18	105	60	105 (2000)
Electrical Engineers	34	200	119	200 (2000)
Mechanical Engineers	33	160	89	160 (2000)
Mining Engineers	0	14	5	15 (1997)
Nuclear Engineers	0	26	7	26 (2000)
Geological Engineers	0	7	3	7 (1997)
Petroleum Engineers	0	0	0	0 ()
Other Engineers	31	137	86	137 (2000)
Engineers Total	146	727	420	728 (2000)
Designers & Draftsmen	28	146	84	146 (2000)
Supervisors & Managers	383	1,581	1,106	1,581 (2000)
Other Technical	75	477	238	477 (2000)
Nonmanual, Tech. Total	632	2,931	1,848	2,932 (2000)
Nonmanual, Nontech.	224	1,410	767	1,410 (2000)
Nonmanual Total	856	4,341	2,615	4,342 (2000)
Pipefitters	182	480	389	482 (1998)
Welders	77	279	209	279 (2000)
Electricians	222	1,119	666	1,119 (2000)
Boilermakers	25	66	43	68 (1998)
Mechanics	767	3,079	2,228	3,079 (2000)
Machinists	195	720	550	726 (1998)
Ironworkers	14	32	21	32 (2000)
Carpenters	28	58	42	60 (1998)
Equipment Operators	88	838	411	838 (2000)
Other Operators	770	4,282	2,172	4,282 (2000)
Meter Readers	281	2,015	1,211	2,015 (2000)
Teamsters & Laborers	1,797	6,521	5,088	6,521 (2000)
Lineman	61	595	295	595 (2000)
Other	482	2,889	1,626	2,889 (2000)
Manual Total	4,989	22,973	14,951	22,973 (2000)
Manpower Total	5,845	27,314	17,566	27,316 (2000)

*Include requirements for energy supply and transportation facilities.

6.0 COMPARISON OF MANPOWER NEEDS AND EXISTING MANPOWER BASE

The calculated need for indigenous manpower in 1976 (see Section 5.0) to design, construct, startup, operate and maintain the Egyptian energy-related facilities is 11,626 man years. Assuming no overtime, this represents a need for 11,626 workers, of which 450 are engineers; 143 are designers and draftsmen; 479 are supervisors, managers, and other technical personnel; 570 are non-manual, nontechnical; and 9,909 are manual laborers of diverse types.

The 450 engineers presently required represents about 10.6 percent of the engineers graduated in just 1 year by the Egyptian universities (See Section 3.0). Assuming that the average working career of an engineer was only 10 years, the requirement for engineers to man the existing energy-related facilities would be about 1 percent of the available engineers--an extremely small and quite reasonable match. This is the reason no general problems are encountered in obtaining the quantity of indigenous engineers required. The match by profession, however, is variable. Increasing the university output in certain specialized fields or providing specialty training to other types of engineers will, however, insure the availability of the required engineering manpower.

The number of designers and draftsmen graduated in 1 year is 154 (see Section 3.0). It is almost equal to the calculated number (143) presently required (see Section D). This category of manpower is in short supply and may continue to be so until the number being trained is increased. Thus, the presently planned expansion of the technical institute facilities in this field appears to be justified. Competition for this manpower will probably become quite keen if the domestic economy expands. One technique to overcome shortages in this field will be to assign the newly hired engineers, of which there appears to be a surplus, to work for a few years as draftsmen and designers. This would provide some additional practical training for the engineers while at the same time negating the effect of the shortage of designers and draftsmen.

The required supervisors, managers, and other technical personnel are generally available from the surplus of presently employed engineering manpower. The more experienced personnel are generally assigned as supervisors and managers, while the newly hired engineers generally fill the other technical positions and in this manner, hopefully, benefit from the added experience and diversity.

One of the problems noted by the staff is the lack of practical experience of the existing middle and often senior managers. The primary cause of this was the paucity of civilian technical activity from the late 1960's to the present due to the war effort and the consequent shortage of capital to pay for civilian development projects. Additional training via especially designed training courses to promote the transfer of practical technology (as opposed to academic technology) and on-the-job training appear to be dictated.

The non-manual, non-technical personnel needs appear to be readily filled through the employment of secondary and non-technical university graduates of which there is a surplus. Such employees should be selected by the energy facility management. Selections should be on the basis of training and personal interest rather than by assignment from outside the facility as is presently done.

The 9,909 manual laborers called for in 1976 consist of two groups, namely, skilled workers and unskilled workers. The skilled worker group consists of pipefitters, welders, electricians, boilermakers, mechanics, machinists, ironworkers, carpenters, equipment operators, and linemen. This is the class of workers which is presently the most difficult to obtain, particularly, for direct Government employment if existing wage rates are paid. Since these workers can easily find more lucrative employment at other trades, they do not find sufficient inducement in Government employment to hire on for the required work. It is unlikely that the 4,587 skilled-craft employees represented in this category can be replaced by the surplus university people due to the low prestige of such work nor will they be obtained from the ranks of the unskilled without a great deal of training and, probably, basic education. Thus, it appears that when the real need arises the energy facilities will have to, first, pay competitive wages and, second, set up training courses and/or provide on-the-job training to fill its needs. Although contracts on a project-by-project basis may be adequate to temporarily fill the needs, the rapidly increasing future need for such employees will make it desirable to secure the inhouse capability to perform this class of labor whenever the project-by-project development is transformed into a continuously executed program. As noted in Section 5.0, requirements for skilled laborers could rise from 4,587 in 1976 to over 30,000 by the year 2000. If such development is attempted without resolving the shortage, severe difficulties will occur.

The remaining required labor is primarily low-skilled or unskilled. It is doubtful that any real difficulties will be experienced in either locating or employing this class of labor where adequate funds exist to execute the near-term or long-term energy facility expansion projects.

As the hypothesized energy facility expansion program moves in time from 1976 to the year 2000, all categories of labor except the skilled-craft labor (discussed above) should be readily available. The number of engineers employed would increase from 450 to 3,152. Since the total number is less than 3 percent of the number of engineers that would be graduated during the period (assuming that yearly graduations are maintained at the 4,230 per year that occurred in the 1975-1976 school year) and the universities would have sufficient time to adjust to the increasing demand, no shortage of engineers is anticipated. The supply/demand situation would, however, require frequent monitoring to assure that a balance between production and requirements are maintained.

The number of designers and draftsmen is anticipated to increase from 143 in 1976 to 1,082 by the year 2000. Since 1,082 designers and draftsmen represent about 32 percent of the number which would be

produced by the technician training institutes during the intervening 22 years, this class of personnel will become extremely critical unless adequate steps are taken to increase the number trained per year. The present projects of the International Bank for Reconstruction and Development (World Bank), which would provide for doubling the number of trained technicians, would still not be adequate to relieve the hypothesized shortage. Although the excess engineers could temporarily be used to fill the need, the added expense to the economy of overtraining such personnel could not be justified on a long-term basis.

The number of supervisors, managers, and other non-manual, technical personnel is hypothesized to increase from 479 in 1976 to 2,101 in the year 2000. The supervisory and managerial increased requirements should be easily filled from the ranks of experienced engineering personnel that will be developed as the program progresses. The non-manual, technical personnel requirement should likewise be easily filled from the ranks of academically trained science graduates or newly graduated engineers.

The problem of lack of experience in the middle and senior management positions will automatically disappear as the expansion program progresses and projects move from phase to phase and from project to project.

The increase in non-manual, non-technical personnel from 570 in 1976 to 5,142 in the year 2000 will still be relatively easy to accommodate by the employment of non-technical university graduates and/or secondary school graduates.

No problem is anticipated throughout the hypothesized energy facility expansion regarding employment of low-skilled or non-skilled labor.

7.0 OTHER FACTORS AFFECTING MANPOWER

While identification of the factors discussed in Section 3.0 (Manpower Education and Training Resources) and Section 4.0 (Existing Manpower Base) is a basic requirement for understanding the manpower situation of Egypt, it does not address the underlying economic and social factors which will make Egypt energy facility development very difficult to plan and execute.

The major economic factor in Egypt is the inability to obtain sufficient internally-generated, internally-controlled capital to carry out the desired projects and programs without outside assistance and, consequently, outside influence. Since outside capital is normally obtained in a piecemeal manner, long-term programs will become fragmented into a series of sporadic projects and thus lose continuity. The social factors involve both the individual workers and society as a whole. The individuals who will become the manpower for the energy facility program will be drawn from society at large and will be preconditioned by that social environment. In Egypt this environment is the Arab culture, the

Moslem religion, and an emerging but largely as yet nonindustrialized society. The society itself is becoming a multi-class society consisting of a wealthy and/or politically powerful class; an aggressive and dynamic middle class of merchants, private entrepreneurs, skilled craftsmen, etc.; a bureaucratic class; an agrarian class; and others. It has not, however, completed the transition and, consequently, still holds to some of the vestiges of thinking, values, and patterns of the former two-class society which consisted of a wealthy, educated, politically powerful upper class (elite) and relatively classless populace. Superimposed on this change in class structure is the recent shift from a predominantly military stance to a planned industrialized nonmilitary stance. This change is also currently in process and is as yet incomplete.

COST, EQUIPMENT, MANPOWER REQUIREMENTS:

ENERGY SUPPLY PLANNING

MODEL PRINTOUTS

BY

BECHTEL NATIONAL INC.

U.S. EGYPT COOPERATIVE ENERGY ASSESSMENT

SEPTEMBER, 1978

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The data base for the Energy Supply Planning Model, upon which this report is based, includes information on "nominal" energy facilities. Although many of the facilities studied here may be similar to facilities actually built by the Bechtel Group of Companies, it must be recognized that actual facilities have many characteristics that are specific to the site and the local and general economic conditions at the time of construction. The information herein is generalized for "nominal" facilities and therefore not of the detail or accuracy needed for use at specific plants.

Further, the report has been prepared in a short time, which has not permitted thorough analysis, review, editing, or presentation in elaborate format.

ABSTRACT

Implementation of national energy policy decisions concerning development of new energy sources or expansion of old sources will inevitably result in significant requirements for a nation's resources of capital, labor, materials and equipment. This report on the implementation requirements of alternative Egyptian energy futures describes the first analysis carried out by Bechtel for the International Energy Development Program of the U.S. Department of Energy.

The analysis is based on Bechtel's Energy Supply Planning Model, which provides a systematic means of calculating, based on any user-specified energy development strategy, the total resources required directly to build and operate the energy supply facilities needed to implement the strategy. The ESPM was developed originally for the analysis of energy options in the United States, and the model has seen extensive use in supporting the analysis of U.S. energy plans. This Egypt energy assessment marks its first use by Bechtel in analyzing energy options outside the United States. Accordingly, a major task in the current study was to develop a methodology to adapt the model and data base to conditions appropriate to the Egyptian energy system. The adaptation methodology involved conversion of existing ESPM estimates from a U.S. basis to an Egyptian basis using factors for Egyptian wage rates, labor project efficiency, expatriate labor usage, import surcharges on capital goods, and other variables. In addition, facility sizes were scaled downward when appropriate.

It was recognized that a thorough conversion effort would not be possible given the study's limited time and budget; however, it was believed that even the limited effort practicable could provide useful, internally-consistent "ballpark" estimates of resource requirements.

The adapted model and data base was applied to a Comparison Case energy development program as specified by the DOE, as well as several alternative cases testing the sensitivity of resource requirements to lower levels of nuclear power, increased use of natural gas or renewable energy resources, and improved efficiency of energy use.

Cumulative capital costs of the Comparison Case amount to roughly LE 18 billion, in constant January 1978 Egyptian pounds, exclusive of land costs, interest during construction, or escalation. Roughly 75 percent of these requirements accrue to the electric utility sector. Construction labor requirements increase from 5,800 man-years in 1976 to 50,000 man-years in 2000, whereas the operations and maintenance requirements increase from 5,800 man-years to 32,000 man-years over the period. The assumptions on the use of foreign labor and material lead to results that the import component represents about 80 percent of total capital costs, about 20 percent of operating costs, and about 25 percent of construction labor requirements.

Cumulative capital costs are reduced by up to 15 percent over the range of sensitivity cases evaluated. A particularly significant finding of the sensitivity analysis was the the oil production levels postulated are not sufficient to allow oil to continue to substitute completely for nuclear energy beyond the year 2005 unless Egypt reverses its position from oil exporter to oil importer.

PREFACE

This report summarizes a preliminary analysis of the capital, labor, materials and equipment resources required to implement alternative Egyptian energy futures. The basis for the study is the Bechtel Energy Supply Planning Model, which has been adapted for analysis of the Egyptian energy system from its original focus on the United States.

The program was conducted by Bechtel National, Inc's Research and Engineering organization for the International Affairs Office of the United States Department of Energy under Contract EH-78-C-03-1898.

Special thanks go to Mr. Edward Purvis, the DOE Technical Representative, for his guidance and interest throughout the program.

The technical program was managed and executed within Bechtel's Energy Systems Group under the overview of Mr. Harold E. Shaw, the manager of this group.

Dr. Michael Gallagher was the Bechtel Project Manager and was responsible for relations with the DOE Technical Representative, and for the management, scheduling, control, and supervision of all tasks carried out under this contract. Dr. Ronald Barany, Mr. Ralph G. H. Zimmermann, and other members of the Energy Systems Group staff performed the technical tasks. Key assumptions of the analysis have been reviewed by Mr. Anthony J. Bowles of Bechtel's Cost Engineering Group.

1.0 INTRODUCTION

The Office of International Affairs of the United States Department of Energy (DOE) convened a team in March, 1978 to study issues related to energy supply and demand in Egypt. This study is the first effort organized by the DOE to initiate its planned series of cooperative energy assessment with developing countries.* This international energy development program dates to March, 1977, when President Carter directed that a pilot program be initiated to assist individual developing countries in developing their indigenous energy resources. During this initial year of the program, the United States and participating countries are jointly conducting a preliminary analysis of the participating countries' energy situations. The analysis includes an assessment of national energy resources, energy supply and demand options, applicable technologies, environmental effects, and capital, labor and other resource requirements.

DOE provides overall planning and management for the program, while the policy guidance is provided by the U.S. Department of State assisted by the Agency for International Development.

Bechtel was invited by the DOE to participate in the Egypt energy assessment and to adapt its Energy Supply Planning Model (ESPM) to analyze the capital, manpower, materials and equipment resources required to implement Egyptian energy futures developed by the DOE team.

Bechtel developed the Energy Supply Planning Model to provide a quantitative tool useful in analyzing the feasibility and impacts of candidate future energy development programs. Candidate programs typically emphasize various energy conversion and supply options such as offshore oil, coal, synthetic fuels, nuclear or hydroelectric power. The implementation of these various energy options accordingly requires differing amounts of a nation's capital, labor, and other resources.

This report documents the assessment of several Egyptian energy development programs selected by the DOE. It begins with brief overviews of the ESPM model and data base. It then describes the method by which the system was adapted to Egyptian conditions and the results of this modification. The Comparison Case energy development program developed jointly by the DOE team and Egyptian authorities is described, followed by a summary of ESPM-derived facility and resource requirements. Finally, the sensitivity of these results to several alternative energy strategies is illustrated.

* The second cooperative energy assessment has recently been initiated with Peru.

2.0 OVERVIEW OF THE MODEL

The Energy Supply Planning Model incorporates an engineering approach to energy and resources planning. The model provides a systematic means of calculating, based on any user-specified energy development strategy, the total resources required directly to build and operate the energy supply facilities needed to implement the strategy. The model is specifically designed to facilitate its use in the analysis of energy scenarios, whether these are generated by other models or as elements of national energy policy. With this tool, the feasibility of various proposed mixes can be reviewed in terms of the time, capital, manpower, materials and equipment, and construction schedules required for the necessary energy supply system. To date, the modeling effort has involved an expenditure of approximately 50,000 man-hours over the past four years. The model has been extensively documented in Bechtel National Publications.¹⁻⁴

Among the many existing energy system models now in use in public policy analysis, the ESPM is unusual in several important respects:

- o The data base consists of detailed engineering estimates developed by an engineering and construction organization and has become a standard of reference for other energy researchers.
- o The model is conceptually simple and transparent to user understanding. No feedback loops or optimizing procedures are employed.
- o The model includes extensive technological detail.
- o The model user (not the model itself) specifies the energy development program to be evaluated.
- o The model provides an integrated assessment of detailed capital, labor and other resource requirements for the entire energy supply system.

¹ "The Energy Supply Model," Volume I: Model Structure and Use; Volume II: User's Manual and Appendices; M. Carasso, J.M. Gallagher, K.J. Sharma, J.R. Gayle, R. Barany; Bechtel Corporation; NTIS NO. PB-245 382, PB-245 383, August 1975.

^{2,3} "Resource Requirements, Impacts, and Potential Constraints Associated with Various Energy Futures," J. Michael Gallagher, Ronald Barany, Paul F. Paskert, and Ralph G.J. Zimmermann, Bechtel Corporation, NTIS No. PAE-3794-6, 9, March 1977 and March 1978 Annual Reports.

⁴ "Coal in Transition, An Analysis of Coal Development Programs Using the Bechtel Energy Supply Planning Model," J. Michael Gallagher and Ralph G.J. Zimmermann, Bechtel National, Inc., February 1978.

- o The model highlights the dynamics of energy transition strategies by calculating annual schedules for required facilities and resources.

The model has been used as an energy policy analysis tool by several organizations, including the U.S. Department of Energy, the U.S. Department of Commerce, the Electric Power Research Institute, the International Institute of Applied Systems Analysis (IIASA), the U.S. National Academies of Science and Engineering (Committee on Nuclear and Alternative Energy Systems, CONAES), and the Workshop on Alternative Energy Strategies (WAES), among others.

Design of the model emphasizes three features:

- o Straightforward structure
- o User access to decision variables
- o Flexibility

Although dimensionally quite large, the model is structurally straightforward and, therefore, easily understandable. It proceeds from user-specified assumptions for major variables, and explicit assumptions for other variables, through a series of easily understood submodels to produce resource requirements results. This decomposition into submodels is intended to allow model users a step-by-step specification of decision variables and, in so doing, to permit testing the sensitivity of results to these variables.

User access to policy and other variables is deliberately emphasized, so that model results represent information derived from user decisions rather than from a decision-making capability endogenous to the model. In addition, flexible exercise of the various user options is easily accommodated. For most user options, there is a capability to specify user considerations at various levels of detail, making the model suitable for use by energy policymakers and analysts alike. To allow this flexibility, reference (or default) specifications exist in the model and become operative only when the user chooses not to exercise his prerogative to specify variables at all levels of detail.

An application of the model follows this procedure:

- o The user chooses a candidate future energy mix of interest, for example, for the years 1980, 1985, 1990, and 2000.
- o The model then calculates, by year, the number of new energy supply facilities of various types that must be brought onstream and operated in order to supply the specified mix.
- o Employing user specifications, and at user option, the model then locates the facilities in various regions of the country, allocates fuels derived from the

facilities to the regional demands, and calculates transportation facilities required to accomplish the distribution. Alternatively, as for the Egypt energy assessment, transportation facility schedules are calculated based on nationally-averaged statistics.

- o The model next calculates separately, the annual schedules of capital, manpower, material, and equipment resources required for resulting energy and transportation facilities (from initial commitment to plant startup and for operation and maintenance throughout their economic lives), and for the energy supply system as a whole. These requirements are expressed without regard to the availability of such resources.

Examples of questions for which the model can provide explicit answers include:

- o What energy supply and transportation facilities must be constructed to implement a candidate national energy development program? When would they need to be on-line? Committed?
- o What direct capital, manpower, equipment, raw materials would be needed? When? Where?
- o What would be the requirements of a specific energy industry? (e.g., What will be the manpower requirements of the nuclear power industry in 1983?)
- o How different are the requirements of different energy programs?

The model can help answer some other questions:

- o For which capital, manpower, and material resource categories are future shortages likely to occur unless remedial actions are taken?
- o What is the total impact of the resource development strategy on other branches of the national economy?

The following list contains some of the questions the model does not presume to answer:

- o What should be the national energy program?
- o What should be the national nuclear program?
- o What should be the national energy export program?

3.0 OVERVIEW OF THE DATA BASE

A central feature of the Energy Supply Planning Model is its extensive engineering data base, which consists of those resources directly required to engineer, construct, start up, operate, and maintain energy supply and transportation facilities. This section describes the data base as developed for the United States; the next section describes its adaptation to Egypt. Most of the data are based on in-house engineering estimates by the various divisions of the Bechtel Group of Companies, relying on past construction experience, literature, and industry contacts. Some of the original operations and maintenance estimates were subcontracted to Stanford Research Institute, but these have since been updated by Bechtel. This extensive technology data base is frequently used as a primary data source by other energy researchers.

Currently, there are 101 "nominal" energy facilities in the ESPM data base. These facilities include energy extraction, processing, and transportation facilities and were selected to give a comprehensive coverage of the energy supply industry in the United States.

The concept of a nominal facility was used to translate the "101" energy facilities into building blocks with certain energy technology and resource requirements characteristics. A nominal facility represents a "future average" facility in that its resource requirements are intended to be typical of requirements for a facility of that kind and size likely to be under construction in the 1978 to 2000 period. This definition implies that a nominal facility may not be identical to any existing or planned facility but can yield reasonably accurate results over a future time period.

Estimates of resources required for construction of each of the "101" ESPM facilities have been developed for approximately 100 categories of:

- o Capital
- o Manpower
- o Materials and equipment (directly purchased)
- o Raw materials

All capital costs are expressed in March 1977 dollars. These cost estimates were⁵ originally developed in 1974 dollars and have recently been escalated to reflect unit cost increases in the detailed production factors (e.g., manpower, materials, and equipment), without consideration of the effects of facility design changes that may have occurred since the original estimates were made (such changes in scope are currently being studied for subsequent inclusion). The material

"Escalation in the Costs of Manpower, Materials, and Equipment Needed for Energy Facilities," Paul F. Paskert and J. Michael Gallagher, Bechtel Corporation, Report No. PAE-3794-7, October 1977.

and equipment components of capital cost are summarized in two-digit Bureau of Economic Analysis accounts (e.g., primary iron and steel products, BEA 37) to allow direct use in econometric input-output models, that is, to determine the total impacts of ESPM-derived results on other branches of the national economy.^{6,7}

In addition to various capital cost categories, manpower requirements have been estimated for the major engineering disciplines (e.g., mechanical, electrical), designers and draftsmen, supervisors and managers, and the major manual skills (pipefitters, electricians, carpenters, etc.).

To complement the categories of capital and manpower requirements described above, estimates have been developed for quantities of selected major material and equipment items that must be directly purchased for energy construction projects. Examples of these items include draglines, oil country tubular goods, compressors, and boilers. In addition, since the energy industries are major consumers of many raw materials (steel, aluminum, copper, etc.), it is important to be able to trace the impacts of various energy options on the raw material supply industries. In this case, the data estimates include total construction requirements, whether directly purchased or contained within purchased equipment.⁸

Construction resources are expended at various rates during the construction period. To account for this effect, time-phased data on the percentage of the total resources that are required during each year of the construction project have been developed. Detailed annual requirements for the operation and maintenance of the "101" ESPM facilities have also been developed. Annual costs for manpower, materials, equipment, and utilities, as well as annual manpower requirements by discipline, have been developed at a level of detail similar to that described above for construction resources.

It is important to note that all requirements refer to direct requirements for the construction and operation of facilities. "Ripple" effects through the economy on indirect physical labor and material requirements are excluded. For example, the data base includes the (direct) engineering requirements for the design of a power plant, but not the (indirect) engineering requirements associated with the design of manufactured equipment (piping, heat exchangers, etc.) included in the power plant.

One other limitation is that currently neither of the two sets of costs includes all the costs that one might wish to include in an overall

⁶ "Direct and Indirect Requirements for a Project Independence Scenario," Clark W. Bullard and David A. Pilati, Center for Advanced Computation, Urbana, Illinois, September 1975.

⁷ "Evaluation and Accounting of Energy Strategies Impact on the National Economy," Draft, Yuri Kononov, International Institute for Applied Systems Analysis, 2361 Laxenburg.

⁸ "Raw Material Costs for Energy Development Programs," J. Michael Gallagher and Paul F. Paskert, Bechtel Corporation, Report No. PAE-3794-8, January 1978.

economic analysis. The excluded costs could be termed "owner's costs" and include such factors as interest during construction, land costs, and taxes. These costs are now being added to the data base.

4.0 ADAPTATION FOR EGYPT ANALYSIS

The focus on the Energy Supply Planning Model on critical resource issues from an engineering perspective makes it a natural component in the analysis of international energy development programs. Although the model was developed originally for the analysis of energy options in the United States, the major values of this information system to the Egypt energy assessment are believed to be two-fold:

- o The energy facilities data base is comprehensive, consistent, current and accessible. It provides a set of engineering information derived under common ground rules for a wide variety of energy supply technologies covering the entire system.
- o The ESPM modeling system organizes this data base into an integrated framework which permits rapid and flexible analysis of the sensitivity of capital, labor and other resource requirements to changes in energy policy variables.

Because the model had not previously been adapted to countries outside the United States, a principal task of this analysis was to develop and implement a method to adapt the ESPM to the Egyptian energy system. This section describes the methodology developed, major assumptions used to implement the methodology, principal results of the adaptation, and some significant limitations on these results. It is believed that one of the more important contributions of this task is the development of a generic process which can be used to adapt the ESPM to other countries of interest.

4.1 Methodology

Adaptation of the ESPM for the Egypt analysis required efforts primarily in two areas:

- o Revision of the energy supply system definition (fuels, technologies, transportation system, etc.) to include energy options applicable to Egypt
- o Modification of the facilities data base using ground rules compatible with Egyptian conditions (labor rates, materials prices, etc.)

Given the short time period of six weeks allowed by DOE schedules for completion of the adaptation, it was clear that the adaptation methodology must be based on readily available information. Further,

since facility cost and resource requirements data for Egypt are not readily available, it was determined that the most appropriate methodology would involve modification of existing ESPM estimates from a U.S. basis to an Egyptian basis, rather than the development of entirely new estimates for Egyptian facilities. Factors for Egyptian wage rates, project efficiency factors, expatriate labor conditions, import surcharges on capital goods, and other variables could be used to transform the U.S. data. This approach has previously been used by others for countries where cost information is not readily available and can be expected to yield reasonable results for facilities such as electric power plants and oil refineries for which costs are not overly site-specific.

The existence of the comprehensive U.S. data base in computerized ESPM form made practical the implementation of this factoring approach. Perhaps the most significant advantage of the approach is that the transformed facility data largely retain the relative consistency developed on a U.S. basis across the various energy options.

Given additional resources and time, improved results could be obtained by complementing this factoring approach with the development of new estimates for those energy technologies with highly site-specific characteristics, e.g., hydro facilities and oil wells. For the Egypt study such site-specific estimates were the responsibility of individual technology specialists assigned to the DOE team and are not considered further here.

Two other aspects of the methodology merit mention:

- o Scaling of facility sizes
- o Foreign exchange costs

It was recognized that facility sizes typical of energy projects in the United States would, in many cases, be larger than appropriate for developing countries such as Egypt. Thus, it was decided to use parametric scaling equations to adjust resource requirements data for appropriate facilities. Because there are limits to the size range over which these scaling relationships are valid, it was decided to limit their use to facility sizes within a reasonable range (arbitrarily defined as approximately a factor of two) of the size defined for U.S. data.

A final methodological note concerns the handling of foreign exchange components of development program requirements. A primary element of resource development strategy for most countries is the encouragement of the use of indigenous labor, industry, and capital in carrying out programs, thereby reducing balance of payments burdens. It was, therefore, decided to provide information of use in analyzing the foreign exchange implications of alternative energy strategies. Accordingly, the ESPM data base was modified by partitioning it into two data sets, the first containing total resource requirements; and the second containing the imported component of the total requirements. The "Import" data set contained the costs of direct purchases of foreign labor, materials, equipment and services, as

⁹ "Construction Costs in Saudi Arabia," David M. Wallace, Arabian American Oil Company, AACE Bulletin, March/April 1977.

well as the quantities of foreign labor required for energy facilities. Creation of this data base required assumptions regarding the use of foreign vs. local labor, materials, etc., for the various types of energy facilities.

4.2 Country Visit

An important feature of the analysis was a visit to Egypt to:

- o develop a first-hand feel for the applicability of the existing ESPM to Egyptian energy conditions,
- o determine the most significant areas for modification of the model and data base,
- o determine the extent of available construction and operating cost information, and
- o collect information useful in executing the modification.

A preliminary adjustment of the facilities data was carried out prior to the Egypt visit using a reference set of parameters to be refined during the country visit.

An extensive set of questions was developed to guide the in-country information collection effort in such areas as labor, materials and equipment, capital and financing, energy facility characteristics, and energy system parameters.

Egyptian energy officials knowledgeable in planning, industry, labor, finance, construction, and power and fuels were interviewed on these issues, and results of the interviews led to refinement of the preliminary information. The names of personnel contacted in Egypt are given in Section 8.0.

4.2.1 Labor: The following labor-related questions were developed to guide the interviews in Egypt.

- o What are the local costs for labor by discipline (relative to USA)?
 - managerial
 - technical
 - clerical
 - skilled manual
 - unskilled manual
- o What escalation in these rates has occurred recently? Future expectations?
- o What picture emerges for the use of expatriate labor - technical, manual, etc. - in building or operating facilities? What is the government policy here?

- o What fraction of projects are built by local vs. foreign companies (field vs. home office labor distinctions)?
- o Where does expatriate labor come from? What are the relative wage rates of source countries vs. Egypt and vs. USA?
- o Upon what factors are labor rates based (locale, marital status, food and housing, etc.)?
- o "Project efficiency" - Compared to a plant in USA, how many man-years are required for construction? For operation?
- o What is the mix of skilled vs. unskilled manual labor on different types of projects?
- o Are locally available labor supplies adequate?

4.2.2 Materials and equipment: Questions of significance on materials and equipment include:

- o What is the cost of materials and equipment purchased in Egypt (relative to world prices)?
- o What materials are available locally? In what quantities?
- o What is the cost of imported materials and equipment (relative to world prices)?
- o What is the government's policy toward importation of material?
- o Are there bottlenecks in getting items into the country or to project sites (ports, rail lines, etc.)?
- o What are the existing and planned capacities for domestic supplier industries?
- o What is the escalation rate anticipated for local supplies? How does it compare to worldwide escalation rates?
- o Are there Egyptian wholesale price statistics, like those in the USA, which could be used to price materials and equipment?
- o How do labor-intensive procedures translate into materials and equipment input reductions?

4.2.3 Capital and financing:

- o What are the sources of capital?
 - within Egypt
 - within Arab World
 - from export credit and world development sources (Exim, World Bank, etc.)
 - from financial institutions on a project financing basis
- o What is the expected rate of growth of capital availability if no major change occurs in the present political-financial climate?
- o What is the attractiveness of the Egyptian energy field to each source of capital and what are the reasons for this, including susceptibility to changes in political-financial scenarios?
- o What are variations in rate of growth or in attractiveness of the Egyptian energy field, if elements of the political-financial climate should change?
- o What is the attractiveness of each category of project in the Egyptian energy field for each source of capital (including consideration of self-financing projects, impact of currency fluctuations on the rate of return, protection of the institutions' interest for the duration of financing agreement, etc.)?
- o Who owns the facilities? Local vs. foreign vs. government owners? What is the owner's cost of money/capital?
- o Who builds the facilities? Local vs. foreign builders?
- o Who operates the facilities?
- o What has been the past general rate of inflation? Expected future inflation rates?
- o How are projects financed (oil company, domestic subsidy, etc.)?

4.2.4 Energy facility characteristics:

- o What energy technologies and facilities are of interest?
- o What are the operating characteristics of these facilities?
- o What are reasonable cost estimates for these?
- o What are the major differences from identical facilities in USA (cooling towers, sulfur removal, particulate removal, etc.)?

- o What other differences are apparent in typical size or process or lifetime?
- o What have been the costs of actual projects built or planned (records available)?
- o Are there differences in construction lead time from the U.S. experience?
- o For what facilities must entirely new estimates be developed to complement the ESPM analysis?

4.2.5 Energy system parameters:

- o What energy supply technologies are included in the Egyptian energy supply system?
- o What are the facility parameters necessary to quantify the system description:
 - size
 - capacity factor
 - process efficiency
 - transportation characteristics, e.g., annual carrying capabilities, haul lengths
- o What facilities in supply chain are domestic vs. foreign (e.g., uranium enrichment)? Will this picture change over time?
- o How are process by-products (e.g., associated gas) used?
- o What are likely ranges of implementation for supply options? Do these represent a small number of facilities, in which case project-specific data would be desirable, or many facilities, where the "nominal" facility concept would be appropriate?

4.3 Major Modification Assumptions

The detailed ESPM listing of labor, materials, equipment, and other resource requirements, coupled with computerization of this detailed data, enabled the separate modification of many facility parameters, which then formed the basis of results aggregated at the facility level. Carrying out the modification required many assumptions regarding relative Egypt-USA differentials for cost components and local vs. foreign sources of the components. The major assumptions utilized are documented below.

However, it is very important to remember that the primary objective of this process was to yield reasonable aggregated Egyptian facility data (e.g., total capital and labor requirements) which could be used to analyze the impacts of total energy development programs. Many

alternative sets of assumptions regarding detailed parameters can give similar results when aggregated at the facility level.

4.3.1 General assumptions: A basic assumption was that future energy projects in Egypt would be engineered and constructed according to worldwide standards. Such methods place a high premium on capital-intensive construction equipment and techniques, with less dependence on unskilled labor.

The significance of this assumption is that the ESPM's U.S. data on the relative mixes of labor and material quantities for energy facilities can be used for Egyptian facilities. Thus, construction or operation of identical oil refineries in the United States or Egypt can be assumed to require identical quantities of capital goods and labor (as adjusted for project efficiency differences). Without this simplifying assumption, modification of the ESPM's data base would require considerably more effort than was available for this study.

Based on discussions held in Egypt, this assumption of world standards does appear to be reasonable for the major energy projects being considered (e.g., nuclear power plants, refineries, pipelines). However, this would not be as good an assumption for more routine civil construction projects such as housing.

4.3.2 Materials and equipment: Quantities of materials and equipment required for Egyptian facilities are assumed to be the same as for similar facilities in the United States which were as stated above. Determination of the costs of these quantities requires assessment of:

- o local vs. foreign source
- o costs of local sources
- o costs of imported sources.

Basic materials such as wood products, cement, concrete and steel are currently available from local suppliers in Egypt, but this is not the case for finished heavy equipment.¹⁰

Uniform national price statistics for capital goods were not available; it was assumed that locally available materials could be purchased at prices roughly equal to world prices, which were estimated by escalating ESPM prices from March 1977 to January 1978.

¹⁰ "Egypt National Transport Study," Interim Report, Louis Berger International, Inc., January 1977.

Despite the availability of many basic materials, the supplies tend to be marginally adequate, with slippage of project construction schedules a typical consequence of over-reliance on local industry. For this reason, importation of locally available materials may be necessary and is allowed for major projects. In practice, on the most important construction projects, essentially all materials and equipment are imported. For these major projects, import tariffs are typically waived. Thus, materials and equipment procured from international suppliers in the United States, Europe and Japan can be obtained at the world price plus costs of overseas transportation and local handling and transportation within Egypt.

The delivered price for imports has been estimated to be 20 percent above the world price, which includes about 10 percent extra for overseas transportation and 10 percent for local handling. This 20 percent premium corresponds to procurement from Japan or Europe; another 5 percent might be added if the United States is the source.

These general guidelines were converted to detailed import fractions for about 20 sectors as necessary to develop the costs of materials and equipment for Egyptian facilities at the ESPM level of detail. Separate fractions were estimated for different types of facilities depending on the detailed bill-of-goods make-up of the requirements. For most facilities, items currently produced in Egypt were assumed to be procured there for construction, whereas estimates for operations and maintenance assumed additional items would be available following implementation of the Five-Year National Plan. For a few facilities (oil and gas wells, nuclear power plants) that were considered to be of high priority or complexity, it was assumed that essentially all items would be imported to save time.

4.3.3 Labor: There exists in Egypt an abundance of local labor. Large numbers of semi-skilled, unskilled administrative, clerical, and technical workers are readily available. Skilled Egyptian workers are available in moderate numbers in almost all disciplines, except for skilled craft workers such as pipe welders and millwrights.

However, there is little experience with large complex energy projects, and the highly trained labor that does exist is frequently drawn to other higher-paying countries in the Arab region and elsewhere.

The first step in modifying the ESPM labor data base to Egyptian conditions was to derive adjusted requirements for quantities of labor. As previously stated, the quantities of labor required to build and operate Egyptian energy facilities were assumed to be identical, after adjustment for "project efficiency" factors, to similar facilities in the United States. A project efficiency factor is defined to be the ratio of the number of hours of labor required in Egypt relative to the

U.S. for similar projects. Such a factor is a composite of many individual conditions such as, laborer work knowledge and ability, job-site conditions, local climate, length of workweek, management methods, general economic conditions, and culture.

A project efficiency factor of 2-3 was felt to be appropriate for Egyptian projects. For expatriates working in Egypt, project efficiency factors could be expected to be somewhat reduced, to perhaps a range of 1.5-2.5.

Regarding the use of expatriates, it was assumed that most facilities would be operated and maintained by an entirely Egyptian work force. For the higher priority oil and gas wells and nuclear power plants, about one-fifth of the operations work force was assumed to be expatriates. A training program for local operators that is tied to the energy development program is implicitly assumed with these factors.

The engineering and construction of energy facilities is expected to see a somewhat greater use of foreign labor. For most facilities a figure of one-half of the engineering and one-sixth of the manual labor was used, and for the highest-priority facilities foreign labor is assumed to account for all of the engineering and one-third of the manual workers. It should be noted that only about one-third or less of the foreign engineering work would involve expatriates, since the bulk of the engineering work would be carried out in the home office of the foreign company.

The final step necessary to modify the Egyptian labor data was to develop adjusted labor costs, taking into account the use of local vs. foreign labor and project efficiency factors developed above, and unit labor costs. Unit costs for Egyptian construction labor is estimated to range from an average of about 1 LE/hour for manual to an average of about 3.25 LE/hour for nonmanual technical labor. These figures include all benefits, including an allowance for housing and food.

In the case of operations and maintenance, the housing and food allowance is removed to give annual wages of 1725 LE-4850 LE for the same range. These unit costs are roughly 1/3 - 1/6 those prevailing in the United States. Thus, although Egyptian projects may require three times as many man-hours, overall labor costs amount to only 50 percent - 70 percent of those in the United States.

Of course, this saving is reduced to the degree that foreign labor is used on Egyptian projects. Manual labor expatriates are likely to be sourced not from Western developed countries but rather from developing countries such as South Korea, India, Pakistan, Indonesia, and the Philippines. After inclusion of incentive premiums, unit costs of these manual expatriates are expected to be about 4-5 LE/hour or nearly five times the cost of using local labor. However, this is still less than the equivalent U.S. labor rate for manual manpower and far less than the cost of using expatriates from Western developed countries.

The major portion of foreign engineering and field supervision manpower is expected to be provided by developed countries (e.g., United States, West Germany, United Kingdom). In the case of facilities engineering, the home office portion of this work force has been costed out at U.S. rates already existing in the ESPM data base. However, certain other costs and labor burdens are applicable to expatriates in this class. For this study an average overall premium of 135 percent has been assumed to cover base salary premium, air fares, food and housing (not included for operations manpower), vehicle, and marital status allowances.

4.3.4 Other cost assumptions: Total construction costs are the sum of labor, materials, equipment, and "other," which includes contractor overhead, fee, and contingency. This other cost component has been assumed here to be the same percentage for Egyptian facilities as for the United States. Its exact size varies among the various facility types. It should be noted that this factor would in practice be set by the management of the contracting company. Higher rates than those assumed here would not be unreasonable, in that overhead costs and risks associated with international projects are higher than for domestic projects.

A factor has also been applied to total construction costs to cover working capital costs, as well as general plant and intangible costs. The costs of land and land rights, escalation and interest during construction have not been included. All costs are stated in constant January 1978 Egyptian pounds. A currency conversion rate of LE 1.00 = \$1.45 was used to convert to Egyptian pounds from U.S. dollars when necessary.

4.3.5 Facility scaling: The previous sections describe the assumptions necessary to adjust the resource requirements data to Egyptian conditions for facilities identical in size to those in the United States. In some cases, a final step was necessary to scale the data to facility sizes more appropriate to Egypt. Resource requirements data were scaled down for oil and gas wells, oil refineries, coal mines, uranium mills, and electric generating facilities using oil, gas, coal, nuclear, and pumped storage hydro.

The relationship used to express the effect of economies-of-scale on resource costs is $C = (ax)^b$, where "x" is the size of a facility, "a" is a proportionality constant, "b" is the scale coefficient, and "C" is the resource cost. Separate scale coefficients were developed for manpower, basic materials, other materials and equipment, land, energy and utilities, and miscellaneous costs. The coefficients also varied among facilities.

4.4 Summary of Egyptian Resource Requirements Data

The diverse assumptions described above were integrated into overall sets of construction and operations resource requirements data for Egyptian energy supply facilities. Two parallel data sets were developed, one set describing the total resource requirements to build and operate Egyptian energy facilities, and a second set describing the foreign or import component of these totals. This second or "Imports" data set refers to direct purchases of labor, materials and equipment from foreign sources and can be used to investigate the foreign exchange implications of alternative energy strategies.

The result of this process was the creation of an extensive preliminary data base for Egyptian energy facilities. A summary of this data base is presented in Tables 1 through 8 (placed at the end of this section), and complete details are available on the computer tape being prepared in conjunction with this report. Tables 1 and 2 present the total resource requirements for the construction of energy supply and transportation facilities. Tables 3 and 4 present the operation and maintenance resource requirements. Tables 5 through 8 present the corresponding import components of the total resource requirements. In the table titles, the term "Investment Resources" in Tables 1, 2, 5, and 6 refers to the total resources required for the financing, engineering, construction, and start-up of facilities. The term "Annual Resources" in Tables 3, 4, 7, and 8 refers to resources required annually for the operation and maintenance of the facilities.

The aggregate results indicate that total project costs vary across facilities from about -10 percent to +10 percent of U.S. costs for facilities of similar sizes, depending on assumptions made regarding the use of foreign labor, materials and equipment. This variation across facilities is considerably less than the uncertainty surrounding the basic estimates.

One special case should be mentioned. Egyptian oil and gas wells are much more productive than those in the United States, hence a given amount of production can be obtained for correspondingly less investment.

4.5 Data Limitations

The "ballpark" nature of the data developed for this study must again be emphasized. The data has been developed to assess order-of-magnitude impacts of Egyptian energy development strategies on national capital and labor requirements, and the quality of the data is considered adequate for that purpose. An example of an inappropriate use of this data would be a detailed economic comparison of specific competing projects.

More specific limitations arise from the short time allowed for the study which restricted the coverage of energy technologies to those already existing in the ESPM. Thus, technologies for generation of

electric power via solar thermal, wind, biomass, Nile River barrages, or the Qattara hydroelectric project are not included in this assessment. Further, technologies were excluded for which the typical size of an Egyptian facility was so much smaller than U.S. size that scaling equations were felt to be invalid. In this class were mine-mouth coal-fired power plants, crude oil and gas pipelines, and the annual costs of operating oil and gas wells. Estimates for the excluded technologies were the responsibility of individual technology specialists assigned to the DOE team.

RESOURCE REQUIREMENTS

08/14/78

Table 1

ENERGY FACILITY INVESTMENT RESOURCES -TOTAL

RESOURCES:

85.	CONSTRUCTION MANPOWER TOTAL	(THOUSAND MAN-HOURS)
4.	MANPOWER TOTAL	(MILLION JAN 78 EPOUNDS)
15.	MATERIALS TOTAL	(MILLION JAN 78 EPOUNDS)
29.	EQUIPMENT TOTAL	(MILLION JAN 78 EPOUNDS)
37.	MISCELLANEOUS MATERIALS & EQUIPMENT	(MILLION JAN 78 EPOUNDS)

FACILITY:

	85	4	15	29	37
1. ONSHORE PRIMARY OIL RECOVERY-(1,000 MBPD)	145,008	0.569	1.005	1.156	0.235
2. ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	474,683	1.914	2.711	3.018	1.869
3. ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	822,904	3.297	4.484	8.369	2.776
4. OFFSHORE OIL RECOVERY (12.5 MBPD)	203,365	0.854	2.715	4.543	1.172
6. HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	38968,598	94,948	81,995	167,198	1,503
7. LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	20195,098	48,941	38,728	103,146	7,084
8. HEAVY FUEL OIL GASIFICATION (250 MMCF/D)	33351,500	78,723	70,437	186,791	4,509
9. NAPHTHA GASIFICATION (174 MMCF/D)	7702,199	17,703	18,941	29,171	0.537
11. OIL EXPORT (1000 MB/D)	21383,797	46,449	52,069	95,953	38,925
19. ONSHORE CONVENTIONAL GAS RECOVERY (100 MMCF/D)	249,510	0.980	1.610	1.202	0.371
20. ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	12829,797	46,531	71,502	36,040	1,610
21. OFFSHORE GAS RECOVERY (25 MMCF/D)	949,637	3,164	9,962	10,791	4,206
24. LNG EXPORT (3030 MMCF/D)	75038,750	173,993	204,546	468,823	58,017
27. UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	1732,390	4,246	4,996	19,615	0.776
37. SURFACE URANIUM MINE (275.4 M TONNES/Y)	1453,270	3,017	1,059	4,289	0.067
38. UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	489,429	1,216	1,237	2,918	0.067
39. URANIUM MILL (275.4 M TONNES/Y)	509,688	2,260	0,705	2,069	0.257
40. URANIUM CONVERSION (9072 TONNES/Y)	3379,820	14,984	7,512	15,850	0.660
41. URANIUM ENRICHMENT-DIFFUSION (8.75 MILLN SWU/YR)	167989,000	641,556	353,612	1375,100	7,318
42. LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	3248,290	15,072	3,747	11,326	13,734
43. LWR FUEL FABRICATION - PU RECYCLE (150 MTU/Y)	2912,400	13,019	4,272	15,154	4,187
46. LWR SPENT FUEL REPROCESSING (1500 MTU/Y)	39666,199	167,157	90,760	125,545	7,515
49. HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	3286,210	12,159	9,641	5,837	5,969
50. OIL-FIRED POWER PLANT (800 MWE)	12122,598	24,440	16,072	71,060	1,213
51. OIL-FIRED POWER PLANT (600 MWE)	9493,156	19,139	12,937	58,937	1,006
52. OIL-FIRED POWER PLANT (450 MWE)	7433,520	14,986	13,707	48,889	0.835
53. COAL FIRED POWER PLANT-LOW BTU (800 MWE)	15625,797	32,160	25,810	108,917	2,061
54. COAL FIRED POWER PLANT-HIGH BTU (800 MWE)	13145,898	27,165	22,414	90,948	1,933
55. COAL FIRED POWER PLANT-LOW BTU (600 MWE)	12413,098	25,548	21,274	91,654	1,735
56. COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	10443,098	21,580	18,476	76,533	1,626
59. HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	7536,539	15,753	4,383	48,266	0.709
60. HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	5901,859	12,336	3,539	40,032	0.588
61. COMBINED CYCLE POWER PLANT (400 MWE)	3418,740	8,721	3,365	35,443	0.397
62. GAS TURBINE POWER PLANT (133 MWE)	601,447	1,348	0,467	15,302	0.090
63. FUEL CELLS (26 MWE)	103,034	0.231	0,010	7,102	0.0
64. LIGHT WATER REACTOR (LWR) (1200 MWE)	31899,199	117,426	67,180	163,419	1,616
65. LIGHT WATER REACTOR (LWR) (900 MWE)	25341,500	93,285	53,163	131,712	1,302
66. LIGHT WATER REACTOR (LWR) (600 MWE)	18322,500	67,700	38,252	97,173	0.961
67. DAM & HYDROELECTRIC POWER PLANT (200 MWE)	6234,637	15,279	10,412	34,125	0.859
68. PUMPED STORAGE (500 MWE)	8998,270	22,138	25,326	37,611	1,000
69. GEOTHERMAL POWER COMPLEX (200 MWE)	2640,910	6,062	17,447	64,327	0.050

ENERGY FACILITY INVESTMENT RESOURCES -TOTAL

RESOURCES:

39.	OTHER CONSTRUCTOR COSTS	(MILLION JAN 78 EPOUNDS)
40.	CONSTRUCTOR COST TOTAL ##	(MILLION JAN 78 EPOUNDS)
50.	ZZZZCAPITAL COST TOTAL	(MILLION JAN 78 EPOUNDS)

39 40 50

FACILITY:

1.	ONSHORE PRIMARY OIL RECOVERY-(1,000 MBPD)	0.090	3.055	3.509
2.	ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	0.280	9.792	11.249
3.	ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	0.392	19.318	22.193
4.	OFFSHORE OIL RECOVERY (12.5 MBPD)	0.652	9.936	11.414
6.	HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	35.774	381.418	438.181
7.	LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	20.285	218.184	250.654
8.	HEAVY FUEL OIL GASIFICATION (250 MMCF/D)	35.987	376.447	432.470
9.	NAPHTHA GASIFICATION (174 MMCF/D)	6.469	72.822	83.659
11.	OIL EXPORT (1000 MB/D)	25.300	258.696	297.194
19.	ONSHORE CONVENTIONAL GAS RECOVERY (100 MMCF/D)	0.137	4.299	4.939
20.	ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	3.020	158.703	182.322
21.	OFFSHORE GAS RECOVERY (25 MMCF/D)	1.758	29.881	34.328
24.	LNG EXPORT (3030 MMCF/D)	104.481	1009.860	1160.150
27.	UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	5.085	34.719	42.507
37.	SURFACE URANIUM MINE (275.4 M TONNES/Y)	2.549	10.980	12.712
38.	UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	1.276	6.715	7.633
39.	URANIUM MILL (275.4 M TONNES/Y)	1.511	6.802	7.835
40.	URANIUM CONVERSION (9072 TONNES/Y)	11.507	50.512	58.180
41.	URANIUM ENRICHMENT-DIFFUSION (8.75 MILLN SWU/YR)	586.313	2963.900	3413.820
42.	LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	4.541	48.419	55.770
43.	LWR FUEL FABRICATION - PU RECYCLE (150 MTH/Y)	4.290	40.922	47.133
46.	LWR SPENT FUEL REPROCESSING (1500 MTU/Y)	41.326	432.303	497.926
49.	HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	4.076	37.682	43.403
50.	OIL-FIRED POWER PLANT (800 MWE)	33.271	146.056	162.013
51.	OIL-FIRED POWER PLANT (600 MWE)	27.146	119.164	132.183
52.	OIL-FIRED POWER PLANT (450 MWE)	23.133	101.551	112.645
53.	COAL FIRED POWER PLANT-LOW BTU (800 MWE)	48.522	217.471	241.230
54.	COAL FIRED POWER PLANT-HIGH BTU (800 MWE)	41.883	184.343	204.483
55.	COAL FIRED POWER PLANT-LOW BTU (600 MWE)	40.269	180.480	200.197
56.	COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	34.755	152.971	169.683
59.	HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	21.397	90.508	100.396
60.	HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	17.491	73.986	82.069
61.	COMBINED CYCLE POWER PLANT (400 MWE)	12.557	60.483	67.091
62.	GAS TURBINE POWER PLANT (133 MWE)	2.557	19.764	21.923
63.	FUEL CELLS (26 MWE)	2.440	9.783	10.851
64.	LIGHT WATER REACTOR (LWR) (1200 MWE)	113.773	463.413	514.040
65.	LIGHT WATER REACTOR (LWR) (900 MWE)	90.937	370.399	410.865
66.	LIGHT WATER REACTOR (LWR) (600 MWE)	66.409	270.495	300.047
67.	DAM & HYDROELECTRIC POWER PLANT (200 MWE)	8.701	69.376	76.955
68.	PUMPED STORAGE (500 MWE)	38.978	125.054	158.865
69.	GEOTHERMAL POWER COMPLEX (200 MWE)	33.467	121.353	134.611

RESOURCE REQUIREMENTS

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Table 2

TRANSPORTATION FACILITY INVESTMENT RESOURCES -TOTAL

RESOURCES:

85.	CONSTRUCTION MANPOWER TOTAL	(THOUSAND MAN-HOURS)
4.	MANPOWER TOTAL	(MILLION JAN 78 POUNDS)
15.	MATERIALS TOTAL	(MILLION JAN 78 POUNDS)
29.	EQUIPMENT TOTAL	(MILLION JAN 78 POUNDS)
37.	MISCELLANEOUS MATERIALS & EQUIPMENT	(MILLION JAN 78 POUNDS)

FACILITY:

	85	4	15	29	37
1. CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	2581,970	6.141	29,986	11,030	1,194
3. OIL TANKER (90,000 DWT; 620,000 B)	0.0	0.0	0.0	0.0	0.0
4. OIL BARGES (90,000 BBL)	0.0	0.0	0.0	0.0	0.0
5. OIL TANK TRUCK (226 BBL)	0.0	0.0	0.0	0.0	0.0
6. PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	857,370	1.853	4,916	4,835	0,370
7. HOT OIL PIPELINE (40 MB/D, 80.5 KM)	558,966	1.350	5,021	3,460	0,254
8. REFINED PRODUCTS BULK STATION (69 MB/D)	315,698	0.769	1,338	2,985	0,200
9. RAIL LINE (64.4 KM, SINGLE TRACK)	1154,800	3.314	8,391	3,065	0.0
10. MIXED TRAIN (6556 TONNES)	0.0	0.0	0.0	0.0	0.0
11. COAL UNIT TRAIN (9,528 TONNES)	0.0	0.0	0.0	0.0	0.0
12. COAL SLURRY PIPELINE (22.69 MM TONNES/Y, 241.4 KM)	2805,380	6.451	28,490	12,042	1,643
13. COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	5547,500	10.344	19,547	43,660	1,106
14. COAL SLURRY DEWATERING (22.69 MM TONNES/Y)	1761,570	3.943	6,021	23,359	0,300
15. COAL BARGES (19,048 TONNES)	0.0	0.0	0.0	0.0	0.0
16. COAL TRUCK (22.7 TONNES)	0.0	0.0	0.0	0.0	0.0
17. GAS PIPELINE (.87 BSCF/D, 241.4 KM)	2581,970	6.141	31,770	13,208	1,194
18. GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	2049,090	4.542	9,905	4,290	0,642
20. LNG TANKER (2.6 BCF)	0.0	0.0	0.0	0.0	0.0
21. 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	6313,008	13.920	34,711	7,614	0.0
22. 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	8549,590	18.301	40,138	8,786	0.0
23. 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	11809,098	26.197	66,216	21,507	0.0
24. 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	15849,500	34.329	65,521	31,163	0.0
25. +-400 KVDC TRANSMISSION LINE (1500 MWE, 1287 KM)	12494,898	27.716	73,407	130,521	0.0
26. ELECTRICITY DISTRIBUTION-AERIAL LINES(131.6MWE)	1063,660	2.340	2,141	2,129	0.0

RESOURCE REQUIREMENTS

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Table 2 (Continued)

TRANSPORTATION FACILITY INVESTMENT RESOURCES -TOTAL

RESOURCES:

38.	MOBILE FACILITY	(MILLION JAN 78 EPOUNDS)
39.	OTHER CONSTRUCTOR COSTS	(MILLION JAN 78 EPOUNDS)
40.	CONSTRUCTOR COST TOTAL ##	(MILLION JAN 78 EPOUNDS)
50.	ZZZZCAPITAL COST TOTAL	(MILLION JAN 78 EPOUNDS)

FACILITY:

	38	39	40	50
1. CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	0.0	4.830	53.182	61.096
3. OIL TANKER (90,000 DWT; 620,000 B)	34.926	1.048	35.974	41.435
4. OIL BARGES (90,000 BBL)	3.545	0.106	3.651	4.206
5. OIL TANK TRUCK (226 BBL)	0.080	0.002	0.082	0.097
6. PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	0.0	1.226	13.201	15.165
7. HOT OIL PIPELINE (40 MB/D, 80.5 KM)	0.0	0.999	11.084	12.734
8. REFINED PRODUCTS BULK STATION (69 MB/D)	0.0	0.512	5.804	6.668
9. RAIL LINE (64.4 KM, SINGLE TRACK)	0.0	3.573	18.343	20.210
10. MIXED TRAIN (6556 TONNES)	3.579	0.107	3.687	4.247
11. COAL UNIT TRAIN (9,528 TONNES)	6.755	0.203	6.958	8.014
12. COAL SLURRY PIPELINE (22.69 MM TONNES/Y, 241.4 KM)	0.0	4.872	53.499	58.945
13. COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	0.0	8.205	82.863	91.298
14. COAL SLURRY DEWATERING (22.69 MM TONNES/Y)	0.0	2.727	36.349	40.050
15. COAL BARGES (19,048 TONNES)	4.115	0.123	4.238	4.882
16. COAL TRUCK (22.7 TONNES)	0.057	0.002	0.058	0.067
17. GAS PIPELINE (.87 BSCF/D, 241.4 KM)	0.0	5.325	57.638	66.215
18. GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	0.0	1.973	21.352	24.530
20. LNG TANKER (2.6 BCF)	111.246	3.337	114.583	129.227
21. 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	0.0	2.074	58.319	64.598
22. 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	0.0	27.009	94.234	104.381
23. 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	0.0	40.244	154.164	170.763
24. 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	0.0	49.899	180.913	200.393
25. +-400 KVDC TRANSMISSION LINE (1500 MWE, 1287 KM)	0.0	56.236	287.880	318.877
26. ELECTRICITY DISTRIBUTION-AERIAL LINES (131.6 MWE)	0.0	3.057	9.667	10.708

ENERGY FACILITY ANNUAL RESOURCES -TOTAL

RESOURCES:

90.	MANPOWER TOTAL	(MAN-YEARS/YEAR)
4.	MANPOWER TOTAL	(MILLION JAN 78 EPOUNDS)
15.	MATERIALS TOTAL	(MILLION JAN 78 EPOUNDS)
29.	EQUIPMENT TOTAL	(MILLION JAN 78 EPOUNDS)
34.	UTILITY TOTAL	(MILLION JAN 78 EPOUNDS)

	90	4	15	29	34
FACILITY:					
2. ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	44,148	0.253	0.059	0.051	0.044
3. ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	91,036	0.585	0.115	0.420	0.084
6. HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	1413,050	3.090	6.350	3.144	7.273
7. LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	580,031	1.317	4.578	1.662	2.668
8. HEAVY FUEL OIL GASIFICATION (250 MMCF/D)	1483,020	3.001	4.198	2.302	3.561
9. NAPHTHA GASIFICATION (174 MMCF/D)	90,166	0.190	0.106	0.181	0.774
11. OIL EXPORT (1000 MB/D)	369,486	0.817	1.780	3.510	0.483
20. ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	401,612	2.305	0.721	1.050	0.0
24. LNG EXPORT (3030 MMCF/D)	1417,410	2.883	12.150	1.753	0.0
27. UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	2394,680	4.771	3.167	5.859	0.815
37. SURFACE URANIUM MINE (275.4 M TONNES/Y)	512,999	1.064	0.831	0.408	0.061
38. UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	728,713	1.412	0.299	0.135	0.056
39. URANIUM MILL (275.4 M TONNES/Y)	323,497	0.439	0.940	0.120	0.262
40. URANIUM CONVERSION (9072 TONNES/Y)	778,051	3.641	6.636	0.848	1.389
41. URANIUM ENRICHMENT-DIFFUSION (8.75 MILLN SWU/YR)	2695,450	13.077	3.900	30.091	290.002
42. LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	1208,890	6.164	34.865	2.355	0.959
43. LWR FUEL FABRICATION - PU RECYCLE (150 MTU/Y)	654,587	3.492	8.792	2.173	0.268
46. LWR SPENT FUEL REPROCESSING (1500 MTU/Y)	1317,370	8.677	1.496	1.557	0.527
49. HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	900,235	5.473	21.795	0.050	0.018
50. OIL-FIRED POWER PLANT (800 MWE)	301,045	0.669	0.904	0.462	0.628
51. OIL-FIRED POWER PLANT (600 MWE)	232,377	0.516	0.705	0.367	0.471
52. OIL-FIRED POWER PLANT (450 MWE)	179,363	0.399	0.550	0.292	0.353
53. COAL FIRED POWER PLANT-LOW BTU (800 MWE)	305,716	0.678	1.204	0.565	0.942
54. COAL FIRED POWER PLANT-HIGH BTU (800 MWE)	267,409	0.592	1.042	0.457	0.690
55. COAL FIRED POWER PLANT-LOW BTU (600 MWE)	239,406	0.531	0.943	0.449	0.707
56. COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	209,408	0.463	0.815	0.363	0.517
59. HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	232,022	0.524	0.621	0.462	0.624
60. HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	179,098	0.405	0.484	0.367	0.468
61. COMBINED CYCLE POWER PLANT (400 MWE)	108,591	0.231	0.429	0.329	0.211
62. GAS TURBINE POWER PLANT (133 MWE)	12,991	0.034	0.063	0.053	0.0
63. FUEL CELLS (26 MWE)	6,793	0.014	0.000	0.106	0.0
64. LIGHT WATER REACTOR (LWR) (1200 MWE)	287,723	1.532	2.158	0.817	1.839
65. LIGHT WATER REACTOR (LWR) (900 MWE)	222,091	1.183	1.662	0.649	1.379
66. LIGHT WATER REACTOR (LWR) (600 MWE)	154,171	0.821	1.151	0.469	0.919
67. DAM & HYDROELECTRIC POWER PLANT (200 MWE)	35,083	0.071	0.046	0.193	0.0
68. PUMPED STORAGE (500 MWE)	37,066	0.084	0.028	0.272	0.0
69. GEOTHERMAL POWER COMPLEX (200 MWE)	268,499	0.518	0.411	0.247	0.0

RESOURCE REQUIREMENTS

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Table 3 (Continued)

ENERGY FACILITY ANNUAL RESOURCES -TOTAL

RESOURCES:

38. SERVICES & MISCELLANEOUS	(MILLION JAN 78 EPOUNDS)
41. ANNUAL OPERATING COST (EX FUEL)	(MILLION JAN 78 EPOUNDS)

38

41

FACILITY:

2. ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	0.225	0.631
3. ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	0.479	1.683
6. HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	1.496	21.353
7. LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	0.762	10.986
8. HEAVY FUEL OIL GASIFICATION (250 MMCF/D)	0.883	13.945
9. NAPHTHA GASIFICATION (174 MMCF/D)	0.088	1.338
11. OIL EXPORT (1000 MB/D)	2.634	9.224
20. ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	1.293	5.370
24. LNG EXPORT (3030 MMCF/D)	7.982	24.769
27. UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	3.950	18.563
37. SURFACE URANIUM MINE (275.4 M TONNES/Y)	1.351	3.715
38. UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	0.457	2.359
39. URANIUM MILL (275.4 M TONNES/Y)	0.405	2.166
40. URANIUM CONVERSION (9072 TONNES/Y)	1.089	13.603
41. URANIUM ENRICHMENT-DIFFUSION (8.75 MILLN SWU/YR)	24.293	361.362
42. LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	2.080	46.424
43. LWR FUEL FABRICATION - PU RECYCLE (150 MTH/Y)	0.691	15.416
46. LWR SPENT FUEL REPROCESSING (1500 MTU/Y)	0.875	13.132
49. HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	1.296	28.632
50. OIL-FIRED POWER PLANT (800 MWE)	0.677	3.340
51. OIL-FIRED POWER PLANT (600 MWE)	0.540	2.600
52. OIL-FIRED POWER PLANT (450 MWE)	0.421	2.015
53. COAL FIRED POWER PLANT-LOW BTU (800 MWE)	0.858	4.247
54. COAL FIRED POWER PLANT-HIGH BTU (800 MWE)	0.706	3.486
55. COAL FIRED POWER PLANT-LOW BTU (600 MWE)	0.667	3.296
56. COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	0.549	2.708
59. HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	0.601	2.833
60. HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	0.467	2.191
61. COMBINED CYCLE POWER PLANT (400 MWE)	0.0	1.200
62. GAS TURBINE POWER PLANT (133 MWE)	0.0	0.149
63. FUEL CELLS (26 MWE)	0.0	0.120
64. LIGHT WATER REACTOR (LWR) (1200 MWE)	1.673	8.019
65. LIGHT WATER REACTOR (LWR) (900 MWE)	1.290	6.162
66. LIGHT WATER REACTOR (LWR) (600 MWE)	0.895	4.255
67. DAM & HYDROELECTRIC POWER PLANT (200 MWE)	0.153	0.463
68. PUMPED STORAGE (500 MWE)	0.168	0.552
69. GEOTHERMAL POWER COMPLEX (200 MWE)	0.350	1.525

TRANSPORTATION FACILITY ANNUAL RESOURCES -TOTAL

RESOURCES:

90.	MANPOWER TOTAL	(MAN-YEARS/YEAR)
4.	MANPOWER TOTAL	(MILLION JAN 78 EPOUNDS)
15.	MATERIALS TOTAL	(MILLION JAN 78 EPOUNDS)
29.	EQUIPMENT TOTAL	(MILLION JAN 78 EPOUNDS)
34.	UTILITY TOTAL	(MILLION JAN 78 EPOUNDS)

	90	4	15	29	34
FACILITY:					
1. CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	39.005	0.104	0.082	0.016	2.643
3. OIL TANKER (90,000 DWT; 620,000 B)	176,585	0.368	2.701	0.046	0.003
4. OIL BARGES (90,000 BBL)	62,814	0.145	0.426	0.013	0.001
5. OIL TANK TRUCK (226 BBL)	5,017	0.010	0.006	0.0	0.0
6. PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	35,733	0.119	0.053	0.008	0.054
7. HOT OIL PIPELINE (40 MB/D, 80.5 KM)	36,100	0.079	0.033	0.017	0.097
8. REFINED PRODUCTS BULK STATION (69 MB/D)	28,279	0.073	0.009	0.007	0.012
9. RAIL LINE (64.4 KM, SINGLE TRACK)	58,436	0.131	0.076	0.023	0.005
10. MIXED TRAIN (6556 TONNES)	74,100	0.133	0.100	0.001	0.0
11. COAL UNIT TRAIN (9,528 TONNES)	327,066	0.628	1.118	0.010	0.0
12. COAL SLURRY PIPELINE (22.69 MM TONNES/Y, 241.4 KM)	98,439	0.191	0.049	0.208	1.722
13. COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	160,200	0.310	1.043	0.378	4.554
14. COAL SLURRY DEWATERING (22.69 MM TONNES/Y)	60,560	0.117	0.032	0.136	1.139
15. COAL BARGES (19,048 TONNES)	63,384	0.146	0.419	0.015	0.001
16. COAL TRUCK (22.7 TONNES)	5,145	0.009	0.008	0.0	0.0
17. GAS PIPELINE (.87 BSCF/D, 241.4 KM)	51,350	0.143	0.043	0.257	0.003
18. GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	230,980	0.477	0.421	0.089	0.0
20. LNG TANKER (2.6 BCF)	204,111	0.433	3.598	0.054	0.003
21. 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	11,521	0.026	0.025	0.0	0.0
22. 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	14,542	0.033	0.032	0.0	0.0
23. 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	25,572	0.058	0.046	0.011	0.0
24. 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	32,172	0.072	0.055	0.017	0.0
25. 1-400 KVDC TRANSMISSION LINE (1500 MWE, 1287 KM)	56,286	0.125	0.081	0.110	0.0
26. ELECTRICITY DISTRIBUTION-AERIAL LINES(131.6MWE)	66,356	0.136	0.075	0.064	0.0

RESOURCE REQUIREMENTS

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Table 4 (Continued)

TRANSPORTATION FACILITY ANNUAL RESOURCES -TOTAL

RESOURCES:

38. SERVICES & MISCELLANEOUS	(MILLION JAN 78 POUNDS)
41. ANNUAL OPERATING COST (EX FUEL)	(MILLION JAN 78 POUNDS)

38

41

FACILITY:

1. CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	0.0	2.845
3. OIL TANKER (90,000 DWT, 620,000 B)	0.202	3.319
4. OIL BARGES (90,000 BBL)	0.0	0.585
5. OIL TANK TRUCK (226 BBL)	0.008	0.024
6. PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	0.098	0.331
7. HOT OIL PIPELINE (40 MB/D, 80.5 KM)	0.099	0.326
8. REFINED PRODUCTS BULK STATION (69 MB/D)	0.010	0.111
9. RAIL LINE (64.4 KM, SINGLE TRACK)	0.038	0.273
10. MIXED TRAIN (6556 TONNES)	0.072	0.306
11. COAL UNIT TRAIN (9,528 TONNES)	0.751	2.507
12. COAL SLURRY PIPELINE (22.69 MM TONNES/Y, 241.4 KM)	0.133	2.303
13. COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	0.354	6.638
14. COAL SLURRY DEWATERING (22.69 MM TONNES/Y)	0.093	1.517
15. COAL BARGES (19,048 TONNES)	0.049	0.630
16. COAL TRUCK (22.7 TONNES)	0.014	0.032
17. GAS PIPELINE (.87 BSCF/D, 241.4 KM)	0.054	0.499
18. GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	0.261	1.248
20. LNG TANKER (2.6 BCF)	0.266	4.353
21. 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	0.023	0.074
22. 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	0.028	0.092
23. 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	0.048	0.163
24. 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	0.060	0.205
25. +/-400 KVDC TRANSMISSION LINE (1500 MWE, 1287 KM)	0.121	0.437
26. ELECTRICITY DISTRIBUTION-AERIAL LINES (131.6 MWE)	0.095	0.369

ENERGY FACILITY INVESTMENT RESOURCES-IMPORTS

RESOURCES:

85.	CONSTRUCTION MANPOWER TOTAL	(THOUSAND MAN-HOURS)
4.	MANPOWER TOTAL	(MILLION JAN 78 EPOUNDS)
15.	MATERIALS TOTAL	(MILLION JAN 78 EPOUNDS)
29.	EQUIPMENT TOTAL	(MILLION JAN 78 EPOUNDS)
37.	MISCELLANEOUS MATERIALS & EQUIPMENT	(MILLION JAN 78 EPOUNDS)

FACILITY:

	85	4	15	29	37
1. ONSHORE PRIMARY OIL RECOVERY-(1,000 MBPD)	51,933	0.471	0.921	1.059	0.215
2. ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	170,697	1.590	2.485	2.767	1.714
3. ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	296,285	2.739	4.111	7.672	2.545
4. OFFSHORE OIL RECOVERY (12.5 MBPD)	74,532	0.717	2.489	4.165	1.074
6. HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	6500,949	54.592	44,300	140,595	1,378
7. LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	3366,330	28.099	20,920	87,016	6,493
8. HEAVY FUEL OIL GASIFICATION (250 MMCF/D)	5540,328	44.884	36,704	164,403	4,133
9. NAPHTHA GASIFICATION (174 MMCF/D)	1239,120	9.850	9,892	24,709	0,492
11. OIL EXPORT (1000 MB/D)	3402,310	27.515	35,721	83,375	29,530
19. ONSHORE CONVENTIONAL GAS RECOVERY (100 MMCF/D)	89,360	0.811	1,476	1,102	0,340
20. ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	4431,797	37.692	65,544	33,036	1,476
21. OFFSHORE GAS RECOVERY (25 MMCF/D)	320,280	2.510	9,132	9,892	3,856
24. LNG EXPORT (3030 MMCF/D)	12119,797	106.725	140,275	416,170	53,182
27. UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	307,663	2.419	3,066	17,877	0,651
37. SURFACE URANIUM MINE (275.4 M TONNES/Y)	237,532	1.601	0,440	3,620	0,0
38. UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	88,373	0.700	0,512	2,468	0,034
39. URANIUM MILL (275.4 M TONNES/Y)	98,581	0.860	0,498	1,852	0,236
40. URANIUM CONVERSION (9072 TONNES/Y)	1413,890	12.774	6,886	14,409	0,269
41. URANIUM ENRICHMENT-DIFFUSION (8.75 MILLN SWU/YR)	64772,000	529.000	324,144	1260,400	6,708
42. LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	1309,540	12.956	3,435	10,260	12,589
43. LWR FUEL FABRICATION - PU RECYCLE (150 MTH/Y)	1163,410	11.146	3,916	13,790	3,838
46. LWR SPENT FUEL REPROCESSING (1500 MTU/Y)	15314,699	141.093	83,196	113,535	6,889
49. HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	1282,950	10.016	8,837	5,226	5,472
50. OIL-FIRED POWER PLANT (800 MWE)	1860,440	12.342	9,327	59,186	1,112
51. OIL-FIRED POWER PLANT (600 MWE)	1456,910	9.665	7,569	49,088	0,922
52. OIL-FIRED POWER PLANT (450 MWE)	1140,820	7.568	7,543	40,720	0,765
53. COAL FIRED POWER PLANT-LOW BTU (800 MWE)	2416,430	16.395	17,538	93,240	1,890
54. COAL FIRED POWER PLANT-HIGH HTU (800 MWE)	2034,680	14.897	15,228	77,575	1,771
55. COAL FIRED POWER PLANT-LOW BTU (600 MWE)	1919,610	13.980	14,509	78,461	1,590
56. COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	1616,350	11.834	12,598	65,279	1,491
59. HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	1177,650	8.730	2,957	41,980	0,650
60. HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	922,220	6.836	2,401	34,818	0,539
61. COMBINED CYCLE POWER PLANT (400 MWE)	576,687	5.360	2,391	31,751	0,364
62. GAS TURBINE POWER PLANT (133 MWE)	93,544	0.764	0,292	12,721	0,076
63. FUEL CELLS (26 MWE)	15,936	0.128	0,004	5,967	0,0
64. LIGHT WATER REACTOR (LWR) (1200 MWE)	11675,098	94.802	61,581	138,676	1,481
65. LIGHT WATER REACTOR (LWR) (900 MWE)	9275,020	75.313	48,733	111,770	1,194
66. LIGHT WATER REACTOR (LWR) (600 MWE)	6706,047	54.453	35,065	82,460	0,881
67. DAM & HYDROELECTRIC POWER PLANT (200 MWE)	1109,290	8.715	3,348	31,214	0,787
68. PUMPED STORAGE (500 MWE)	1602,090	12.636	15,699	22,575	0,917
69. GEOTHERMAL POWER COMPLEX (200 MWE)	450,294	3.350	13,099	52,431	0,030

ENERGY FACILITY INVESTMENT RESOURCES -IMPORTS

RESOURCES:

39.	OTHER CONSTRUCTOR COSTS	(MILLION JAN 78 EPOUNDS)
40.	CONSTRUCTOR COST TOTAL ##	(MILLION JAN 78 EPOUNDS)

39

40

FACILITY:

1.	ONSHORE PRIMARY OIL RECOVERY-(1,000 MBPD)	0.081	2.748
2.	ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	0.252	8.807
3.	ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	0.353	17.419
4.	OFFSHORE OIL RECOVERY (12.5 MBPD)	0.593	9.037
6.	HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	24.929	265.795
7.	LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	14.609	157.138
8.	HEAVY FUEL OIL GASIFICATION (250 MMCF/D)	26.438	276.562
9.	NAPHTHA GASIFICATION (174 MMCF/D)	4.382	49.324
11.	OIL EXPORT (1000 MB/D)	19.094	195.235
19.	ONSHORE CONVENTIONAL GAS RECOVERY (100 MMCF/D)	0.123	3.851
20.	ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	2.672	140.421
21.	OFFSHORE GAS RECOVERY (25 MMCF/D)	1.587	26.976
24.	LNG EXPORT (3030 MMCF/D)	82.667	799.019
27.	UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	4.121	28.135
37.	SURFACE URANIUM MINE (275.4 M TONNES/Y)	1.712	7.373
38.	UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	0.871	4.585
39.	URANIUM MILL (275.4 M TONNES/Y)	0.984	4.431
40.	URANIUM CONVERSION (9072 TONNES/Y)	10.129	44.466
41.	URANIUM ENRICHMENT-DIFFUSION (8.75 MILLN SWU/YR)	522.854	2643.110
42.	LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	4.061	43.301
43.	LWR FUEL FABRICATION - PU RECYCLE (150 MTH/Y)	3.828	36.518
46.	LWR SPENT FUEL REPROCESSING (1500 MTU/Y)	36.436	381.149
49.	HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	3.585	33.136
50.	OIL-FIRED POWER PLANT (800 MWE)	24.180	106.147
51.	OIL-FIRED POWER PLANT (600 MWE)	19.837	87.082
52.	OIL-FIRED POWER PLANT (450 MWE)	16.696	73.291
53.	COAL FIRED POWER PLANT-LOW BTU (800 MWE)	37.067	166.130
54.	COAL FIRED POWER PLANT-HIGH BTU (800 MWE)	32.184	141.655
55.	COAL FIRED POWER PLANT-LOW BTU (600 MWE)	31.173	139.713
56.	COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	26.813	118.016
59.	HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	16.816	71.133
60.	HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	13.806	58.400
61.	COMBINED CYCLE POWER PLANT (400 MWE)	10.445	50.312
62.	GAS TURBINE POWER PLANT (133 MWE)	2.058	15.911
63.	FUEL CELLS (26 MWE)	2.027	8.126
64.	LIGHT WATER REACTOR (LWH) (1200 MWE)	96.494	393.035
65.	LIGHT WATER REACTOR (LWR) (900 MWE)	77.123	314.133
66.	LIGHT WATER REACTOR (LWH) (600 MWE)	56.248	229.107
67.	DAM & HYDROELECTRIC POWER PLANT (200 MWE)	6.319	50.384
68.	PUMPED STORAGE (500 MWE)	7.468	59.295
69.	GEO THERMAL POWER COMPLEX (200 MWE)	26.241	95.151

RESOURCE REQUIREMENTS

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Table 6

TRANSPORTATION FACILITY INVESTMENT RESOURCES-IMPORTS

RESOURCES:

85.	CONSTRUCTION MANPOWER TOTAL	(THOUSAND MAN-HOURS)
4.	MANPOWER TOTAL	(MILLION JAN 78 EPOUNDS)
15.	MATERIALS TOTAL	(MILLION JAN 78 EPOUNDS)
29.	EQUIPMENT TOTAL	(MILLION JAN 78 EPOUNDS)
37.	MISCELLANEOUS MATERIALS & EQUIPMENT	(MILLION JAN 78 EPOUNDS)

FACILITY:

	85	4	15	29	37
1. CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	421,702	3,896	26,771	9,308	1,002
3. OIL TANKER (90,000 DWT; 620,000 B)	0.0	0.0	0.0	0.0	0.0
4. OIL BARGES (90,000 BBL)	0.0	0.0	0.0	0.0	0.0
5. OIL TANK TRUCK (226 BBL)	0.0	0.0	0.0	0.0	0.0
6. PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	135,967	1,110	4,110	4,129	0,311
7. HOT OIL PIPELINE (40 MB/D, 80.5 KM)	92,717	0,868	4,389	2,980	0,213
8. REFINED PRODUCTS BULK STATION (69 MB/D)	52,259	0,496	0,912	2,465	0,135
9. RAIL LINE (64.4 KM, SINGLE TRACK)	223,838	2,228	0,731	1,828	0.0
10. MIXED TRAIN (6556 TONNES)	0.0	0.0	0.0	0.0	0.0
11. COAL UNIT TRAIN (9,528 TONNES)	0.0	0.0	0.0	0.0	0.0
12. COAL SLURRY PIPELINE (22.69 MM TONNES/Y, 241.4 KM)	451,077	3,678	25,612	9,926	1,506
13. COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	825,752	5,214	14,917	37,161	1,014
14. COAL SLURRY DEWATERING (22.69 MM TONNES/Y)	283,667	2,233	4,509	19,262	0,275
15. COAL BARGES (19,048 TONNES)	0.0	0.0	0.0	0.0	0.0
16. COAL TRUCK (22,7 TONNES)	0.0	0.0	0.0	0.0	0.0
17. GAS PIPELINE (.87 BSCF/D, 241.4 KM)	421,702	3,563	28,359	11,262	1,002
18. GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	328,018	2,556	3,685	3,599	0,487
20. LNG TANKER (2.6 BCF)	0.0	0.0	0.0	0.0	0.0
21. 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	1044,900	8,003	31,574	1,611	0.0
22. 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	1387,120	10,306	36,449	1,859	0.0
23. 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	1947,350	15,052	60,093	12,181	0.0
24. 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	2584,900	19,461	59,238	18,927	0.0
25. +-400 KVDC TRANSMISSION LINE (1500 MWE, 1287 KM)	2070,730	15,973	66,740	107,650	0.0
26. ELECTRICITY DISTRIBUTION-AERIAL LINES (131.6 MWE)	174,679	1,338	1,003	1,952	0.0

RESOURCE REQUIREMENTS

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Table 6 (Continued)

TRANSPORTATION FACILITY INVESTMENT RESOURCES -IMPORTS

RESOURCES:

38.	MOBILE FACILITY	(MILLION JAN 78 EPOUNDS)
39.	OTHER CONSTRUCTOR COSTS	(MILLION JAN 78 EPOUNDS)
40.	CONSTRUCTOR COST TOTAL ##	(MILLION JAN 78 EPOUNDS)

	38	39	40
FACILITY:			
1. CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	0.0	4.094	45.071
3. OIL TANKER (90,000 DWT; 620,000 B)	31.889	0.957	32.846
4. OIL BARGES (90,000 BBL)	3.237	0.097	3.334
5. OIL TANK TRUCK (226 BBL)	0.073	0.002	0.075
6. PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	0.0	0.989	10.650
7. HOT OIL PIPELINE (40 MB/D, 80.5 KM)	0.0	0.837	9.287
8. REFINED PRODUCTS BULK STATION (69 MB/D)	0.0	0.388	4.395
9. RAIL LINE (64.4 KM, SINGLE TRACK)	0.0	1.158	5.946
10. MIXED TRAIN (6556 TONNES)	1.219	0.037	1.255
11. COAL UNIT TRAIN (9,528 TONNES)	6.192	0.186	6.378
12. COAL SLURRY PIPELINE (22.69 MM TONNES/Y, 241.4 KM)	0.0	4.080	44.801
13. COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	0.0	6.408	64.714
14. COAL SLURRY DEWATERING (22.69 MM TONNES/Y)	0.0	2.131	28.410
15. COAL BARGES (19,048 TONNES)	3.757	0.113	3.870
16. COAL TRUCK (22.7 TONNES)	0.052	0.002	0.053
17. GAS PIPELINE (.87 BSCF/D, 241.4 KM)	0.0	4.498	48.684
18. GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	0.0	1.051	11.379
20. LNG TANKER (2.6 BCF)	101.572	3.047	104.619
21. 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	0.0	1.519	42.707
22. 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	0.0	19.531	68.144
23. 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	0.0	30.850	118.176
24. 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	0.0	37.183	134.809
25. +-400 KVDC TRANSMISSION LINE (1500 MWE, 1287 KM)	0.0	46.214	236.577
26. ELECTRICITY DISTRIBUTION-AERIAL LINES (131.6 MWE)	0.0	1.986	6.279

RESOURCE REQUIREMENTS

08/14/78

Table 7

ENERGY FACILITY ANNUAL RESOURCES-IMPORTS

RESOURCES:

90.	MANPOWER TOTAL	(MAN-YEARS/YEAR)
4.	MANPOWER TOTAL	(MILLION JAN 78 EPOUNDS)
15.	MATERIALS TOTAL	(MILLION JAN 78 EPOUNDS)
29.	EQUIPMENT TOTAL	(MILLION JAN 78 EPOUNDS)
34.	UTILITY TOTAL	(MILLION JAN 78 EPOUNDS)

	90	4	15	29	34
FACILITY:					
2. ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	7.419	0.072	0.039	0.021	0.0
3. ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	15.155	0.183	0.086	0.267	0.0
6. HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	0.0	0.0	2.736	0.839	0.0
7. LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	0.0	0.0	2.096	0.566	0.0
8. HEAVY FUEL OIL GASIFICATION (250 MMCF/D)	0.0	0.0	2.321	0.537	0.0
9. NAPHTHA GASIFICATION (174 MMCF/D)	0.0	0.0	0.038	0.123	0.0
11. OIL EXPORT (1000 MB/D)	0.0	0.0	0.182	1.168	0.0
20. ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	67.474	0.660	0.640	0.488	0.0
24. LNG EXPORT (3030 MMCF/D)	0.0	0.0	7.231	2.399	0.0
27. UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	0.0	0.0	0.359	4.107	0.0
37. SURFACE URANIUM MINE (275.4 M TONNES/Y)	0.0	0.0	0.290	0.032	0.0
38. UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	0.0	0.0	0.026	0.007	0.0
39. URANIUM MILL (275.4 M TONNES/Y)	0.0	0.0	0.377	0.067	0.0
40. URANIUM CONVERSION (9072 TONNES/Y)	124.480	0.956	5.802	0.538	0.0
41. URANIUM ENRICHMENT-DIFFUSION (8.75 MILLN SWU/YR)	437.531	3.551	3.438	24.195	0.0
42. LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	175.963	1.688	31.966	1.444	0.0
43. LWR FUEL FABRICATION - PU RECYCLE (150 MTH/Y)	83.234	0.985	8.061	1.380	0.0
46. LWR SPENT FUEL REPROCESSING (1500 MTU/Y)	196.875	2.863	1.483	0.824	0.0
49. HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	137.867	1.700	18.722	0.030	0.0
64. LIGHT WATER REACTOR (LWR) (1200 MWE)	43.822	0.419	1.868	0.949	0.0
65. LIGHT WATER REACTOR (LWR) (900 MWE)	33.826	0.324	1.440	0.754	0.0
65. LIGHT WATER REACTOR (LWR) (600 MWE)	23.481	0.225	0.998	0.545	0.0

RESOURCE REQUIREMENTS

08/14/78

Table 7 (Continued)

ENERGY FACILITY ANNUAL RESOURCES -IMPORTS

RESOURCES:

38.	SERVICES & MISCELLANEOUS	(MILLION JAN 78 POUNDS)
41.	ANNUAL OPERATING COST (EX FUEL)	(MILLION JAN 78 POUNDS)

FACILITY:

	38	41
2. ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	0.042	0.174
3. ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	0.050	0.586
6. HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	0.230	3.805
7. LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	0.115	2.777
8. HEAVY FUEL OIL GASIFICATION (250 MMCF/D)	0.110	2.968
9. NAPHTHA GASIFICATION (174 MMCF/D)	0.018	0.179
11. OIL EXPORT (1000 MB/D)	0.245	1.595
20. ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	0.070	1.856
24. LNG EXPORT (3030 MMCF/D)	0.495	10.125
27. UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	0.747	5.213
37. SURFACE URANIUM MINE (275.4 M TONNES/Y)	0.377	0.698
38. UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	0.047	0.080
39. URANIUM MILL (275.4 M TONNES/Y)	0.131	0.575
40. URANIUM CONVERSION (9072 TONNES/Y)	0.205	7.500
41. URANIUM ENRICHMENT-DIFFUSION (8.75 MILLN SWU/YR)	3.457	34.641
42. LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	0.0	35.097
43. LWR FUEL FABRICATION - PU RECYCLE (150 MTH/Y)	0.0	10.427
46. LWR SPENT FUEL REPROCESSING (1500 MTU/Y)	0.122	5.293
49. HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	0.006	20.458
64. LIGHT WATER REACTOR (LWR) (1200 MWE)	0.147	3.384
65. LIGHT WATER REACTOR (LWR) (900 MWE)	0.115	2.632
66. LIGHT WATER REACTOR (LWR) (600 MWE)	0.081	1.849

RESOURCE REQUIREMENTS

08/14/78

Table 8

TRANSPORTATION FACILITY ANNUAL RESOURCES -IMPORTS

RESOURCES:

90.	MANPOWER TOTAL	(MAN-YEARS/YEAR)
4.	MANPOWER TOTAL	(MILLION JAN 78 POUNDS)
15.	MATERIALS TOTAL	(MILLION JAN 78 POUNDS)
29.	EQUIPMENT TOTAL	(MILLION JAN 78 POUNDS)
34.	UTILITY TOTAL	(MILLION JAN 78 POUNDS)

	90	4	15	29	34
FACILITY:					
1. CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	0.0	0.0	0.033	0.013	0.0
3. OIL TANKER (90,000 DWT; 620,000 B)	0.0	0.0	0.006	0.019	0.0
4. OIL BARGES (90,000 BBL)	0.0	0.0	0.002	0.006	0.0
5. OIL TANK TRUCK (226 BBL)	0.0	0.0	0.002	0.0	0.0
6. PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	0.0	0.0	0.020	0.003	0.0
7. HOT OIL PIPELINE (40 MB/D, 80.5 KM)	0.0	0.0	0.011	0.007	0.0
8. REFINED PRODUCTS BULK STATION (69 MB/D)	0.0	0.0	0.003	0.004	0.0
9. RAIL LINE (64.4 KM, SINGLE TRACK)	0.0	0.0	0.0	0.017	0.0
10. MIXED TRAIN (6556 TONNES)	0.0	0.0	0.000	0.000	0.0
11. COAL UNIT TRAIN (9,528 TONNES)	0.0	0.0	0.0	0.004	0.0
12. COAL SLURRY PIPELINE (22.69 MM TONNES/Y, 241.4 KM)	0.0	0.0	0.020	0.087	0.0
13. COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	0.0	0.0	0.830	0.354	0.0
14. COAL SLURRY DEWATERING (22.69 MM TONNES/Y)	0.0	0.0	0.011	0.057	0.0
15. COAL BARGES (19,048 TONNES)	0.0	0.0	0.019	0.006	0.0
16. COAL TRUCK (22.7 TONNES)	0.0	0.0	0.002	0.0	0.0
17. GAS PIPELINE (.87 BSCF/D, 241.4 KM)	0.0	0.0	0.017	0.202	0.0
18. GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	0.0	0.0	0.117	0.080	0.0
20. LNG TANKER (2.6 BCF)	0.0	0.0	0.049	0.022	0.0
21. 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	0.0	0.0	0.009	0.0	0.0
22. 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	0.0	0.0	0.011	0.0	0.0
23. 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	0.0	0.0	0.017	0.004	0.0
24. 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	0.0	0.0	0.020	0.007	0.0
25. +/-400 KVDC TRANSMISSION LINE (1500 MWE, 1287 KM)	0.0	0.0	0.035	0.083	0.0
26. ELECTRICITY DISTRIBUTION-AERIAL LINES (131.6 MWE)	0.0	0.0	0.002	0.026	0.0

RESOURCE REQUIREMENTS

08/14/78

Table 8 (Continued)

TRANSPORTATION FACILITY ANNUAL RESOURCES-IMPORTS

RESOURCES:

38. SERVICES & MISCELLANEOUS (MILLION JAN 78 EPOUNDS)
41. ANNUAL OPERATING COST (EX FUEL) (MILLION JAN 78 EPOUNDS)

87070

	38	41
FACILITY:		
1. CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	0.0	0.046
3. OIL TANKER (90,000 DWT; 620,000 B)	0.022	0.047
4. OIL BARGES (90,000 BBL)	0.0	0.007
5. OIL TANK TRUCK (226 BBL)	0.001	0.003
6. PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	0.002	0.025
7. HOT OIL PIPELINE (40 MB/D, 80.5 KM)	0.004	0.022
8. REFINED PRODUCTS BULK STATION (69 MB/D)	0.002	0.009
9. RAIL LINE (64.4 KM, SINGLE TRACK)	0.011	0.028
10. MIXED TRAIN (6556 TONNES)	0.024	0.024
11. COAL UNIT TRAIN (9,528 TONNES)	0.260	0.264
12. COAL SLURRY PIPELINE(22.69 MM TONNES/Y,241.4 KM)	0.012	0.119
13. COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	0.023	1.207
14. COAL SLURRY DEWATERING (22.69 MM TONNES/Y)	0.010	0.078
15. COAL BARGES (19,048 TONNES)	0.009	0.034
16. COAL TRUCK (22.7 TONNES)	0.003	0.005
17. GAS PIPELINE (.87 BSCF/D, 241.4 KM)	0.014	0.233
18. GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	0.005	0.203
20. LNG TANKER (2.6 BCF)	0.029	0.100
21. 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	0.001	0.010
22. 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	0.001	0.013
23. 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	0.002	0.023
24. 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	0.002	0.029
25. +-400 KVDC TRANSMISSION LINE (1500 MWE,1287 KM)	0.003	0.121
26. ELECTRICITY DISTRIBUTION-AERIAL LINES(131.6MWE)	0.009	0.037

5.0 APPLICATION OF THE MODEL TO THE COMPARISON CASE

Previous sections describe the methodology and the data base for adapting the Energy Supply Planning Model to Egypt. This section describes the application of the model to analyze the capital, labor, materials and equipment resource requirements for a Comparison Case Egyptian energy development program.

5.1 Description of the Comparison Case

The Comparison Case was developed by the U.S.-Egypt energy assessment team and provided to Bechtel by U.S. DOE representatives. Table 9 presents the specifications for primary (point of resource extraction) energy supplies for the 1975-2000 period. Domestic consumption of primary energy supplies grows at 5.6 percent per year from 680×10^{15} joules in 1975 to 2646×10^{15} joules in 2000. This corresponds roughly to a quadrupling of energy supplied to domestic consumption over the time period.

Significant features of this Comparison Case as specified by DOE include:

- o Egypt becomes a significant net exporter of energy by the early 1980's, with a peak net export of 1350×10^{15} joules (about 650,000 BPD crude oil equivalent) in 1985
- o Production of crude oil increases to 1 MMBPD in 1985 and continues at that level through 2000
- o Nuclear energy provides a substantial contribution to the Egyptian energy balance in the year 2000, increasing from 0 in 1985 to 866×10^{15} joules or one-fourth of total domestic production.

Table 10 shows the corresponding Comparison Case values for secondary energy, which reflect system losses primarily in electric generation and oil refining facilities. The growth rate in secondary energy consumption is 4.8 percent corresponding to a tripling of energy use over the time period. Contributions to final energy use are indicated as follows:

- o Direct use of commercial fuels (oil, gas, coal) increases from 55 percent of final energy use in 1975 to 65 percent in 2000.
- o Electricity increases from 5 percent in 1975 to 17 percent in 2000.
- o The contribution of non-commercial fuels (crop residues, wood, animal wastes, human and animal power, and non-electric solar) to domestic energy use decreases from 40 percent to 18 percent over the time period.

The installed electric generating capacity corresponding to the energy supply and consumption figures as specified by DOE are indicated in Table 11. Installed capacity grows from 4000 MWe in 1975 to just over 20,000 MWe in 2000, for a compound annual growth rate of 6.8 percent per year. As can be seen, this case envisions that nuclear energy will be the primary base-load power source, increasing to 12,600 MWe in the year 2000.

5.2 Facility Requirements

Energy supply facility requirements have been derived by the Energy Supply Planning Model directly from the above Comparison Case specifications. The annual schedule of required new facilities is presented in Table 12. These schedules account for assumptions about facility lifetimes and retirements of existing capacity as well as energy demand growth. It should be noted that in the case of electric power generation facilities, annual build schedules were specified directly by DOE representatives. In all cases, schedules are determined to the year 2010 so that resource requirements can be calculated through 2000 after accounting for construction lead times.

Energy transportation facility requirements necessary to support the Comparison Case supply levels have also been derived by the ESPM and are given in Table 13**. Calculation of transportation requirements is subject to considerably more uncertainty than is the case for energy supply facilities in that assumptions must be made regarding allocation of energy flows to competing transport modes and the average distances over which the energy forms will be moved.

5.3 Resource Requirements

Resource requirements for the Comparison Case can be calculated based on the facility schedules derived above and the model's extensive facilities data base. Direct requirements of capital, labor, materials and equipment necessary to engineer and construct the facilities were calculated, as were the annual costs and labor requirements associated with their operation and maintenance.

* An additional 1,446 MWe of solar-electric capacity (902 MWe direct solar, 364 MWe wind, 180 MWe biomass) were specified by DOE but are not included here because no data exists in the ESPM for solar-electric technologies. These technologies have been treated independently by the Solar Technology Specialists from DOE and Arthur D. Little.

** As stated previously, unit size for the crude oil and gas pipeline facilities characterized in the ESPM are too large for Egyptian use. Those technologies are treated independently by the Fossil Technology Specialist from MITRE.

5.3.1 Capital: The capital results are detailed by facility grouping in Tables 14 and 15. All capital results are presented in constant January 1978 Egyptian pounds and exclude such owner's cost factors as land, escalation, and interest during construction. Thus the costs represent direct construction costs plus a factor to account for working capital and some other minor factors.

Cumulative capital requirements for Egyptian energy facilities amount to LE 3.5 billion for the 1978-1985 period and LE 16.2 billion over the 1978-2000 period, summarized by sector as follows:

- o Oil, gas, and coal supply = LE4.0 billion
- o Hydro and pumped storage electric = LE 1.0 billion
- o Oil and gas electric = LE 0.5 billion
- o Nuclear-electric = LE 9.0 billion
- o Electric transmission and distribution = LE 1.7 billion

It can be seen that the capital requirements are broken down roughly 25 percent for fuels supply sectors and 75 percent for electric utilities.

Table 16 shows the time stream of direct construction requirements for the total energy industry and each industry sector.

Annual construction requirements increase from about LE 200 million in 1976 to LE 480 billion in 1985 and about LE 1 billion in the year 2000. The acceleration in growth of capital requirements is stronger through 1985 than later.

Total capital requirements are broken down by labor, materials, equipment and other categories in Table 17.

5.3.2 Construction labor: Table 18 presents the annual time stream of the manpower requirements for the design, construction, and startup of energy supply facilities. Total construction manpower requirements increase at the rate of 8.2 percent per year from 5,800 man-years in 1976 to 38,000 man-years in 2000. A growth rate of 12.3 percent per year from 1976-1985 slows to 5.8 percent per year in 1985-2000. The breakdown of these figures by energy industry sector is indicated in Table 19.

*The cost of solar-electric facilities are not included here but have been independently estimated to be about LE 1.6 billion from figures provided by the Solar Technology Specialist.

5.3.3 Construction materials and equipment: Table 20 presents requirements for major materials and equipment items utilized in the construction of energy facilities. Selected results indicate that:

- o Energy industry requirements for concrete increase from 93,000 metric tons in 1976 to 1,100,000 metric tons in the year 2000
- o Total steel requirements increase from 40,000 metric tons in 1976 to 140,000 metric tons in 2000
- o Requirements of rebar increase from 900 metric tons in 1976 to 22,000 metric tons in 2000

5.3.4 Operation and maintenance cost: Table 21 presents the growth in annual costs for the operation and maintenance of energy-related facilities for the Comparison Case. As indicated, the annual costs* increase from about LE 50 million in 1976 to LE 270 million in 2000.

5.3.5 Operation and maintenance labor: Table 22 presents annual growth in manpower required to operate and maintain the facilities. The figures indicate a** growth from 5,800 to 27,000 man-years over the 1976-2000 period.

* The requirements for solar-electric facilities are estimated independently by the Solar Technology Specialist to add another 12,000 man-years to the year 2000 requirement.

** Annual costs for operating solar-electric facilities are independently estimated by the Solar Technology Specialist to add LE 50 million to the year 2000 result. The operating requirement is estimated at 4800 man-years in the year 2000.

5.4 Import Component of Resource Requirements

Results on the direct foreign purchases of labor, materials and equipment necessary to build and operate Egyptian energy facilities have also been calculated. These results can be traced directly to assumptions described in Section 4 regarding the fraction of materials and equipment assumed to be imported for construction and operation of various kinds of facilities, as well as the assumptions on the use of expatriate labor. Alternative assumptions regarding these factors would, of course, significantly modify the results described here.

Tables 23 through 27 present the import component of total resource requirements for the Comparison Case for 1978-85 cumulative capital, 1978-2000 cumulative capital, annual growth in capital requirements, annual growth in construction manpower requirements, and annual growth in operating cost. Comparison with results previously described indicate that, under the assumptions used, the import component represents about 80 percent of total capital requirements, about 20 percent of operating costs, and about 25 percent of construction labor requirements (45 percent for nonmanual and 20 percent for manual).

Tables 25 and 27 indicate that the annual import component of construction costs averages LE 500 million, whereas the figure is LE 35 million for operating costs. These tables can also be used to determine the potential effects of reducing reliance on overseas supplies of resources. For example, Table 25 indicates that for construction imports an annual average of LE 63 million is attributable to use of foreign nonmanual manpower, LE 40 million for foreign manual manpower, LE 96 million for imported materials and LE 182 million for imported equipment. In the case of annual average operating cost import components, Table 27 indicates that only LE 1 million is attributable to use of expatriates, whereas LE 28 million can be traced to materials and equipment imports.

ENERGY SUPPLY SYSTEM INPUTS
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VALUES IN 10E15 JOULES	1975	1982	1985	2000	AVERAGE ANNUAL GROWTH
DOMESTIC PETROLEUM PRODUCTION	448.99	1865.50	2100.82	2100.82	6.37%
DOMESTIC NATURAL GAS PRODUCTION	14.39	125.42	125.42	125.42	9.05%
DOMESTIC COAL PRODUCTION	0.0	0.0	8.00	8.00	-----
NUCLEAR POWER INPUTS	0.0	0.0	0.0	865.90	-----
HYDRO-ELECTRIC POWER INPUTS	78.03	89.97	105.32	99.66	0.98%
GEOTHERMAL GENERATION INPUT	0.0	0.0	0.0	1.29	-----
INPUTS TO SOLAR-ELECTRIC PLANTS	0.0	0.0	0.0	36.70	-----
INPUTS TO BIOGAS PLANTS	0.0	0.0	0.0	18.00	-----
SOLAR ENERGY (NON-ELECTRIC)	0.0	0.0	0.21	10.00	-----
ENERGY FROM CROP RESIDUES	172.00	190.00	200.00	250.00	1.51%
ENERGY FROM WOOD (FOR HEAT)	1.50	1.50	1.50	1.50	0.0 %
ENERGY FROM ANIMAL WASTES	43.00	45.00	46.00	50.00	0.61%
ENERGY FROM HUMAN AND ANIMAL POWER	6.60	7.90	8.30	11.00	2.06%
DOMESTIC ENERGY PRODUCTION	764.50	2325.28	2595.57	3578.28	6.37%
IMPORTED COAL	30.00	44.00	47.00	216.00	8.22%
PETROLEUM IMPORTS	129.45	80.00	123.94	110.63	-0.63%
ENERGY IMPORTS	159.45	124.00	170.94	326.63	2.91%
TOTAL ENERGY EXTRACTION AND IMPORTATION	923.95	2449.28	2766.51	3904.91	5.93%
TOTAL PETROLEUM EXPORTS	243.98	1395.00	1522.52	1258.81	6.78%
ENERGY EXPORTS	243.98	1395.00	1522.52	1258.81	6.78%
PRODUCTION AND IMPORTS FOR DOMESTIC CONSUMPTION	679.97	1054.28	1243.99	2646.10	5.59%

ENERGY SUPPLY SYSTEM OUTPUTS
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Table 10

VALUES IN 10E15 JOULES

	1975	1982	1985	2000	AVERAGE ANNUAL GROWTH
OIL FOR DIRECT USE	264.13	355.17	425.56	823.98	4.66%
HIGH-BTU GAS FOR DIRECT USE	13.67	119.15	119.15	119.15	9.05%
COAL FOR DIRECT USE	30.00	44.00	55.00	224.00	8.37%
ELECTRICITY FOR CONSUMPTION	29.86	66.76	98.02	316.75	9.91%
SOLAR ENERGY (NON-ELECTRIC)	0.0	0.0	0.21	10.00	-----
ENERGY FROM CROP RESIDUES	172.00	190.00	200.00	250.00	1.51%
ENERGY FROM WOOD (FOR HEAT)	1.50	1.50	1.50	1.50	0.0 %
ENERGY FROM ANIMAL WASTES	43.00	45.00	46.00	50.00	0.61%
ENERGY FROM HUMAN AND ANIMAL POWER	6.60	7.90	8.30	11.00	2.06%
DOMESTIC ENERGY CONSUMPTION	560.76	829.48	953.74	1806.38	4.79%
TOTAL PETROLEUM EXPORTS	243.98	1395.00	1522.52	1258.81	6.78%
ENERGY EXPORTS	243.98	1395.00	1522.52	1258.81	6.78%
DOMESTIC CONSUMPTION AND EXPORTS	804.74	2224.48	2476.26	3065.19	5.50%

RECHIFI. ENERGY SUPPLY PLANNING MODEL

Table 11

ELECTRIC GENERATING CAPACITY (MWE)

Egypt - Comparison Case

	1975	1982	1985	2000	AVERAGE ANNUAL GROWTH
COAL AND COAL/WASTE PLANTS	0.0	0.0	0.0	0.0	-----
OIL-STEAM PLANTS	1420.0	2904.0	4068.0	2817.0	2.78%
GAS-STEAM PLANTS	0.0	0.0	0.0	0.0	-----
LOW-BTU GAS-STEAM PLANTS	0.0	0.0	0.0	0.0	-----
GAS TURBINE PLANTS	137.0	437.0	437.0	0.0	-----
COMBINED CYCLE PLANTS	0.0	0.0	0.0	0.0	-----
FUEL CELLS	0.0	0.0	0.0	0.0	-----
NUCLEAR POWER PLANTS	0.0	0.0	0.0	12600.0	-----
CONVENTIONAL HYDRO PLANTS	2445.0	2445.0	2445.0	2603.0	0.25%
PUMPED STORAGE PLANTS	0.0	0.0	0.0	2550.0	-----
GEOTHERMAL PLANTS	0.0	0.0	0.0	20.0	-----
TOTAL CAPACITY	4002.0	5786.0	6950.0	20590.0	6.77%

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 12

Schedule of Annual Energy Facilities Additions 10 Supply Fuel Mix: Comparison Case 1976-2010

FACILITY NAME	1975 TOTALS	1976	1977	1978	1979	1980	1981	1982	TOTAL ADDED (1976- 1982)
1 ONSHORE PRIMARY OIL RECOVERY-(1,000 MBPD)	66.0	17*	17*	17*	18*	17	18	17	87
2 ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	0.0	0	0	0	0	0	0	0	0
3 ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	0.0	0	0	0	0	0	0	0	0
4 OFFSHORE OIL RECOVERY (12.5 MBPD)	11.8	3*	3*	3*	3*	4*	3	3	16
6 HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	0.0	0	0	0	0	0	0	0	0
7 LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	2.0	0	0	0	0	0	0	1	1
19 ONSHORE CONVENTIONAL GAS RECOVERY (100 MMCF/D)	0.4	1*	0	0	1*	0	0	0	1
20 ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	0.0	0	0	0	0	0	0	0	0
21 OFFSHORE GAS RECOVERY (25 MMCF/D)	-0.0	0	0	0	0	0	0	0	0
24 LNG EXPORT (3030 MMCF/D)	0.0	0	0	0	0	0	0	0	0
27 UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	0.0	0	0	0	0	0	0	0	0
37 SURFACE URANIUM MINE (275.4 M TONNES/Y)	0.0	0	0	0	0	0	0	0	0
38 UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	0.0	0	0	0	0	0	0	0	0
39 URANIUM MILL (275.4 M TONNES/Y)	0.0	0	0	0	0	0	0	0	0
42 LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	0.0	0	0	0	0	0	0	0	0
43 LWR FUEL FABRICATION - PU RECYCLE (150 MTH/Y)	0.0	0	0	0	0	0	0	0	0
49 HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	0.0	0	0	0	0	0	0	0	0
50 OIL-FIRED POWER PLANT (800 MWE)	0.0	0	0	0	0	0	0	0	0
51 OIL-FIRED POWER PLANT (600 MWE)	0.0	0	0	0	0	1*	1*	0	2
52 OIL-FIRED POWER PLANT (450 MWE)	3.2	0	0	0	1*	0	0	0	1
53 COAL FIRED POWER PLANT-LOW BTU (800 MWE)	0.0	0	0	0	0	0	0	0	0
54 COAL FIRED POWER PLANT-HIGH BTU (800 MWE)	0.0	0	0	0	0	0	0	0	0
55 COAL FIRED POWER PLANT-LOW BTU (600 MWE)	0.0	0	0	0	0	0	0	0	0
56 COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	0.0	0	0	0	0	0	0	0	0
59 HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	0.0	0	0	0	0	0	0	0	0
60 HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	0.0	0	0	0	0	0	0	0	0
61 COMBINED CYCLE POWER PLANT (400 MWE)	0.0	0	0	0	0	0	0	0	0
62 GAS TURBINE POWER PLANT (133 MWE)	1.0	0	1*	1*	0	0	0	0	1
63 FUEL CELLS (26 MWE)	0.0	0	0	0	0	0	0	0	0
64 LIGHT WATER REACTOR (LWR) (1200 MWE)	0.0	0	0	0	0	0	0	0	0
65 LIGHT WATER REACTOR (LWR) (900 MWE)	0.0	0	0	0	0	0	0	0	0
66 LIGHT WATER REACTOR (LWR) (600 MWE)	0.0	0	0	0	0	0	0	0	0
67 DAM & HYDROELECTRIC POWER PLANT (200 MWE)	12.2	0	0	0	0	0	0	0	0
68 PUMPED STORAGE (500 MWE)	0.0	0	0	0	0	0	0	0	0
69 GEOTHERMAL POWER COMPLEX (200 MWE)	0.0	0	0	0	0	0	0	0	0

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 12 (Continued)

Schedule of Annual Energy Facilities Additions to Supply Fuel Mix: Comparison Case

1976-2010

FACILITY NAME	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	TOTAL ADDED (1978- 1993)
1 ONSHORE PRIMARY OIL RECOVERY (1,000 MBPD)	17	16	16	14	13	14	13	13	14	13	14	244
2 ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	0	0	0	0	0	0	0	0	0	0	0	0
3 ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	0	0	0	0	0	0	0	0	0	0	0	0
4 OFFSHORE OIL RECOVERY (12.5 MBPD)	3	3	3	3	2	3	2	3	2	3	2	45
6 HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	0	0	0	0	0	0	0	0	0	0	0	0
7 LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	0	0	0	1	0	0	0	1	0	0	0	3
19 ONSHORE CONVENTIONAL GAS RECOVERY (100 MMCF/D)	1	0	0	0	0	1	0	0	0	0	1	4
20 ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0	0
21 OFFSHORE GAS RECOVERY (25 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0	0
24 LNG EXPORT (3030 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0	0
27 UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0	0
37 SURFACE URANIUM MINE (275.4 M TONNES/Y)	0	0	0	0	0	1	0	0	0	1	0	2
38 UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0	0
39 URANIUM MILL (275.4 M TONNES/Y)	0	0	0	0	0	1	0	0	0	1	0	2
42 LWR FUEL FABRICATION-NO PU RECYCLE (600MTU/Y)	0	0	0	0	0	0	0	0	0	0	0	0
43 LWR FUEL FABRICATION - PU RECYCLE (150 MTU/Y)	0	0	0	0	0	0	0	0	0	0	0	0
49 HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	0	0	0	0	0	0	0	0	0	0	0	0
50 OIL-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
51 OIL-FIRED POWER PLANT (600 MWE)	0	1	1	0	0	0	0	0	0	0	0	4
52 OIL-FIRED POWER PLANT (450 MWE)	0	0	0	0	0	0	0	0	0	0	0	1
53 COAL FIRED POWER PLANT-LOW BTU (800 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
54 COAL FIRED POWER PLANT-HIGH BTU (800 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
55 COAL FIRED POWER PLANT-LOW BTU (600 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
56 COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
59 HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
60 HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
61 COMBINED CYCLE POWER PLANT (400 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
62 GAS TURBINE POWER PLANT (133 MWE)	0	0	0	0	0	0	0	0	0	0	0	1
63 FUEL CELLS (26 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
64 LIGHT WATER REACTOR (LWR) (1200 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
65 LIGHT WATER REACTOR (LWR) (900 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
66 LIGHT WATER REACTOR (LWR) (600 MWE)	0	0	0	1	0	1	1	1	1	1	1	7
67 DAM & HYDROELECTRIC POWER PLANT (200 MWE)	0	0	0	0	0	1	0	0	0	0	0	1
68 PUMPED STORAGE (500 MWE)	0	0	0	0	0	0	0	0	1	0	1	2
69 GEOTHERMAL POWER COMPLEX (200 MWE)	0	0	0	0	0	0	0	0	0	0	0	0

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

Table 12 (Continued)

HECHTEL ENERGY SUPPLY PLANNING MODEL

Schedule of Annual Energy Facilities Addition 10 Supply Fuel Mix: Comparison Case

1976-2010

FACILITY NAME	1994	1995	1996	1997	1998	1999	2000	TOTAL ADDED (1978- 2000)
1 ONSHORE PRIMARY OIL RECOVERY-(1,000 MHPD)	13	14	14	14	14	15	14	342
2 ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	0	0	0	0	0	0	0	0
3 ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	0	0	0	0	0	0	0	0
4 OFFSHORE OIL RECOVERY (12.5 MBPD)	3	2	3	3	2	3	3	64
6 HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	0	0	0	0	0	0	0	0
7 LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	1	0	0	0	1	0	0	5
19 ONSHORE CONVENTIONAL GAS RECOVERY (100 MMCF/D)	0	0	0	0	1	0	0	5
20 ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	0	0	0	0	0	0	0	0
21 OFFSHORE GAS RECOVERY (25 MMCF/D)	0	0	0	0	0	0	0	0
24 LNG EXPORT (3030 MMCF/D)	0	0	0	0	0	0	0	0
27 UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	0	0	0	0	0	0	0	0
37 SURFACE URANIUM MINE (275.4 M TONNES/Y)	0	1	0	1	0	0	0	4
38 UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	0	0	0	0	0	0	0	0
39 URANIUM MILL (275.4 M TONNES/Y)	0	1	0	1	0	0	0	4
42 LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	0	0	0	0	0	0	0	0
43 LWR FUEL FABRICATION - PU RECYCLE (150 MTH/Y)	0	0	0	0	0	0	0	0
49 HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	0	0	0	0	0	0	0	0
50 OIL-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0
51 OIL-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	4
52 OIL-FIRED POWER PLANT (450 MWE)	0	0	0	0	0	0	0	1
53 COAL FIRED POWER PLANT-LOW BTU (800 MWE)	0	0	0	0	0	0	0	0
54 COAL FIRED POWER PLANT-HIGH BTU (800 MWE)	0	0	0	0	0	0	0	0
55 COAL FIRED POWER PLANT-LOW BTU (600 MWE)	0	0	0	0	0	0	0	0
56 COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	0	0	0	0	0	0	0	0
59 HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0
60 HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	0
61 COMBINED CYCLE POWER PLANT (400 MWE)	0	0	0	0	0	0	0	0
62 GAS TURBINE POWER PLANT (133 MWE)	0	0	0	0	0	0	0	1
63 FUEL CELLS (26 MWE)	0	0	0	0	0	0	0	0
64 LIGHT WATER REACTOR (LWR) (1200 MWE)	0	0	0	0	0	0	1	1
65 LIGHT WATER REACTOR (LWR) (900 MWE)	1	1	1	2	2	1	0	8
66 LIGHT WATER REACTOR (LWR) (600 MWE)	0	0	0	0	0	0	0	7
67 DAM & HYDROELECTRIC POWER PLANT (200 MWE)	0	0	0	0	0	0	0	1
68 PUMPED STORAGE (500 MWE)	0	1	0	0	1	0	1	5
69 GEOTHERMAL POWER COMPLEX (200 MWE)	0	0	0	0	0	0	0	0

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

BLECHTEL ENERGY SUPPLY PLANNING MODEL

Table 12 (Continued)

Schedule of Annual Energy Facilities Additions 10 Supply Fuel Mix: Comparison Case

1976-2010

FACILITY NAME	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL ADDED (1978- 2010)
1 ONSHORE PRIMARY OIL RECOVERY-(1,000 MBPD)	14	14	14	14	14	14	14	14	14	14	482
2 ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	0	0	0	0	0	0	0	0	0	0	0
3 ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	0	0	0	0	0	0	0	0	0	0	0
4 OFFSHORE OIL RECOVERY (12.5 MBPD)	3	3	3	3	3	3	3	3	3	3	94
6 HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	0	0	0	0	0	0	0	0	0	0	0
7 LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	0	1	0	0	0	1	0	0	0	0	7
19 ONSHORE CONVENTIONAL GAS RECOVERY (100 MMCF/D)	0	0	0	0	0	1	0	0	0	0	6
20 ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0
21 OFFSHORE GAS RECOVERY (25 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0
24 LNG EXPORT (3030 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0
27 UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0
37 SURFACE URANIUM MINE (275.4 M TONNES/Y)	1	0	0	1	0	0	1	0	0	1	8
38 UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0
39 URANIUM MILL (275.4 M TONNES/Y)	1	0	0	1	0	0	1	0	0	1	8
42 LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	0	0	0	0	0	0	0	0	0	0	0
43 LWR FUEL FABRICATION - PU RECYCLE (150 MTH/Y)	0	0	0	0	0	0	0	0	0	0	0
49 HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	0	0	0	0	0	0	0	0	0	0	0
50 OIL-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0	0	0	0
51 OIL-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	0	0	0	4
52 OIL-FIRED POWER PLANT (450 MWE)	0	0	0	0	0	0	0	0	0	0	1
53 COAL FIRED POWER PLANT-LOW BTU (800 MWE)	0	0	0	0	0	0	0	0	0	0	0
54 COAL FIRED POWER PLANT-HIGH BTU (800 MWE)	0	0	0	0	0	0	0	0	0	0	0
55 COAL FIRED POWER PLANT-LOW BTU (600 MWE)	0	0	0	0	0	0	0	0	0	0	0
56 COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	0	0	0	0	0	0	0	0	0	0	0
59 HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0	0	0	0
60 HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	0	0	0	0
61 COMBINED CYCLE POWER PLANT (400 MWE)	0	0	0	0	0	0	0	0	0	0	0
62 GAS TURBINE POWER PLANT (133 MWE)	0	0	0	0	0	0	0	0	0	0	1
63 FUEL CELLS (26 MWE)	0	0	0	0	0	0	0	0	0	0	0
64 LIGHT WATER REACTOR (LWR) (1200 MWE)	1	2	1	2	1	2	2	2	2	3	19
65 LIGHT WATER REACTOR (LWR) (900 MWE)	0	0	0	0	0	0	0	0	0	0	8
66 LIGHT WATER REACTOR (LWR) (600 MWE)	0	0	0	0	0	0	0	0	0	0	7
67 DAM & HYDROELECTRIC POWER PLANT (200 MWE)	0	0	0	0	0	0	0	0	0	0	1
68 PUMPED STORAGE (500 MWE)	0	1	0	1	1	1	1	1	1	1	13
69 GEOTHERMAL POWER COMPLEX (200 MWE)	0	0	0	0	0	0	0	0	0	0	0

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

HECHTEL ENERGY SUPPLY PLANNING MODEL

Table 13

Schedule of Annual Energy Facilities Additions 10 Supply Fuel Mix: Comparison Case 1976-2010

FACILITY NAME	1975 TOTALS	1976	1977	1978	1979	1980	1981	1982	TOTAL ADDED (1978- 1982)
1 CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	0.1	0	0	0	0	0	0	0	0
3 OIL TANKER (90,000 DWT, 620,000 B)	0.0	0	0	0	0	0	0	0	0
4 OIL BARGES (90,000 BBL)	3.0	1*	2*	1*	1	0	1	1	4
5 OIL TANK TRUCK (226 BBL)	290.3	128*	130*	131*	130	129	136	149	675
6 PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	0.5	0	0	0	0	0	0	0	0
7 HOT OIL PIPELINE (40 MB/D, 80.5 KM)	2.4	0	0	1*	0	0	0	0	1
8 REFINED PRODUCTS BULK STATION (69 MB/D)	1.6	0	0	0	1*	0	0	0	1
9 RAIL LINE (64.4 KM, SINGLE TRACK)	0.0	0	0	0	0	0	0	0	0
10 MIXED TRAIN (6556 TONNES)	2.3	0	0	1*	0	0	0	1	2
11 COAL UNIT TRAIN (9,528 TONNES)	0.0	0	0	0	0	0	0	0	0
12 COAL SLURRY PIPELINE (22.69 MM TONNES/Y, 241.4 KM)	0.0	0	0	0	0	0	0	0	0
13 COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	0.0	0	0	0	0	0	0	0	0
14 COAL SLURRY DEWATERING (22.69 MM TONNES/Y)	0.0	0	0	0	0	0	0	0	0
15 COAL BARGES (19,048 TONNES)	0.2	0	0	0	0	0	0	0	0
16 COAL TRUCK (22.7 TONNES)	4.8	1*	1*	1*	1	1	1	1	5
17 GAS PIPELINE (.87 BSCF/D, 241.4 KM)	0.1	0	0	0	0	0	0	0	0
19 GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	0.7	1*	2*	0	1*	1*	0	1*	3
20 LNG TANKER (2.6 BCF)	0.0	0	0	0	0	0	0	0	0
21 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	0.5	0	0	0	0	1	0	0	1
22 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	0.0	0	0	0	0	0	0	0	0
23 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	0.2	0	0	0	0	0	0	0	0
24 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	0.0	0	0	0	0	0	0	0	0
25 +-400 KVDC TRANSMISSION LINE (1500 MWE, 1287 KM)	0.0	0	0	0	0	0	0	0	0
26 ELECTRICITY DISTRIBUTION-AERIAL LINES (131.6 MWE)	9.0	1*	1*	1*	2*	2*	3	2	10

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 13 (Continued)

Schedule of Annual Energy Facilities Additions 10 Supply Fuel Mix: Comparison Case 1976-2010

FACILITY NAME	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	TOTAL ADDED (1978- 1993)
1 CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0	0
3 OIL TANKER (90,000 DWT, 620,000 B)	0	0	0	0	0	0	0	0	0	0	0	0
4 OIL BARGES (90,000 BBL)	0	1	0	1	0	0	1	0	0	0	0	7
5 OIL TANK TRUCK (226 BBL)	168	179	178	177	182	185	188	189	187	184	180	2672
6 PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	1	0	0	0	0	0	0	0	0	0	0	1
7 HOT OIL PIPELINE (40 MB/D, 80.5 KM)	1	0	0	1	0	0	1	0	0	0	1	5
8 REFINED PRODUCTS BULK STATION (69 MB/D)	0	0	1	0	0	0	0	1	0	0	0	3
9 RAIL LINE (64.4 KM, SINGLE TRACK)	0	0	0	0	0	0	0	0	0	0	0	0
10 MIXED TRAIN (6556 TONNES)	0	0	1	0	1	0	1	1	1	0	1	8
11 COAL UNIT TRAIN (9,528 TONNES)	0	0	0	0	0	0	0	0	0	0	0	0
12 COAL SLURRY PIPELINE (22.69 MM TONNES/Y, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0	0
13 COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0	0
14 COAL SLURRY DEWATERING (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0	0
15 COAL BARGES (19,048 TONNES)	0	0	0	0	0	0	0	1	0	0	0	1
16 COAL TRUCK (22.7 TONNES)	2	1	2	2	2	3	3	3	3	3	4	33
17 GAS PIPELINE (.87 BSCF/D, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0	0
18 GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	0	0	0	0	0	0	0	0	0	0	0	3
20 LNG TANKER (2.6 BCF)	0	0	0	0	0	0	0	0	0	0	0	0
21 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	0	0	0	1	0	0	0	1	0	0	0	3
22 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	0	0	0	0	0	0	0	0	0	0	0	0
23 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	1	0	0	0	0	0	0	0	0	0	0	1
24 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	0	0	0	0	0	0	0	0	0	0	0	0
25 +-400 KVDC TRANSMISSION LINE (1500 MWE, 1287 KM)	0	0	0	0	0	0	0	0	0	0	0	0
26 ELECTRICITY DISTRIBUTION-AERIAL LINES (131.6 MWE)	3	4	3	4	3	4	4	4	5	4	5	53

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

HECHTEL ENERGY SUPPLY PLANNING MODEL

Table 13 (Continued)

Schedule of Annual Energy Facilities Additions 10 Supply Fuel Mix: Comparison Case 1976-2010

FACILITY NAME	1994	1995	1996	1997	1998	1999	2000	TOTAL ADDED (1976- 2000)
1 CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	0	0	0	0	0	0	0	0
3 OIL TANKER (90,000 DWT, 620,000 B)	0	0	0	0	0	0	0	0
4 OIL BARGES (90,000 BBL)	0	0	0	0	0	0	0	7
5 OIL TANK TRUCK (226 BBL)	174	167	157	146	133	120	103	3672
6 PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	0	0	0	0	0	0	0	1
7 HOT OIL PIPELINE (40 MB/D, 80.5 KM)	0	0	0	0	0	1	0	6
8 REFINED PRODUCTS BULK STATION (69 MB/D)	0	0	1	0	0	0	0	4
9 RAIL LINE (64.4 KM, SINGLE TRACK)	0	0	0	0	0	0	0	0
10 MIXED TRAIN (6556 TONNES)	1	1	2	1	1	1	2	17
11 COAL UNIT TRAIN (9,528 TONNES)	0	0	0	0	0	0	0	0
12 COAL SLURRY PIPELINE (22.69 MM TONNES/Y, 241.4 KM)	0	0	0	0	0	0	0	0
13 COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0
14 COAL SLURRY DEWATERING (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0
15 COAL BARGES (19,048 TONNES)	0	0	0	0	0	0	0	1
16 COAL TRUCK (22.7 TONNES)	4	4	5	5	5	5	6	67
17 GAS PIPELINE (.87 BSCF/D, 241.4 KM)	0	0	0	0	0	0	0	0
18 GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	0	0	0	0	0	0	0	3
20 LNG TANKER (2.6 BCF)	0	0	0	0	0	0	0	0
21 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	1	0	0	0	1	0	0	5
22 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	0	0	0	0	0	0	0	0
23 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	1	0	0	0	0	0	0	2
24 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	0	0	0	0	0	0	0	0
25 +-400 KVDC TRANSMISSION LINE (1500 MWE, 1287 KM)	0	0	0	0	0	0	0	0
26 ELECTRICITY DISTRIBUTION-AERIAL LINES (131.6 MWE)	4	5	5	5	6	5	6	89

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 13 (Continued)

Schedule of Annual Energy Facilities Additions 10 Supply Fuel Mix: Comparison Case 1976-2010

FACILITY NAME	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL ADDED (1978- 2010)
1 CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0
3 OIL TANKER (90,000 DWT, 620,000 B)	0	0	0	0	0	0	0	0	0	0	0
4 OIL BARGES (90,000 BBL)	0	0	0	0	0	0	0	0	0	0	7
5 OIL TANK TRUCK (226 BBL)	103	103	103	103	103	103	103	103	103	103	4702
6 PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	0	0	0	0	0	0	0	0	0	0	1
7 HOT OIL PIPELINE (40 MB/D, 80.5 KM)	0	0	0	0	0	1	0	0	0	0	7
8 REFINED PRODUCTS BULK STATION (69 MB/D)	0	0	0	0	0	1	0	0	0	0	5
9 RAIL LINE (64.4 KM, SINGLE TRACK)	0	0	0	0	0	0	0	0	0	0	0
10 MIXED TRAIN (6556 TONNES)	2	2	2	2	2	2	2	2	2	2	37
11 COAL UNIT TRAIN (9,528 TONNES)	0	0	0	0	0	0	0	0	0	0	0
12 COAL SLURRY PIPELINE (22.69 MM TONNES/Y, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0
13 COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0
14 COAL SLURRY DEWATERING (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0
15 COAL BARGES (19,048 TONNES)	0	0	0	0	0	0	0	0	0	0	1
16 COAL TRUCK (22.7 TONNES)	6	6	6	6	6	6	6	6	6	6	127
17 GAS PIPELINE (1.87 BSCF/D, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0
18 GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	0	0	0	0	0	0	0	0	0	0	3
20 LNG TANKER (2.6 BCF)	0	0	0	0	0	0	0	0	0	0	0
21 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	0	0	0	0	0	1	0	0	0	0	6
22 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	0	0	0	0	0	0	0	0	0	0	0
23 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	0	0	0	0	0	0	0	0	0	0	2
24 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	0	0	0	0	0	0	0	0	0	0	0
25 +-400 KVDC TRANSMISSION LINE (1500 MWE, 1287 KM)	0	0	0	0	0	0	0	0	0	0	0
26 ELECTRICITY DISTRIBUTION-AERIAL LINES (131.6 MWE)	6	6	6	6	6	6	6	6	6	6	149

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

Table 14

BECHTEL ENERGY SUPPLY PLANNING MODEL

CUMULATIVE CAPITAL REQUIREMENTS (MILLION EPOUNDS, JAN 1978) OF THE ENERGY INDUSTRY
BY FACILITY GROUPING

(1978-1985)

Egypt - Comparison Case

FACILITY	CONSTRUCTION COSTS	OWNER'S COSTS PRIOR TO STARTUP	TOTAL
OIL			
EXPLORATION, DEVELOPMENT, & PRODUCTION	643.2	98.9	742.1
REFINING AND PROCESSING	436.4	70.0	506.4
PIPELINES	35.4	6.0	41.4
TANKERS, BARGES, TRUCKS	117.0	20.5	137.5
BULK STATIONS	9.7	1.6	11.3
OTHER	0.0	0.0	0.0
TOTAL OIL	1241.6	197.0	1438.6
OIL SHALE	0.0	0.0	0.0
GAS			
EXPLORATION, DEVELOPMENT, & PRODUCTION	7.3	1.1	8.4
GEOPRESSURED METHANE	0.0	0.0	0.0
PIPELINES	0.0	0.0	0.0
LNG TANKERS	0.0	0.0	0.0
DISTRIBUTION	39.5	6.7	46.2
OTHER	0.0	0.0	0.0
TOTAL GAS	46.8	7.8	54.7
COAL			
UNDERGROUND MINING	0.0	0.0	0.0
SURFACE MINING	0.0	0.0	0.0
RAIL	11.1	1.9	12.9
PIPELINES	0.0	0.0	0.0
BARGES, TRUCKS	0.6	0.1	0.7
TOTAL COAL	11.6	2.0	13.6
COAL SYNTHETICS			
LIQUEFACTION	0.0	0.0	0.0
METHANOL	0.0	0.0	0.0
SOLVENT REFINING	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.0	0.0	0.0
TOTAL SYNTHETICS	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	8.0	1.2	9.2
SOLAR	0.0	0.0	0.0
ELECTRIC UTILITIES			
COAL-FIRED	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.0	0.0	0.0
NUCLEAR	831.4	93.6	925.0
HYDRO & PUMPED STORAGE	30.9	3.2	34.1
OIL & GAS	406.4	45.9	452.3
GEOTHERMAL	0.0	0.0	0.0
TOTAL GENERATION	1268.7	142.8	1411.5
TRANSMISSION	270.8	31.4	302.2
DISTRIBUTION	233.5	26.6	260.1
TOTAL UTILITIES	1773.0	200.8	1973.8
TOTAL ENERGY INDUSTRY	3081.0	408.9	3489.9

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 15

CUMULATIVE CAPITAL REQUIREMENTS (MILLION EPOUNDS, JAN 1978) OF THE ENERGY INDUSTRY BY FACILITY GROUPING

(1978-2000)

Egypt - Comparison Case

FACILITY	CONSTRUCTION COSTS	OWNER'S COSTS PRIOR TO STARTUP	TOTAL
OIL			
EXPLORATION, DEVELOPMENT, & PRODUCTION	1665.8	256.2	1922.0
REFINING AND PROCESSING	1265.5	203.0	1468.4
PIPELINES	68.6	11.7	80.3
TANKERS, BARGES, TRUCKS	327.8	57.4	385.1
BULK STATIONS	21.3	3.6	24.9
OTHER	0.0	0.0	0.0
TOTAL OIL	3348.9	531.8	3880.8
OIL SHALE	0.0	0.0	0.0
GAS			
EXPLORATION, DEVELOPMENT, & PRODUCTION	20.2	3.1	23.3
GEOPRESSURED METHANE	0.0	0.0	0.0
PIPELINES	0.0	0.0	0.0
LNG TANKERS	0.0	0.0	0.0
DISTRIBUTION	39.5	6.7	46.2
OTHER	0.0	0.0	0.0
TOTAL GAS	59.7	9.8	69.5
COAL			
UNDERGROUND MINING	0.0	0.0	0.0
SURFACE MINING	0.0	0.0	0.0
RAIL	62.7	10.7	73.3
PIPELINES	0.0	0.0	0.0
BARGES, TRUCKS	8.1	1.4	9.5
TOTAL COAL	70.8	12.0	82.9
COAL SYNTHETICS			
LIQUEFACTION	0.0	0.0	0.0
METHANOL	0.0	0.0	0.0
SOLVENT REFINING	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.0	0.0	0.0
TOTAL SYNTHETICS	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	93.5	14.0	107.5
SOLAR	0.0	0.0	0.0
ELECTRIC UTILITIES			
COAL-FIRED	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.0	0.0	0.0
NUCLEAR	8037.6	905.0	8942.6
HYDRO & PUMPED STORAGE	876.0	92.0	967.9
OIL & GAS	406.4	45.9	452.3
GEOTHERMAL	0.0	0.0	0.0
TOTAL GENERATION	9319.9	1042.9	10362.9
TRANSMISSION	599.9	69.6	669.5
DISTRIBUTION	943.5	107.6	1051.1
TOTAL UTILITIES	10863.4	1220.1	12083.5
TOTAL ENERGY INDUSTRY	14436.4	1787.8	16224.2

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 16

GROWTH IN REQUIREMENTS FOR CONSTRUCTOR COST TOTAL ## (MILLION EPOUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
For The Egypt - Comparison Case CASE

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
OIL									
EXPLORATION, DEVELOPMENT, & PRODUCTION	82.	73.	72.	88.	(1979)	0.6	-3.9	0.4	-0.5
REFINING AND PROCESSING	0.	87.	55.	87.	(1980)	9999.0	-12.9	4.7	9999.0
PIPELINES	2.	0.	3.	21.	(1982)	-100.0	9999.0	-100.0	-100.0
TANKERS, BARGES, TRUCKS	14.	8.	14.	19.	(1989)	-7.0	6.7	-3.6	-2.1
BULK STATIONS	0.	0.	1.	4.	(1978)	0.0	0.0	0.0	0.0
OTHER	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TOTAL OIL	98.	168.	146.	186.	(1984)	16.8	-5.6	1.4	2.3
OIL SHALE	0.	0.	0.	0.		0.0	0.0	0.0	0.0
GAS									
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	0.	1.	3.	(1978)	0.0	0.0	0.0	0.0
GEOPRESSURED METHANE	0.	0.	0.	0.		0.0	0.0	0.0	0.0
PIPELINES	0.	0.	0.	0.		0.0	0.0	0.0	0.0
LNG TANKERS	0.	0.	0.	0.		0.0	0.0	0.0	0.0
DISTRIBUTION	20.	0.	2.	20.	(1976)	-25.0	-100.0	0.0	-100.0
OTHER	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TOTAL GAS	20.	0.	3.	20.	(1976)	-25.0	-100.0	0.0	-100.0
COAL									
UNDERGROUND MINING	0.	0.	0.	0.		0.0	0.0	0.0	0.0
SURFACE MINING	0.	0.	0.	0.		0.0	0.0	0.0	0.0
RAIL	0.	7.	3.	7.	(1996)	0.0	9999.0	4.7	9999.0
PIPELINES	0.	0.	0.	0.		0.0	0.0	0.0	0.0
BARGES, TRUCKS	0.	0.	0.	4.	(1990)	0.0	14.9	7.6	7.8
TOTAL COAL	0.	8.	3.	8.	(1990)	0.0	130.7	4.8	22.6
COAL SYNTHETICS									
LIQUEFACTION	0.	0.	0.	0.		0.0	0.0	0.0	0.0
METHANOL	0.	0.	0.	0.		0.0	0.0	0.0	0.0
SOLVENT REFINING	0.	0.	0.	0.		0.0	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TOTAL SYNTHETICS	0.	0.	0.	0.		0.0	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	0.	11.	4.	11.	(1991)	0.0	9999.0	8.0	9999.0
SOLAR	0.	0.	0.	0.		0.0	0.0	0.0	0.0
ELECTRIC UTILITIES									
COAL-FIRED	0.	0.	0.	0.		0.0	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.		0.0	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
NUCLEAR	0.	718.	349.	718.	(2000)	9999.0	44.9	7.5	9999.0
HYDRO & PUMPED STORAGE	0.	75.	38.	75.	(2000)	0.0	9999.0	7.4	9999.0
OIL & GAS	78.	0.	18.	104.	(1977)	-10.6	-100.0	0.0	-100.0
GEO THERMAL	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TOTAL GENERATION	78.	793.	405.	793.	(2000)	2.9	24.9	7.5	10.1
TRANSMISSION	0.	0.	26.	127.	(1993)	0.0	9999.0	-100.0	0.0
DISTRIBUTION	12.	58.	41.	58.	(1999)	20.1	6.7	3.5	6.8
TOTAL UTILITIES	91.	851.	472.	851.	(2000)	5.7	24.4	6.4	9.8
TOTAL ENERGY INDUSTRY	208.	1038.	628.	1038.	(2000)	9.6	9.8	5.3	6.9

CONSTRUCTOR COST TOTAL DOES NOT INCLUDE OWNER'S COSTS.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 16 (Continued)

GROWTH IN REQUIREMENTS FOR CONSTRUCTOR COST TOTAL ## (MILLION POUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
For The Egypt - Comparison Case CASE

RESOURCES	1976	1977	1978	1979	1980	1981	1982
OIL							
EXPLORATION, DEVELOPMENT, & PRODUCTION	82.	85.	87.	88.	84.	82.	81.
REFINING AND PROCESSING	0.	0.	22.	65.	87.	44.	22.
PIPELINES	2.	9.	0.	0.	0.	4.	21.
TANKERS, BARGES, TRUCKS	14.	18.	14.	14.	11.	15.	16.
BULK STATIONS	0.	2.	4.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL OIL	98.	114.	127.	167.	182.	144.	139.
OIL SHALE	0.	0.	0.	0.	0.	0.	0.
GAS							
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	1.	3.	0.	0.	1.	3.
GEOPRESSURED METHANE	0.	0.	0.	0.	0.	0.	0.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
LNG TANKERS	0.	0.	0.	0.	0.	0.	0.
DISTRIBUTION	20.	13.	15.	12.	6.	6.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL GAS	20.	14.	18.	12.	6.	8.	3.
COAL							
UNDERGROUND MINING	0.	0.	0.	0.	0.	0.	0.
SURFACE MINING	0.	0.	0.	0.	0.	0.	0.
RAIL	0.	0.	4.	0.	0.	0.	4.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
BARGES, TRUCKS	0.	0.	0.	0.	0.	0.	0.
TOTAL COAL	0.	0.	4.	0.	0.	0.	4.
COAL SYNTHETICS							
LIQUEFACTION	0.	0.	0.	0.	0.	0.	0.
METHANOL	0.	0.	0.	0.	0.	0.	0.
SOLVENT REFINING	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.	0.	0.
TOTAL SYNTHETICS	0.	0.	0.	0.	0.	0.	0.
NUCLEAR FUEL CYCLE	0.	0.	0.	0.	0.	0.	0.
SOLAR	0.	0.	0.	0.	0.	0.	0.
ELECTRIC UTILITIES							
COAL-FIRED	0.	0.	0.	0.	0.	0.	0.
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.	0.	0.
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.	0.	0.
NUCLEAR	0.	3.	5.	11.	38.	65.	119.
HYDRO & PUMPED STORAGE	0.	0.	0.	0.	0.	0.	0.
OIL & GAS	78.	104.	89.	60.	50.	60.	69.
GEOTHERMAL	0.	0.	0.	0.	0.	0.	0.
TOTAL GENERATION	78.	106.	95.	70.	88.	125.	188.
TRANSMISSION	0.	0.	23.	35.	0.	62.	92.
DISTRIBUTION	12.	16.	22.	23.	25.	28.	33.
TOTAL UTILITIES	91.	122.	140.	129.	113.	214.	314.
TOTAL ENERGY INDUSTRY	208.	251.	289.	308.	301.	366.	459.

CONSTRUCTOR COST TOTAL DOES NOT INCLUDE OWNER'S COSTS.

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BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 16 (Continued)

GROWTH IN REQUIREMENTS FOR CONSTRUCTOR COST TOTAL ** (MILLION POUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
For The Egypt - Comparison Case CASE

RESOURCES	1983	1984	1985	1986	1987	1988	1989
OIL							
EXPLORATION, DEVELOPMENT, & PRODUCTION	79.	75.	69.	63.	69.	63.	67.
REFINING AND PROCESSING	65.	87.	44.	22.	65.	87.	44.
PIPELINES	0.	2.	9.	0.	2.	9.	0.
TANKERS, BARGES, TRUCKS	14.	18.	15.	18.	15.	15.	19.
BULK STATIONS	2.	4.	0.	0.	0.	2.	4.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL OIL	160.	186.	136.	104.	151.	176.	134.
OIL SHALE	0.	0.	0.	0.	0.	0.	0.
GAS							
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	0.	0.	1.	3.	0.	0.
GEOPRESSURED METHANE	0.	0.	0.	0.	0.	0.	0.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
LNG TANKERS	0.	0.	0.	0.	0.	0.	0.
DISTRIBUTION	0.	0.	0.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL GAS	0.	0.	0.	1.	3.	0.	0.
COAL							
UNDERGROUND MINING	0.	0.	0.	0.	0.	0.	0.
SURFACE MINING	0.	0.	0.	0.	0.	0.	0.
RAIL	0.	0.	4.	0.	4.	0.	4.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
BARGES, TRUCKS	0.	0.	0.	0.	0.	0.	0.
TOTAL COAL	0.	0.	4.	0.	4.	0.	4.
COAL SYNTHETICS							
LIQUEFACTION	0.	0.	0.	0.	0.	0.	0.
METHANOL	0.	0.	0.	0.	0.	0.	0.
SOLVENT REFINING	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.	0.	0.
TOTAL SYNTHETICS	0.	0.	0.	0.	0.	0.	0.
NUCLEAR FUEL CYCLE	0.	5.	3.	4.	6.	5.	3.
SOLAR	0.	0.	0.	0.	0.	0.	0.
ELECTRIC UTILITIES							
COAL-FIRED	0.	0.	0.	0.	0.	0.	0.
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.	0.	0.
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.	0.	0.
NUCLEAR	154.	197.	242.	260.	276.	291.	317.
HYDRO & PUMPED STORAGE	0.	5.	26.	41.	51.	50.	59.
OIL & GAS	55.	24.	0.	0.	0.	0.	0.
GEOTHERMAL	0.	0.	0.	0.	0.	0.	0.
TOTAL GENERATION	209.	226.	267.	301.	327.	341.	376.
TRANSMISSION	0.	23.	35.	0.	0.	23.	35.
DISTRIBUTION	35.	33.	35.	35.	39.	41.	43.
TOTAL UTILITIES	244.	283.	337.	336.	366.	406.	454.
TOTAL ENERGY INDUSTRY	404.	473.	481.	445.	530.	587.	595.

** CONSTRUCTOR COST TOTAL DOES NOT INCLUDE OWNER'S COSTS.

B E C H T E L E N E R G Y S U P P L Y P L A N N I N G M O D E L

Table 16 (Continued)

GROWTH IN REQUIREMENTS FOR CONSTRUCTOR COST TOTAL ** (MILLION POUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
For The Egypt - Comparison Case CASE

RESOURCES	1990	1991	1992	1993	1994	1995	1996
OIL							
EXPLORATION, DEVELOPMENT, & PRODUCTION	65.	67.	65.	67.	68.	71.	70.
REFINING AND PROCESSING	22.	65.	87.	44.	22.	65.	87.
PIPELINES	0.	2.	9.	0.	0.	0.	0.
TANKERS, BARGES, TRUCKS	16.	15.	15.	15.	14.	14.	13.
BULK STATIONS	0.	0.	0.	0.	2.	4.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL OIL	102.	150.	177.	126.	106.	154.	170.
OIL SHALE	0.	0.	0.	0.	0.	0.	0.
GAS							
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	1.	3.	0.	0.	0.	1.
GEOPRESSURED METHANE	0.	0.	0.	0.	0.	0.	0.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
LNG TANKERS	0.	0.	0.	0.	0.	0.	0.
DISTRIBUTION	0.	0.	0.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL GAS	0.	1.	3.	0.	0.	0.	1.
COAL							
UNDERGROUND MINING	0.	0.	0.	0.	0.	0.	0.
SURFACE MINING	0.	0.	0.	0.	0.	0.	0.
RAIL	4.	4.	0.	4.	4.	4.	7.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
BARGES, TRUCKS	4.	0.	0.	0.	0.	0.	0.
TOTAL COAL	8.	4.	0.	4.	4.	4.	8.
COAL SYNTHETICS							
LIQUEFACTION	0.	0.	0.	0.	0.	0.	0.
METHANOL	0.	0.	0.	0.	0.	0.	0.
SOLVENT REFINING	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (LOW & MEDIUM HTU)	0.	0.	0.	0.	0.	0.	0.
TOTAL SYNTHETICS	0.	0.	0.	0.	0.	0.	0.
NUCLEAR FUEL CYCLE	4.	11.	3.	8.	10.	4.	6.
SOLAR	0.	0.	0.	0.	0.	0.	0.
ELECTRIC UTILITIES							
COAL-FIRED	0.	0.	0.	0.	0.	0.	0.
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.	0.	0.
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.	0.	0.
NUCLEAR	351.	407.	476.	547.	577.	544.	548.
HYDRO & PUMPED STORAGE	66.	56.	53.	41.	50.	50.	59.
OIL & GAS	0.	0.	0.	0.	0.	0.	0.
GEOTHERMAL	0.	0.	0.	0.	0.	0.	0.
TOTAL GENERATION	417.	463.	529.	588.	627.	594.	607.
TRANSMISSION	0.	0.	85.	127.	0.	0.	23.
DISTRIBUTION	44.	43.	44.	45.	48.	51.	52.
TOTAL UTILITIES	461.	506.	658.	760.	675.	644.	683.
TOTAL ENERGY INDUSTRY	575.	672.	841.	898.	795.	806.	867.

** CONSTRUCTOR COST TOTAL DOES NOT INCLUDE OWNER'S COSTS.

GROWTH IN REQUIREMENTS FOR CONSTRUCTOR COST TOTAL ## (MILLION EPOUNDS, JANUARY 1978)
 FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
 For The Egypt - Comparison Case CASE

RESOURCES	1997	1998	1999	2000	TOTAL 1978-2000
OIL					
EXPLORATION, DEVELOPMENT, & PRODUCTION	69.	75.	73.	73.	1666.
REFINING AND PROCESSING	44.	22.	65.	87.	1265.
PIPELINES	2.	9.	0.	0.	69.
TANKERS, BARGES, TRUCKS	12.	11.	10.	8.	328.
BULK STATIONS	0.	0.	0.	0.	21.
OTHER	0.	0.	0.	0.	0.
TOTAL OIL	126.	117.	148.	168.	3349.
OIL SHALE	0.	0.	0.	0.	0.
GAS					
EXPLORATION, DEVELOPMENT, & PRODUCTION	3.	0.	0.	0.	20.
GEOPRESSURED METHANE	0.	0.	0.	0.	0.
PIPELINES	0.	0.	0.	0.	0.
LNG TANKERS	0.	0.	0.	0.	0.
DISTRIBUTION	0.	0.	0.	0.	40.
OTHER	0.	0.	0.	0.	0.
TOTAL GAS	3.	0.	0.	0.	60.
COAL					
UNDERGROUND MINING	0.	0.	0.	0.	0.
SURFACE MINING	0.	0.	0.	0.	0.
RAIL	4.	4.	4.	7.	63.
PIPELINES	0.	0.	0.	0.	0.
BARGES, TRUCKS	0.	0.	0.	0.	8.
TOTAL COAL	4.	4.	4.	8.	71.
COAL SYNTHETICS					
LIQUEFACTION	0.	0.	0.	0.	0.
METHANOL	0.	0.	0.	0.	0.
SOLVENT REFINING	0.	0.	0.	0.	0.
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.
TOTAL SYNTHETICS	0.	0.	0.	0.	0.
NUCLEAR FUEL CYCLE	5.	3.	4.	11.	94.
SOLAR	0.	0.	0.	0.	0.
ELECTRIC UTILITIES					
COAL-FIRED	0.	0.	0.	0.	0.
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.
NUCLEAR	569.	649.	677.	718.	8038.
HYDRO & PUMPED STORAGE	66.	59.	69.	75.	876.
OIL & GAS	0.	0.	0.	0.	406.
GEOTHERMAL	0.	0.	0.	0.	0.
TOTAL GENERATION	635.	708.	745.	793.	9320.
TRANSMISSION	35.	0.	0.	0.	600.
DISTRIBUTION	54.	55.	58.	58.	944.
TOTAL UTILITIES	724.	763.	803.	851.	10863.
TOTAL ENERGY INDUSTRY	861.	887.	959.	1038.	14436.

CONSTRUCTOR COST TOTAL DOES NOT INCLUDE OWNER'S COSTS.

BECHTEL ENERGY SUPPLY PLANNING MODEL

GROWTH IN CAPITAL REQUIREMENTS* (MILLION POUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
Egypt - Comparison Case •

Table 17

CATEGORY	ANNUAL REQUIREMENTS-----					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
NON-MANUAL TECHNICAL MANPOWER	12.	105.	59.	105.	(2000)	19.4	13.7	5.9	9.6
NON-MANUAL NON-TECHNICAL MANPOWER	1.	22.	12.	22.	(2000)	21.9	23.3	6.8	12.5
MANUAL MANPOWER	17.	115.	67.	115.	(2000)	15.7	10.9	5.5	8.3
MANPOWER TOTAL	30.	243.	138.	243.	(2000)	17.5	12.9	5.8	9.1
WOOD PRODUCTS (20)	2.	13.	8.	13.	(2000)	17.7	9.7	5.2	8.1
CHEMICALS & ALLIED PROD. (27,28,30,32)	3.	3.	3.	4.	(1998)	-4.8	8.6	-1.4	0.0
PETROLEUM PRODUCTS (31)	6.	9.	6.	9.	(2000)	-5.5	0.4	4.4	1.9
GLASS, CLAY & STONE PRODUCTS (35,36)	4.	26.	15.	26.	(2000)	14.0	14.4	5.5	8.7
PRIMARY IRON & STEEL PRODUCTS (37)	19.	22.	19.	22.	(2000)	3.2	-4.4	1.8	0.7
PRIMARY NON-FERROUS METALS (38)	2.	16.	14.	37.	(1993)	19.4	26.9	1.1	9.0
FABRICATED STRUCTURAL PRODUCTS (40) *	5.	56.	37.	70.	(1993)	16.1	28.7	3.7	10.5
OTHER FABRICATED PRODUCTS (42)	6.	26.	15.	26.	(2000)	13.3	3.5	5.8	6.6
MATERIALS TOTAL	46.	171.	117.	187.	(1993)	7.3	10.5	3.6	5.6
HVAC HEATING & COOLING UNITS (52) ++	0.	8.	4.	8.	(2000)	53.0	29.9	7.2	18.4
HVAC DUCTWORK & ACCESSORIES (40) *	0.	3.	1.	3.	(2000)	40.6	35.0	7.4	17.8
TURBINES (43)	26.	88.	48.	88.	(2000)	-6.0	10.8	6.7	5.3
GAS WELDING SETS (47) ++	0.	0.	0.	0.	(1980)	4.1	-9.8	1.9	-0.3
ELECTRIC WELDING SETS (53) **	0.	1.	1.	1.	(2000)	20.5	10.1	6.1	9.2
CONSTRUCTION, MINING & OIL FIELD EQP (45)	37.	64.	50.	64.	(2000)	0.9	4.2	2.1	2.3
MATERIALS HANDLING EQUIPMENT (46)	0.	4.	2.	4.	(2000)	16.0	18.0	6.5	10.4
GENERAL INDUSTRY EQUIPMENT (49)	3.	16.	10.	16.	(2000)	44.2	-7.0	4.7	7.8
INSTRUMENTATION & CONTROLS (62)	2.	11.	7.	11.	(2000)	35.7	1.4	4.3	8.3
ELECTRICAL EQUIPMENT (53) **	4.	37.	22.	37.	(2000)	23.4	11.2	5.6	9.6
FABRICATED PLATE PRODUCTS (40) *	13.	132.	71.	132.	(2000)	27.2	7.4	6.9	10.2
EQUIPMENT TOTAL	84.	363.	217.	363.	(2000)	9.3	6.4	5.4	6.3
MISCELLANEOUS MATERIALS & EQUIPMENT	9.	13.	10.	13.	(2000)	6.5	-4.0	2.3	1.7
MOBILE FACILITY	14.	16.	17.	23.	(1990)	-7.0	11.6	-0.9	0.5
OTHER CONSTRUCTOR COSTS	26.	232.	128.	232.	(2000)	12.6	15.5	7.0	9.6
CONSTRUCTOR COST TOTAL **	208.	1038.	628.	1038.	(2000)	9.6	9.8	5.3	6.9

• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

* BEA (BUREAU OF ECONOMIC ANALYSIS) TWO-DIGIT CATEGORIES ARE IN PARENTHESIS.

* PARTIAL BEA CATEGORY 40, TOTAL IS SUM OF 3 SEPARATE ENTRIES FOR CATEGORY 40.

++ PARTIAL BEA CATEGORY 52, REMAINDER IS PART OF MISCELLANEOUS ENTRY.

** PARTIAL BEA CATEGORY 53, TOTAL IS SUM OF 2 SEPARATE ENTRIES FOR CATEGORY 53.

** CONSTRUCTION CAPITAL COST TOTAL INCLUDES MANPOWER, MATERIALS AND EQUIPMENT SUBTOTALS ABOVE PLUS OTHER (OVERHEAD, PROFIT, ETC.) COSTS. IT EXCLUDES OWNER'S COSTS, (LAND COSTS, INTEREST DURING CONSTRUCTION, ETC.)

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 18

GROWTH IN MANPOWER REQUIREMENTS (MAN-YEARS) FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES Egypt - Comparison Case

CATEGORY	ANNUAL REQUIREMENTS				AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
CHEMICAL ENGINEERS	0.	18.	22.	39. (1987)	9999.0	-24.2	10.1	9999.0
CIVIL ENGINEERS	96.	945.	540.	945. (2000)	14.3	18.0	6.4	10.0
ELECTRICAL ENGINEERS	87.	740.	473.	740. (2000)	16.3	15.9	5.5	9.3
MECHANICAL ENGINEERS	62.	563.	340.	589. (1999)	20.3	8.9	7.1	9.6
MINING ENGINEERS	0.	4.	2.	5. (1994)	0.0	9999.0	1.9	9999.0
NUCLEAR ENGINEERS	0.	77.	37.	77. (2000)	9999.0	30.6	8.2	9999.0
GEOLOGICAL ENGINEERS	29.	41.	34.	41. (2000)	0.6	2.4	1.3	1.4
PETROLEUM ENGINEERS	29.	25.	26.	32. (1978)	0.6	-4.7	0.4	-0.7
OTHER ENGINEERS	1.	12.	14.	24. (1991)	71.2	-4.5	4.0	11.0
ENGINEERS TOTAL	305.	2425.	1488.	2442. (1999)	15.6	12.9	6.1	9.0
DESIGNERS & DRAFTSMEN	115.	936.	606.	993. (1999)	20.6	9.7	6.1	9.1
SUPERVISORS & MANAGERS	96.	520.	302.	520. (1999)	3.3	14.5	6.1	7.3
NON-MANUAL, TECHNICAL TOTAL	515.	3881.	2397.	3955. (1999)	14.8	12.3	6.1	8.8
NON-MANUAL, NON-TECHNICAL	346.	3732.	2079.	3732. (2000)	17.4	15.3	7.1	10.4
NON-MANUAL TOTAL	861.	7613.	4476.	7613. (2000)	15.9	13.6	6.5	9.5
PIPEFITTERS	748.	5026.	2605.	5026. (2000)	29.1	-3.9	7.5	8.3
PIPEFITTER/WELDERS	391.	2186.	1155.	2186. (2000)	20.0	-1.4	7.3	7.4
ELECTRICIANS	356.	4928.	2514.	4928. (2000)	25.5	12.5	7.8	11.6
BOILERMAKERS	309.	616.	391.	616. (2000)	8.1	-13.6	7.7	2.9
BOILERMAKER/WELDERS	103.	437.	258.	437. (2000)	0.3	7.5	7.4	6.2
IRON WORKERS	148.	2579.	1763.	4496. (1993)	22.4	39.8	2.6	12.7
CARPENTERS	160.	3430.	1687.	3430. (2000)	32.6	16.6	8.1	13.6
EQUIPMENT OPERATORS	546.	2709.	1616.	2709. (2000)	11.7	7.6	5.4	6.9
LINEMEN	167.	1004.	1121.	3123. (1993)	26.4	27.7	-2.4	7.8
TEAMSTERS & LABORERS	1014.	5713.	3244.	5713. (2000)	12.1	8.7	5.9	7.5
OTHER	978.	2075.	1473.	2075. (2000)	4.8	-0.3	3.9	3.2
MANUAL TOTAL	4919.	30703.	17828.	30703. (2000)	16.9	8.0	5.6	7.9
CONSTRUCTION MANPOWER TOTAL	5780.	38316.	22304.	38316. (2000)	16.7	8.9	5.8	8.2

• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A GROWTH RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

BECHTEL ENERGY SUPPLY PLANNING MODEL

SCHEDULE OF MANPOWER RESOURCES (MAN-YEARS) FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES Egypt - Comparison Case

RESOURCES	1976	1977	1978	1979	1980	1981	1982
CHEMICAL ENGINEERS	0.	0.	26.	38.	17.	4.	26.
CIVIL ENGINEERS	96.	125.	207.	205.	164.	280.	319.
ELECTRICAL ENGINEERS	87.	115.	239.	219.	159.	360.	357.
MECHANICAL ENGINEERS	62.	80.	166.	191.	130.	155.	226.
MINING ENGINEERS	0.	0.	0.	0.	0.	0.	0.
NUCLEAR ENGINEERS	0.	1.	2.	4.	6.	10.	13.
GEOLOGICAL ENGINEERS	29.	32.	32.	30.	30.	30.	30.
PETROLEUM ENGINEERS	29.	32.	32.	30.	30.	30.	30.
OTHER ENGINEERS	1.	2.	13.	19.	9.	4.	16.
ENGINEERS TOTAL	305.	386.	715.	737.	545.	873.	1018.
DESIGNERS & DRAFTSMEN	115.	147.	336.	370.	242.	343.	446.
SUPERVISORS & MANAGERS	96.	110.	140.	143.	109.	139.	179.
NON-MANUAL, TECHNICAL TOTAL	515.	643.	1191.	1250.	896.	1355.	1643.
NON-MANUAL, NON-TECHNICAL	346.	446.	698.	775.	657.	988.	1282.
NON-MANUAL TOTAL	861.	1088.	1889.	2025.	1554.	2343.	2925.
PIPEFITTERS	748.	987.	990.	1603.	2077.	1435.	1125.
PIPEFITTER/WELDERS	391.	499.	506.	670.	810.	628.	562.
ELECTRICIANS	356.	591.	604.	708.	883.	928.	1249.
BOILERMAKERS	309.	533.	524.	452.	421.	432.	492.
BOILERMAKER/WELDERS	103.	178.	175.	128.	104.	133.	171.
IRON WORKERS	148.	268.	595.	1239.	331.	938.	2198.
CARPENTERS	160.	270.	259.	352.	493.	459.	536.
EQUIPMENT OPERATORS	546.	670.	701.	784.	849.	794.	919.
LINEMEN	167.	243.	620.	1265.	427.	918.	2101.
TEAMSTERS & LABORERS	1014.	1154.	1266.	1672.	1599.	1519.	1866.
OTHER	978.	1141.	1202.	1151.	1182.	1184.	1314.
MANUAL TOTAL	4919.	6534.	7442.	10022.	9176.	9368.	12534.
CONSTRUCTION MANPOWER TOTAL	5780.	7622.	9331.	12048.	10730.	11710.	15459.

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 18 (Continued)

SCHEDULE OF MANPOWER RESOURCES (MAN-YEARS) FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES Egypt - Comparison Case

RESOURCES	1983	1984	1985	1986	1987	1988	1989
CHEMICAL ENGINEERS	38.	17.	4.	26.	39.	17.	4.
CIVIL ENGINEERS	311.	363.	374.	416.	472.	507.	522.
ELECTRICAL ENGINEERS	282.	354.	333.	331.	372.	458.	446.
MECHANICAL ENGINEERS	256.	226.	200.	272.	332.	297.	281.
MINING ENGINEERS	0.	2.	3.	3.	2.	2.	3.
NUCLEAR ENGINEERS	18.	21.	24.	27.	29.	32.	36.
GEOLOGICAL ENGINEERS	29.	32.	34.	34.	34.	32.	35.
PETROLEUM ENGINEERS	28.	26.	23.	24.	25.	22.	23.
OTHER ENGINEERS	19.	11.	7.	15.	22.	12.	5.
ENGINEERS TOTAL	981.	1052.	1002.	1147.	1328.	1380.	1355.
DESIGNERS & DRAFTSMEN	454.	436.	386.	487.	589.	560.	515.
SUPERVISORS & MANAGERS	184.	202.	215.	251.	296.	286.	286.
NON-MANUAL, TECHNICAL TOTAL	1619.	1690.	1602.	1885.	2212.	2226.	2157.
NON-MANUAL, NON-TECHNICAL	1264.	1310.	1340.	1523.	1724.	1807.	1926.
NON-MANUAL TOTAL	2883.	3000.	2942.	3408.	3937.	4032.	4083.
PIPEFITTERS	2100.	2656.	1707.	1302.	2322.	2961.	2098.
PIPEFITTER/WELDERS	898.	1083.	756.	642.	996.	1221.	942.
ELECTRICIANS	1499.	1767.	1588.	1718.	2151.	2333.	2197.
BOILERMAKERS	526.	416.	202.	143.	283.	371.	250.
BOILERMAKER/WELDERS	165.	138.	150.	196.	252.	248.	271.
IRON WORKERS	684.	1157.	1766.	914.	1106.	1508.	2143.
CARPENTERS	872.	1124.	1064.	1194.	1508.	1619.	1539.
EQUIPMENT OPERATORS	991.	1225.	1222.	1301.	1637.	1644.	1622.
LINEMEN	594.	862.	1449.	577.	669.	954.	1599.
TEAMSTERS & LABORERS	1930.	2464.	2430.	2185.	2922.	3277.	3163.
OTHER	1315.	1334.	1165.	1152.	1347.	1335.	1306.
MANUAL TOTAL	11575.	14226.	13500.	11323.	15194.	17472.	17129.
CONSTRUCTION MANPOWER TOTAL	14458.	17226.	16441.	14732.	19130.	21504.	21212.

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 18 (Continued)

SCHEDULE OF MANPOWER RESOURCES (MAN-YEARS) FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES Egypt - Comparison Case

RESOURCES	1990	1991	1992	1993	1994	1995	1996
CHEMICAL ENGINEERS	26.	39.	17.	5.	27.	39.	18.
CIVIL ENGINEERS	566.	597.	730.	705.	713.	767.	774.
ELECTRICAL ENGINEERS	449.	481.	730.	673.	575.	622.	678.
MECHANICAL ENGINEERS	357.	414.	412.	390.	458.	511.	466.
MINING ENGINEERS	3.	4.	3.	4.	5.	3.	2.
NUCLEAR ENGINEERS	41.	44.	47.	52.	57.	61.	59.
GEOLOGICAL ENGINEERS	34.	36.	35.	36.	38.	35.	36.
PETROLEUM ENGINEERS	23.	25.	24.	23.	24.	24.	25.
OTHER ENGINEERS	15.	24.	13.	6.	18.	22.	10.
ENGINEERS TOTAL	1513.	1664.	2012.	1894.	1914.	2083.	2068.
DESIGNERS & DRAFTSMEN	621.	706.	797.	714.	765.	858.	811.
SUPERVISORS & MANAGERS	328.	349.	373.	350.	396.	426.	411.
NON-MANUAL, TECHNICAL TOTAL	2462.	2720.	3181.	2959.	3076.	3366.	3290.
NON-MANUAL, NON-TECHNICAL	2150.	2351.	2650.	2796.	2862.	3104.	3021.
NON-MANUAL TOTAL	4612.	5071.	5831.	5755.	5938.	6470.	6311.
PIPEFITTERS	1583.	2792.	3795.	3142.	2762.	3778.	4271.
PIPEFITTER/WELDERS	774.	1216.	1614.	1426.	1327.	1690.	1830.
ELECTRICIANS	2186.	2746.	3454.	3601.	3533.	3885.	3989.
BOILERMAKERS	176.	339.	469.	373.	314.	454.	527.
BOILERMAKERS/WELDERS	302.	299.	346.	283.	312.	318.	364.
IRON WORKERS	1186.	1433.	2660.	4496.	1902.	2047.	2387.
CARPENTERS	1561.	1928.	2373.	2332.	2449.	2674.	2765.
EQUIPMENT OPERATORS	1698.	1937.	2074.	1937.	2039.	2081.	2281.
LINEMEN	761.	745.	1554.	3123.	837.	837.	1197.
TEAMSTERS & LABORERS	2880.	3541.	4433.	4438.	3985.	4424.	4843.
OTHER	1276.	1465.	1670.	1606.	1672.	1797.	1837.
MANUAL TOTAL	14384.	18441.	24442.	26756.	21131.	23985.	26290.
CONSTRUCTION MANPOWER TOTAL	18997.	23511.	30273.	32510.	27069.	30455.	32601.

• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 18 (Continued)

SCHEDULE OF MANPOWER RESOURCES (MAN-YEARS) FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES Egypt - Comparison Case *

RESOURCES	1997	1998	1999	2000	TOTAL 1978-2000
CHEMICAL ENGINEERS	4.	26.	39.	18.	515.
CIVIL ENGINEERS	757.	808.	928.	945.	12430.
ELECTRICAL ENGINEERS	642.	648.	726.	740.	10873.
MECHANICAL ENGINEERS	423.	500.	589.	563.	7815.
MINING ENGINEERS	2.	3.	3.	4.	47.
NUCLEAR ENGINEERS	60.	65.	72.	77.	856.
GEOLOGICAL ENGINEERS	37.	38.	39.	41.	765.
PETROLEUM ENGINEERS	26.	25.	25.	25.	594.
OTHER ENGINEERS	5.	17.	22.	12.	318.
ENGINEERS TOTAL	1957.	2130.	2442.	2425.	34234.
DESIGNERS & DRAFTSMEN	735.	845.	993.	936.	13947.
SUPERVISORS & MANAGERS	403.	450.	520.	520.	6955.
NON-MANUAL, TECHNICAL TOTAL	3095.	3426.	3955.	3881.	55133.
NON-MANUAL, NON-TECHNICAL	2990.	3225.	3646.	3732.	47817.
NON-MANUAL TOTAL	6085.	6651.	7601.	7613.	102950.
PIPEFITTERS	3245.	2943.	4193.	5026.	59904.
PIPEFITTER/WELDERS	1480.	1424.	1882.	2186.	26563.
ELECTRICIANS	3624.	3754.	4496.	4928.	57820.
BOILERMAKERS	384.	332.	503.	616.	8999.
BOILERMAKER/WELDERS	377.	342.	421.	437.	5932.
IRON WORKERS	2900.	2009.	2377.	2579.	40556.
CARPENTERS	2535.	2602.	3133.	3430.	38800.
EQUIPMENT OPERATORS	2175.	2083.	2476.	2709.	37179.
LINEMEN	1783.	912.	1004.	1004.	25793.
TEAMSTERS & LABORERS	4580.	4295.	5194.	5713.	74617.
OTHER	1758.	1782.	1950.	2075.	33875.
MANUAL TOTAL	24842.	22479.	27630.	30703.	410040.
CONSTRUCTION MANPOWER TOTAL	30927.	29130.	35231.	38316.	512989.

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 19

GROWTH IN REQUIREMENTS FOR CONSTRUCTION MANPOWER TOTAL (MAN-YEARS/YEAR)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
For The Egypt - Comparison Case CASE

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
OIL									
EXPLORATION, DEVELOPMENT, & PRODUCTION	1602.	1375.	1403.	1686.	(1978)	0.8	-4.4	0.3	-0.6
REFINING AND PROCESSING	0.	4770.	2663.	4770.	(1980)	9999.0	-17.2	6.5	9999.0
PIPELINES	76.	0.	83.	547.	(1982)	-100.0	9999.0	-100.0	-100.0
TANKERS, BARGES, TRUCKS	0.	0.	0.	0.		0.0	0.0	0.0	0.0
BULK STATIONS	0.	0.	26.	96.	(1978)	0.0	0.0	0.0	0.0
OTHER	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TOTAL OIL	1677.	6145.	4175.	6423.	(1980)	39.9	-12.0	4.0	5.6
OIL SHALE	0.	0.	0.	0.		0.0	0.0	0.0	0.0
GAS									
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	0.	26.	88.	(1978)	0.0	0.0	0.0	0.0
GEOPRESSURED METHANE	0.	0.	0.	0.		0.0	0.0	0.0	0.0
PIPELINES	0.	0.	0.	0.		0.0	0.0	0.0	0.0
LNG TANKERS	0.	0.	0.	0.		0.0	0.0	0.0	0.0
DISTRIBUTION	999.	0.	82.	999.	(1976)	-25.3	-100.0	0.0	-100.0
OTHER	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TOTAL GAS	999.	0.	108.	999.	(1976)	-25.3	-100.0	0.0	-100.0
COAL									
UNDERGROUND MINING	0.	0.	0.	0.		0.0	0.0	0.0	0.0
SURFACE MINING	0.	0.	0.	0.		0.0	0.0	0.0	0.0
RAIL	0.	0.	0.	0.		0.0	0.0	0.0	0.0
PIPELINES	0.	0.	0.	0.		0.0	0.0	0.0	0.0
BARGES, TRUCKS	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TOTAL COAL	0.	0.	0.	0.		0.0	0.0	0.0	0.0
COAL SYNTHETICS									
LIQUEFACTION	0.	0.	0.	0.		0.0	0.0	0.0	0.0
METHANOL	0.	0.	0.	0.		0.0	0.0	0.0	0.0
SOLVENT REFINING	0.	0.	0.	0.		0.0	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TOTAL SYNTHETICS	0.	0.	0.	0.		0.0	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	0.	560.	229.	568.	(1994)	0.0	9999.0	8.8	9999.0
SOLAR	0.	0.	0.	0.		0.0	0.0	0.0	0.0
ELECTRIC UTILITIES									
COAL-FIRED	0.	0.	0.	0.		0.0	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.		0.0	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
NUCLEAR	0.	25689.	12063.	25689.	(2000)	9999.0	49.9	8.5	9999.0
HYDRO & PUMPED STORAGE	0.	2598.	1425.	2672.	(1999)	0.0	9999.0	6.2	9999.0
OIL & GAS	2513.	0.	735.	4096.	(1977)	-11.0	-100.0	0.0	-100.0
GEOTHERMAL	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TOTAL GENERATION	2513.	28286.	14224.	28286.	(2000)	0.6	27.3	8.2	10.6
TRANSMISSION	0.	0.	1250.	6575.	(1993)	0.0	9999.0	-100.0	0.0
DISTRIBUTION	591.	3324.	2320.	3324.	(1999)	24.4	6.8	3.5	7.5
TOTAL UTILITIES	3104.	31610.	17793.	31610.	(2000)	6.5	26.4	6.2	10.2
TOTAL ENERGY INDUSTRY	5780.	38316.	22304.	38316.	(2000)	16.7	8.9	5.8	8.2

HECHTEL ENERGY SUPPLY PLANNING MODEL

Table 20

GROWTH IN SELECTED MATERIALS AND EQUIPMENT ITEMS REQUIRED
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
Egypt - Comparison Case

CATEGORY		ANNUAL REQUIREMENTS				AVERAGE GROWTH RATES (%/YEAR)			
		1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
CEMENT	(TONNES)	17594.	123380.	67520.	123380. (2000)	8.8	13.8	6.6	8.5
CONCRETE (INCLUDES CEMENT)	(TONNES)	93526.	1115214.	579114.	1115214. (2000)	14.1	19.7	7.3	10.9
BENTONITE (IN DRILLING MUD)	(TONNES)	2719.	2300.	2399.	2971. (1978)	0.9	-4.7	0.3	-0.7
BARITE (IN DRILLING MUD)	(TONNES)	2636.	2277.	2339.	2893. (1978)	0.8	-4.5	0.3	-0.6
CARBON STEEL	(TONNES)	41076.	124618.	84202.	125655. (1993)	3.0	9.3	3.7	4.7
ALLOY STEEL	(TONNES)	2601.	11428.	6955.	11428. (2000)	11.2	5.3	5.5	6.4
STAINLESS STEEL	(TONNES)	178.	3788.	1961.	3788. (2000)	50.1	5.6	8.0	13.6
STEEL TOTAL	(TONNES)	43854.	139834.	93117.	139834. (2000)	3.9	9.0	3.9	5.0
COPPER	(TONNES)	432.	4779.	2991.	5721. (1993)	27.1	16.0	4.8	10.5
ALUMINUM	(TONNES)	625.	1876.	3091.	12028. (1993)	7.2	37.1	-4.9	4.7
MANGANESE	(TONNES)	332.	1055.	710.	1055. (2000)	4.7	8.6	3.8	4.9
CHROMIUM	(TONNES)	131.	981.	567.	981. (2000)	23.3	5.3	6.3	8.8
NICKEL	(TONNES)	8.	151.	80.	151. (2000)	45.2	8.1	7.4	13.1
CAST IRON	(TONNES)	502.	3126.	1849.	3126. (2000)	25.3	1.7	5.8	7.9
STEEL CASTINGS	(TONNES)	363.	1776.	1024.	1776. (2000)	13.3	9.1	4.4	6.8
ALUMINUM CASTINGS	(TONNES)	31.	160.	96.	160. (2000)	13.6	7.3	5.3	7.1
BRASS & BRONZE CASTINGS	(TONNES)	31.	245.	143.	245. (2000)	32.2	-0.2	6.5	8.9
IRON & STEEL FORGINGS	(TONNES)	318.	1597.	924.	1597. (2000)	10.0	11.0	4.8	7.0
STRUCTURAL STEEL SHAPES	(TONNES)	2274.	16639.	11965.	26229. (1993)	15.7	25.2	1.9	8.6
STEEL PLATE < 3.8 CM THICK	(TONNES)	3333.	20139.	13002.	20139. (2000)	16.9	10.0	4.8	7.8
STEEL PLATE > 3.8 CM THICK	(TONNES)	2.	3857.	1851.	3857. (2000)	177.8	48.2	9.9	36.2
PIPE, CARBON STEEL	(TONNES)	13168.	11653.	10122.	17643. (1982)	-5.0	-3.1	1.6	-0.5
PIPE, ALLOY & STAINLESS STEEL	(TONNES)	98.	5801.	2895.	5801. (2000)	50.7	31.5	7.4	18.5
OIL COUNTRY TUBULAR GOODS	(TONNES)	16166.	13901.	14426.	18061. (1978)	0.8	-4.5	0.3	-0.6
REINFORCING BAR (REBAR)	(TONNES)	935.	22341.	11431.	22341. (2000)	25.0	29.6	6.8	14.1
VALVES, CARBON STEEL	(TONNES)	163.	1076.	693.	1076. (2000)	44.1	-10.8	6.9	8.2
VALVES, ALLOY & STAINLESS STEEL	(TONNES)	7.	513.	262.	513. (2000)	88.3	14.0	7.6	19.6
STEAM TURBOGENERATORS	(MEGAWATTS)	331.	1847.	1007.	1847. (2000)	5.9	8.8	7.4	7.4
STEAM TURBINES (EXCL TRBGENS)	(MEGAWATTS)	7.	34.	20.	34. (2000)	17.3	-4.2	7.7	6.6
GAS TURBOGENERATORS	(MEGAWATTS)	136.	3.	3.	136. (1976)	-60.3	-2.8	1.0	-14.3
DRAGLINES	(CUBIC METERS)	0.	0.	0.	0.	0.0	0.0	0.0	0.0
DRILL RIGS, ONSHORE	(RIG YEARS)	16.	15.	15.	18. (1978)	1.0	-3.7	0.4	-0.4
DRILL RIGS, OFFSHORE	(RIG YEARS)	5.	5.	4.	5. (1979)	0.0	-2.8	1.0	0.0
DRILL BITS	(NUMBER)	1358.	1198.	1237.	1494. (1978)	0.7	-1.6	-0.5	-0.5
PUMPS & DRIVERS > 745 MGAWTS	(MEGAWATTS)	8.	146.	76.	146. (2000)	31.8	17.0	7.2	13.0
PUMPS & DRIVERS < 745 MGAWTS	(MEGAWATTS)	20.	30.	25.	30. (2000)	10.0	-7.8	2.9	1.7
AXIAL COMPRESSORS > 3727 MGAWTS	(MGAWTS)	0.	0.	0.	0.	0.0	0.0	0.0	0.0
CENTRIF COMP & DRV > 7455 MW	(MGAWTS)	0.	19.	12.	19. (1979)	9999.0	-24.2	9.7	9999.0
CENTRIF COMP & DRV < 7455 MW	(MGAWTS)	1.	4.	3.	4. (1979)	38.3	-19.0	6.8	5.2
HEAT EXCHANGERS	(SQUARE METERS)	7053.	101495.	59483.	101495. (2000)	68.9	-11.0	8.0	11.8
NON-NUC PRESS VESS < 3.8 CM WALL	(TONNES)	54.	2062.	1349.	2095. (1984)	148.4	-23.3	9.2	16.3
NON-NUC PRESS VESS 3.8-10 CM W	(TONNES)	4.	4.	4.	4. (1979)	0.0	-2.8	1.0	0.0
NON-NUC PRESS VESS > 10 CM WALL	(TONNES)	0.	0.	0.	0.	0.0	0.0	0.0	0.0
BOILERS	(TONNES STEAM PER HOUR)	981656.	313796.	489200.	1486156. (1978)	5.1	-41.8	9.6	-4.6
NUCLEAR STEAM SUPPLY SYSTEMS	(MEGAWATTS)	0.	1820.	893.	1820. (2000)	9999.0	47.3	7.3	9999.0

ESPM-Egypt 65

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A GROWTH RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 21

GROWTH IN ANNUAL COSTS (MILLION POUNDS JANUARY 1978) FOR THE OPERATION AND MAINTENANCE OF ENERGY-RELATED FACILITIES Egypt - Comparison Case

CATEGORY	ANNUAL REQUIREMENTS				AVERAGE GROWTH RATES (%/YEAR)				
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000	
ON-MANUAL TECHNICAL MANPOWER	3.	19.	10.	19. (2000)	12.0	7.5	7.0	7.9	
ON-MANUAL NON-TECHNICAL MANPOWER	1.	4.	2.	4. (2000)	12.0	7.4	7.1	8.0	
ANUAL MANPOWER	9.	43.	27.	43. (2000)	13.8	7.1	5.1	7.0	
MANPOWER TOTAL	12.	66.	39.	66. (2000)	13.2	7.2	5.7	7.3	
OOD PRODUCTS (20)	1.	5.	2.	5. (2000)	5.2	10.9	7.8	8.0	
HEMICALS & ALLIED PROD. (27,28,30,32)	8.	33.	19.	33. (2000)	-0.7	6.6	7.7	6.1	
PETROLEUM PRODUCTS (31)	4.	15.	12.	15. (1997)	18.4	6.0	2.1	5.5	
GLASS, CLAY & STONE PRODUCTS (35,36)	1.	2.	1.	2. (2000)	0.4	5.4	4.9	4.2	
PRIMARY IRON & STEEL PRODUCTS (37)	1.	12.	5.	12. (2000)	23.5	6.9	9.4	11.1	
PRIMARY NON-FERROUS METALS (38)	0.	4.	2.	4. (2000)	9.5	11.7	7.7	8.8	
FABRICATED STRUCTURAL PRODUCTS (40) *	0.	4.	2.	4. (2000)	14.8	11.1	6.1	8.5	
OTHER FABRICATED PRODUCTS (42)	2.	9.	5.	9. (2000)	6.4	8.0	6.7	7.0	
MATERIALS TOTAL	17.	83.	48.	83. (2000)	8.1	7.1	6.2	6.7	
HVAC HEATING & COOLING UNITS (52) ++	0.	0.	0.	0. (1982)	35.1	3.1	-0.3	5.6	
HVAC DUCTWORK & ACCESSORIES (40) *	0.	0.	0.	0. (1982)	35.1	3.1	-0.3	5.6	
TURBINES (43)	0.	5.	2.	5. (2000)	14.0	11.0	9.8	10.8	
GAS WELDING SETS (47) ++	1.	9.	4.	9. (2000)	1.1	6.1	12.7	9.3	
ELECTRIC WELDING SETS (53) **	0.	0.	0.	0.	0.0	0.0	0.0	0.0	
CONSTRUCTION, MINING & OIL FIELD EQP (45)	0.	2.	1.	2. (2000)	15.6	10.3	12.1	12.3	
MATERIALS HANDLING EQUIPMENT (46)	0.	0.	0.	0. (2000)	21.4	6.1	12.9	12.8	
GENERAL INDUSTRY EQUIPMENT (49)	4.	10.	6.	10. (2000)	-2.3	4.8	6.4	4.5	
INSTRUMENTATION & CONTROLS (62)	1.	5.	3.	5. (2000)	8.4	4.8	6.0	6.1	
ELECTRICAL EQUIPMENT (53) **	3.	15.	8.	15. (2000)	6.6	8.8	7.4	7.6	
FABRICATED PLATE PRODUCTS (40) *	0.	0.	0.	0.	0.0	0.0	0.0	0.0	
EQUIPMENT TOTAL	8.	38.	20.	38. (2000)	4.0	7.0	7.4	6.8	
ELECTRICITY	5.	13.	9.	13. (1998)	-3.4	6.4	5.6	4.2	
NATURAL GAS	0.	1.	0.	1. (1997)	14.7	11.2	24.6	20.0	
WATER	2.	24.	9.	24. (2000)	8.6	10.5	12.3	11.3	
UTILITY TOTAL	7.	37.	18.	37. (2000)	0.3	8.0	9.2	7.4	
RENTS, ROYALTIES, ETC.	0.	0.	0.	0.	0.0	0.0	0.0	0.0	
TAXES	0.	0.	0.	0.	0.0	0.0	0.0	0.0	
SERVICES & MISCELLANEOUS	10.	57.	31.	57. (2000)	11.8	7.1	6.7	7.6	
ANNUAL OPERATING COST (EX FUEL)	53.	271.	152.	271. (2000)	8.8	7.2	6.5	7.0	

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

#BEA (BUREAU OF ECONOMIC ANALYSIS) TWO-DIGIT CATEGORIES ARE IN PARENTHESIS.

* PARTIAL BEA CATEGORY 40. TOTAL IS SUM OF 3 SEPARATE ENTRIES FOR CATEGORY 40.

++ PARTIAL BEA CATEGORY 52. REMAINDER IS PART OF MISCELLANEOUS ENTRY.

** PARTIAL BEA CATEGORY 53. TOTAL IS SUM OF 2 SEPARATE ENTRIES FOR CATEGORY 53.

Note: An error in the estimate for "Gas Welding Sets" caused a minor (less than 5 percent) error in the annual operations cost total. The equipment subtotal is correct.

RECHIEL ENERGY SUPPLY PLANNING MODEL

Table 22

GROWTH IN MANPOWER REQUIREMENTS (MAN-YEARS) FOR THE OPERATION AND MAINTENANCE OF ENERGY-RELATED FACILITIES Egypt - Comparison Case

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
CHEMICAL ENGINEERS	30.	78.	51.	81.	(1998)	-4.5	6.7	5.7	4.1
CIVIL ENGINEERS	18.	105.	60.	105.	(2000)	14.2	7.0	6.2	7.7
ELECTRICAL ENGINEERS	34.	200.	119.	200.	(2000)	15.0	10.4	5.0	7.7
MECHANICAL ENGINEERS	33.	160.	89.	160.	(2000)	9.4	6.1	6.5	6.9
MIMING ENGINEERS	0.	14.	5.	15.	(1997)	0.0	0.0	9999.0	9999.0
NUCLEAR ENGINEERS	0.	26.	7.	26.	(2000)	0.0	0.0	9999.0	9999.0
GEOLOGICAL ENGINEERS	0.	7.	3.	7.	(1997)	0.0	0.0	9999.0	9999.0
PETROLEUM ENGINEERS	0.	0.	0.	0.		0.0	0.0	0.0	0.0
OTHER ENGINEERS	31.	137.	86.	137.	(2000)	8.6	6.5	5.8	6.4
ENGINEERS TOTAL	144.	728.	420.	728.	(2000)	8.9	7.7	6.2	7.0
DESIGNERS & DRAFTSMEN	28.	146.	84.	146.	(2000)	9.2	8.6	6.2	7.2
SUPERVISORS & MANAGERS	383.	1581.	1106.	1581.	(2000)	14.6	7.3	3.5	6.1
OTHER TECHNICAL	75.	477.	238.	477.	(2000)	3.9	8.4	9.0	8.0
NON-MANUAL, TECHNICAL TOTAL	630.	2932.	1849.	2932.	(2000)	12.0	7.5	4.9	6.6
NON-MANUAL, NON-TECHNICAL	224.	1410.	767.	1410.	(2000)	12.0	7.4	7.1	8.0
NON-MANUAL TOTAL	854.	4342.	2616.	4342.	(2000)	12.0	7.5	5.6	7.0
PIPEFITTERS	182.	480.	389.	482.	(1998)	10.7	6.1	1.8	4.1
WELDERS	77.	279.	209.	279.	(2000)	12.8	9.1	2.5	5.5
ELECTRICIANS	222.	1119.	666.	1119.	(2000)	9.4	10.4	5.2	7.0
BOILERMAKERS	25.	66.	43.	68.	(1998)	-4.5	6.7	5.7	4.1
MECHANICS	767.	3079.	2228.	3079.	(2000)	15.5	6.6	3.4	6.0
MACHINISTS	195.	720.	550.	726.	(1998)	16.0	6.4	2.7	5.6
IRGNWORKERS	14.	32.	21.	32.	(2000)	0.0	2.3	4.7	3.4
CARPENTERS	28.	58.	42.	60.	(1998)	-2.7	4.0	4.2	3.0
EQUIPMENT OPERATORS	88.	838.	411.	838.	(2000)	11.4	13.6	8.2	9.8
OTHER OPERATORS	858.	5122.	2584.	5122.	(2000)	3.6	8.3	8.7	7.7
METER READERS	281.	2015.	1211.	2015.	(2000)	23.2	7.9	5.2	8.6
TEAMSTERS & LABORERS	1797.	6521.	5088.	6521.	(2000)	16.4	6.7	2.4	5.5
LINEMEN	61.	595.	295.	595.	(2000)	11.7	14.1	8.1	9.9
OTHER	482.	2889.	1626.	2889.	(2000)	14.6	6.2	6.5	7.7
MANUAL TOTAL	4989.	22973.	14951.	22973.	(2000)	13.8	7.1	4.5	6.6
MANPOWER TOTAL	5843.	27316.	17566.	27316.	(2000)	13.5	7.2	4.7	6.6

INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

GROWTH RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

Note: An error in the "Other Operators" category would, if corrected, reduce the estimate for this category by about 15 percent. The manual total is correct as shown.

HECHTEL ENERGY SUPPLY PLANNING MODEL

Table 23

CUMULATIVE CAPITAL REQUIREMENTS (MILLION EPOUNDS, JAN 1978) OF THE ENERGY INDUSTRY
BY FACILITY GROUPING
Egypt - Reference Case/Import

(1978-1985)

FACILITY	CONSTRUCTION COSTS	OWNER'S COSTS PRIOR TO STARTUP	TOTAL
IL			
EXPLORATION, DEVELOPMENT, & PRODUCTION	581.0	89.4	670.3
REFINING AND PROCESSING	314.3	50.4	364.7
PIPELINES	29.2	5.0	34.2
TANKERS, BARGES, TRUCKS	107.2	18.8	126.0
BULK STATIONS	7.3	1.2	8.6
OTHER	0.0	0.0	0.0
TOTAL OIL	1039.0	164.7	1203.7
IL SHALE	0.0	0.0	0.0
AS			
EXPLORATION, DEVELOPMENT, & PRODUCTION	6.5	1.0	7.6
GEOPRESSURED METHANE	0.0	0.0	0.0
PIPELINES	0.0	0.0	0.0
LNG TANKERS	0.0	0.0	0.0
DISTRIBUTION	21.1	3.6	24.6
OTHER	0.0	0.0	0.0
TOTAL GAS	27.6	4.6	32.2
COAL			
UNDERGROUND MINING	0.0	0.0	0.0
SURFACE MINING	0.0	0.0	0.0
RAIL	3.8	0.6	4.4
PIPELINES	0.0	0.0	0.0
BARGES, TRUCKS	0.5	0.1	0.6
TOTAL COAL	4.3	0.7	5.0
COAL SYNTHETICS			
LIQUEFACTION	0.0	0.0	0.0
METHANOL	0.0	0.0	0.0
SOLVENT REFINING	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.0	0.0	0.0
TOTAL SYNTHETICS	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	5.4	0.8	6.2
SOLAR	0.0	0.0	0.0
ELECTRIC UTILITIES			
COAL-FIRED	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.0	0.0	0.0
NUCLEAR	704.2	79.3	783.5
HYDRO & PUMPED STORAGE	21.6	2.3	23.9
OIL & GAS	296.8	33.5	330.3
GEOTHERMAL	0.0	0.0	0.0
TOTAL GENERATION	1022.6	115.1	1137.8
TRANSMISSION	203.6	23.6	227.2
DISTRIBUTION	151.6	17.3	168.9
TOTAL UTILITIES	1377.9	156.0	1533.9
TOTAL ENERGY INDUSTRY	2454.1	326.9	2781.0

Table 24

HECHTFL ENERGY SUPPLY PLANNING MODEL

CUMULATIVE CAPITAL REQUIREMENTS (MILLION EPOUNDS, JAN 1978) OF THE ENERGY INDUSTRY
BY FACILITY GROUPING

(1978-2000)

Egypt - Reference Case/Imports

FACILITY	CONSTRUCTION COSTS	OWNER'S COSTS PRIOR TO STARTUP	TOTAL
OIL			
EXPLORATION, DEVELOPMENT, & PRODUCTION	1504.8	231.4	1736.3
REFINING AND PROCESSING	911.4	146.2	1057.6
PIPELINES	57.1	9.7	66.8
TANKERS, BARGES, TRUCKS	300.3	52.6	352.9
BULK STATIONS	16.1	2.7	18.9
OTHER	0.0	0.0	0.0
TOTAL OIL	2789.8	442.6	3232.4
OIL SHALE	0.0	0.0	0.0
GAS			
EXPLORATION, DEVELOPMENT, & PRODUCTION	18.1	2.8	20.9
GEOPRESSURED METHANE	0.0	0.0	0.0
PIPELINES	0.0	0.0	0.0
LNG TANKERS	0.0	0.0	0.0
DISTRIBUTION	21.1	3.6	24.6
OTHER	0.0	0.0	0.0
TOTAL GAS	39.2	6.4	45.5
COAL			
UNDERGROUND MINING	0.0	0.0	0.0
SURFACE MINING	0.0	0.0	0.0
RAIL	21.3	3.6	25.0
PIPELINES	0.0	0.0	0.0
BARGES, TRUCKS	7.4	1.3	8.7
TOTAL COAL	28.8	4.9	33.7
COAL SYNTHETICS			
LIQUEFACTION	0.0	0.0	0.0
METHANOL	0.0	0.0	0.0
SOLVENT REFINING	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.0	0.0	0.0
TOTAL SYNTHETICS	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	62.1	9.3	71.4
SOLAR	0.0	0.0	0.0
ELECTRIC UTILITIES			
COAL-FIRED	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.0	0.0	0.0
NUCLEAR	6814.7	767.3	7582.0
HYDRO & PUMPED STORAGE	432.8	45.4	478.3
OIL & GAS	296.8	33.5	330.3
GEOTHERMAL	0.0	0.0	0.0
TOTAL GENERATION	7544.3	846.3	8390.6
TRANSMISSION	449.9	52.2	502.1
DISTRIBUTION	612.8	69.9	682.7
TOTAL UTILITIES	8607.0	968.4	9575.4
TOTAL ENERGY INDUSTRY	11526.8	1431.6	12958.4

RECHTFUL ENERGY SUPPLY PLANNING MODEL

Table 25

GROWTH IN CAPITAL REQUIREMENTS* (MILLION POUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES

Egypt -Reference Case/Imports

CATEGORY	ANNUAL REQUIREMENTS-----					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
NON-MANUAL TECHNICAL MANPOWER	10.	100.	56.	100.	(2000)	18.7	15.3	6.0	9.9
NON-MANUAL NON-TECHNICAL MANPOWER	0.	13.	7.	13.	(2000)	26.5	32.9	7.3	15.3
MANUAL MANPOWER	9.	70.	40.	70.	(2000)	15.7	13.6	5.9	9.0
MANPOWER TOTAL	20.	184.	102.	184.	(2000)	17.6	15.3	6.0	9.8
OOD PRODUCTS (20)	1.	7.	3.	7.	(2000)	13.3	17.1	7.2	10.2
CHEMICALS & ALLIED PROD. (27,28,30,32)	3.	3.	3.	4.	(1998)	-4.8	8.6	-1.4	0.0
PETROLEUM PRODUCTS (31)	2.	5.	3.	5.	(2000)	2.6	5.0	4.2	4.1
GLASS, CLAY & STONE PRODUCTS (35,36)	2.	21.	12.	21.	(1993)	8.1	22.2	5.6	9.3
PRIMARY IRON & STEEL PRODUCTS (37)	15.	19.	16.	19.	(1982)	3.6	-3.1	1.6	0.9
PRIMARY NON-FERROUS METALS (38)	2.	14.	13.	34.	(1993)	19.5	26.9	1.1	9.0
FABRICATED STRUCTURAL PRODUCTS (40) *	4.	50.	33.	63.	(1993)	16.6	30.2	3.7	10.9
OTHER FABRICATED PRODUCTS (42)	32.	156.	91.	156.	(2000)	10.3	7.1	5.9	6.9
MATERIALS TOTAL	33.	140.	96.	160.	(1993)	7.5	13.5	3.6	6.2
HVAC HEATING & COOLING UNITS (52) ++	0.	7.	4.	7.	(2000)	53.0	29.9	7.2	18.4
HVAC DUCTWORK & ACCESSORIES (40) *	0.	3.	1.	3.	(2000)	52.8	38.6	7.4	20.1
TURBINES (43)	22.	81.	44.	81.	(2000)	-4.8	10.8	6.7	5.5
GAS WELDING SETS (47) ++	0.	0.	0.	0.	(1980)	4.1	-9.8	1.9	-0.3
ELECTRIC WELDING SETS (53) **	0.	1.	1.	1.	(2000)	20.6	10.1	6.1	9.2
CONSTRUCTION, MINING & OIL FIELD EQP (45)	31.	34.	31.	34.	(2000)	0.0	1.4	0.3	0.3
MATERIALS HANDLING EQUIPMENT (46)	0.	3.	2.	3.	(2000)	16.1	18.0	6.5	10.4
GENERAL INDUSTRY EQUIPMENT (49)	2.	13.	9.	13.	(2000)	40.4	-6.3	4.8	7.5
INSTRUMENTATION & CONTROLS (62)	1.	10.	6.	10.	(2000)	35.7	1.4	4.3	8.3
ELECTRICAL EQUIPMENT (53) **	4.	31.	19.	31.	(2000)	21.0	11.7	5.6	9.3
FABRICATED PLATE PRODUCTS (40) *	12.	121.	65.	121.	(2000)	27.2	7.4	6.9	10.2
EQUIPMENT TOTAL	73.	306.	182.	306.	(2000)	9.2	5.9	5.4	6.1
MISCELLANEOUS MATERIALS & EQUIPMENT	8.	12.	10.	12.	(2000)	6.8	-4.0	2.3	1.7
MOBILE FACILITY	13.	10.	14.	19.	(1990)	-6.9	8.6	-2.2	-0.9
OTHER CONSTRUCTOR COSTS	19.	177.	97.	177.	(2000)	13.2	17.0	6.6	9.8
CONSTRUCTOR COST TOTAL **	165.	829.	501.	829.	(2000)	9.4	10.5	5.2	6.9

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

#BEA (BUREAU OF ECONOMIC ANALYSIS) TWO-DIGIT CATEGORIES ARE IN PARENTHESIS.

* PARTIAL BEA CATEGORY 40. TOTAL IS SUM OF 3 SEPARATE ENTRIES FOR CATEGORY 40.

++ PARTIAL BEA CATEGORY 52. REMAINDER IS PART OF MISCELLANEOUS ENTRY.

** PARTIAL BEA CATEGORY 53. TOTAL IS SUM OF 2 SEPARATE ENTRIES FOR CATEGORY 53.

** CONSTRUCTION CAPITAL COST TOTAL INCLUDES MANPOWER, MATERIALS AND EQUIPMENT SUBTOTALS ABOVE PLUS OTHER (OVERHEAD, PROFIT, ETC.) COSTS. IT EXCLUDES OWNER'S COSTS, (LAND COSTS, INTEREST DURING CONSTRUCTION, ETC.)

NOTE: Subsequent to this analysis, an error was discovered, correction of which would substantially reduce the "Other Fabricated Products" category. (The materials cost total is, however, correct as shown.) This error also appears in the results for the other cases analyzed.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 26

GROWTH IN MANPOWER REQUIREMENTS (MAN-YEARS)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
Egypt - Reference Case/Imports

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
CHEMICAL ENGINEERS	0.	7.	8.	15.	(1987)	9999.0	-24.2	10.1	9999.0
CIVIL ENGINEERS	41.	787.	416.	787.	(2000)	25.2	22.3	7.2	13.1
ELECTRICAL ENGINEERS	36.	621.	349.	621.	(2000)	26.0	20.8	6.6	12.5
MECHANICAL ENGINEERS	30.	490.	266.	490.	(2000)	26.4	16.3	7.5	12.3
MINING ENGINEERS	0.	1.	1.	2.	(1994)	0.0	9999.0	1.9	9999.0
NUCLEAR ENGINEERS	0.	77.	37.	77.	(2000)	9999.0	30.6	8.2	9999.0
GEOLOGICAL ENGINEERS	29.	31.	29.	32.	(1978)	0.6	-1.9	0.8	0.2
PETROLEUM ENGINEERS	29.	25.	26.	32.	(1978)	0.6	-4.7	0.4	-0.7
OTHER ENGINEERS	0.	4.	5.	9.	(1991)	64.7	-3.6	3.7	10.3
ENGINEERS TOTAL	167.	2042.	1137.	2042.	(2000)	20.0	17.0	6.8	11.0
DESIGNERS & DRAFTSMEN	59.	755.	433.	755.	(2000)	23.7	15.1	6.8	11.2
SUPERVISORS & MANAGERS	54.	410.	225.	410.	(2000)	8.3	16.2	6.7	8.8
NON-MANUAL, TECHNICAL TOTAL	280.	3207.	1795.	3207.	(2000)	18.9	16.4	6.8	10.7
NON-MANUAL, NON-TECHNICAL	11.	604.	298.	604.	(2000)	53.3	26.5	8.0	18.3
NON-MANUAL TOTAL	290.	3812.	2093.	3812.	(2000)	20.8	17.5	7.0	11.3
PIPEFITTERS	123.	1240.	623.	1240.	(2000)	27.6	4.4	7.7	10.1
PIPEFITTER/WELDERS	70.	564.	289.	564.	(2000)	18.2	6.8	7.5	9.1
ELECTRICIANS	54.	1304.	640.	1304.	(2000)	28.2	22.8	8.1	14.2
BOILERMAKERS	44.	148.	84.	148.	(2000)	8.8	-5.6	8.1	5.2
BOILERMAKER/WELDERS	15.	92.	51.	92.	(2000)	1.7	14.0	7.8	8.0
IRON WORKERS	21.	697.	405.	878.	(1993)	27.7	44.1	4.8	15.7
CARPENTERS	23.	909.	436.	909.	(2000)	37.5	27.5	8.3	16.6
EQUIPMENT OPERATORS	117.	569.	335.	569.	(2000)	9.1	8.6	5.6	6.8
LINEMEN	24.	143.	160.	445.	(1993)	26.4	27.7	-2.4	7.8
TEAMSTERS & LABORERS	166.	1344.	719.	1344.	(2000)	12.2	14.2	6.6	9.1
OTHER	260.	548.	387.	548.	(2000)	3.4	0.7	3.9	3.1
MANUAL TOTAL	916.	7557.	4127.	7557.	(2000)	15.1	13.1	6.4	9.2
CONSTRUCTION MANPOWER TOTAL	1206.	11368.	6220.	11368.	(2000)	16.6	14.4	6.6	9.8

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A GROWTH RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

BECA TWO-DIGIT ENERGY SUPPLY PLANNING MODEL

Table 27

GROWTH IN ANNUAL COSTS (MILLION EPOUNDS JANUARY 1978)
FOR THE OPERATION AND MAINTENANCE OF ENRGY-RELATED FACILITIES
Egypt - Reference Case/Imports

CATEGORY	ANNUAL REQUIREMENTS				AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
NON-MANUAL TECHNICAL MANPOWER	0.	3.	1.	3. (2000)	0.0	0.0	9999.0	9999.0
NON-MANUAL NON-TECHNICAL MANPOWER	0.	0.	0.	0.	0.0	0.0	0.0	0.0
MANUAL MANPOWER	0.	1.	0.	1. (2000)	0.0	0.0	9999.0	9999.0
MANPOWER TOTAL	0.	5.	1.	5. (2000)	0.0	0.0	9999.0	9999.0
WOOD PRODUCTS (20)	0.	0.	0.	0. (2000)	0.0	0.0	9999.0	9999.0
CHEMICALS & ALLIED PROD. (27,28,30,32)	4.	19.	11.	19. (2000)	1.0	6.6	7.9	6.4
PETROLEUM PRODUCTS (31)	0.	0.	0.	0.	0.0	0.0	0.0	0.0
GLASS, CLAY & STONE PRODUCTS (35,36)	0.	0.	0.	0. (2000)	12.4	14.0	8.0	10.0
PRIMARY IRON & STEEL PRODUCTS (37)	0.	9.	3.	9. (2000)	31.3	3.5	19.4	17.7
PRIMARY NON-FERROUS METALS (38)	0.	1.	0.	1. (2000)	6.2	5.7	6.2	6.1
FABRICATED STRUCTURAL PRODUCTS (40) *	0.	2.	1.	2. (2000)	0.0	0.0	9999.0	9999.0
OTHER FABRICATED PRODUCTS (42)	1.	6.	3.	6. (2000)	5.6	8.2	10.5	9.2
MATERIALS TOTAL	5.	37.	17.	37. (2000)	3.3	6.6	10.4	8.4
HVAC HEATING & COOLING UNITS (52) ++	0.	0.	0.	0. (1982)	35.1	3.1	-0.3	5.6
HVAC DUCTWORK & ACCESSORIES (40) *	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TURBINES (43)	0.	5.	2.	5. (2000)	14.0	11.0	9.8	10.8
GAS WELDING SETS (47) ++	0.	0.	0.	0.	0.0	0.0	0.0	0.0
ELECTRIC WELDING SETS (53) **	0.	0.	0.	0.	0.0	0.0	0.0	0.0
CONSTRUCTION, MINING & OIL FIELD EQP (45)	0.	0.	0.	0. (2000)	15.7	10.2	6.3	8.7
MATERIALS HANDLING EQUIPMENT (46)	0.	0.	0.	0. (2000)	21.4	6.1	12.9	12.8
GENERAL INDUSTRY EQUIPMENT (49)	1.	4.	2.	4. (2000)	-0.8	2.6	6.9	4.7
INSTRUMENTATION & CONTROLS (62)	1.	4.	2.	4. (2000)	8.4	4.8	6.0	6.1
ELECTRICAL EQUIPMENT (53) **	1.	8.	4.	8. (2000)	4.9	7.9	8.6	7.8
FABRICATED PLATE PRODUCTS (40) *	0.	0.	0.	0.	0.0	0.0	0.0	0.0
EQUIPMENT TOTAL	4.	22.	11.	22. (2000)	5.5	6.4	7.9	7.2
ELECTRICITY	0.	0.	0.	0.	0.0	0.0	0.0	0.0
NATURAL GAS	0.	0.	0.	0.	0.0	0.0	0.0	0.0
WATER	0.	0.	0.	0.	0.0	0.0	0.0	0.0
UTILITY TOTAL	0.	0.	0.	0.	0.0	0.0	0.0	0.0
RENTS, ROYALTIES, ETC.	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TAXES	0.	0.	0.	0.	0.0	0.0	0.0	0.0
SERVICES & MISCELLANEOUS	1.	8.	4.	8. (2000)	10.5	6.3	7.2	7.6
ANNUAL OPERATING COST (EX FUEL)	11.	71.	34.	71. (2000)	5.1	6.5	9.6	8.2

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A GROWTH RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

#BEA (BUREAU OF ECONOMIC ANALYSIS) TWO-DIGIT CATEGORIES ARE IN PARENTHESES.

* PARTIAL BEA CATEGORY 40, TOTAL IS SUM OF 3 SEPARATE ENTRIES FOR CATEGORY 40.

++ PARTIAL BEA CATEGORY 52, REMAINDER IS PART OF MISCELLANEOUS ENTRY.

** PARTIAL BEA CATEGORY 53, TOTAL IS SUM OF 2 SEPARATE ENTRIES FOR CATEGORY 53.

6.0 SENSITIVITY OF RESOURCE REQUIREMENTS TO NUCLEAR-ELECTRIC LEVELS

An analysis of the sensitivity of the preceding results to DOE-specified Low Nuclear and Medium Nuclear cases is presented in this section. ESPM results are sensitive to the electric capacity mix specified since different types of power plants require differing quantities of the various capital, labor, materials and equipment resources.

6.1 Description of the Nuclear Cases

DOE defined a Low Nuclear case and a Medium Nuclear case to provide information on two alternative lower levels of nuclear power implementation in Egypt. In both cases, oil-fired steam or combined cycle power plants were assumed to substitute for decreases in nuclear power capacity. In addition, pumped storage hydro plants were reduced somewhat along with the nuclear capacities. The oil exports assumed for the Comparison Case were reduced by an amount equal to that required for the additional oil-fired plants of each of the sensitivity cases.

In order to make an estimate of resource requirements through 2000, the long lead times involved in power plant construction required specification of construction plans through 2010. It soon became apparent that for the Low Nuclear case, continuing the expansion of oil-fired generation at the same rate as that immediately preceding 2000 would deplete the remaining exportable oil production well before the year 2010, say by 2005.

A simple illustration will clarify the situation. The specified total oil exports in 2000, for this case, is about 580×10^{15} joules. Expansion of oil-fired capacity at the rate of 2000 MWe per year would require approximately 100×10^{15} joules additional fuel per year. In addition, the increase in oil consumption for other uses can be expected to be at least 25×10^{15} joules per year (less than the average yearly rate of increase specified between 1985 and 2000). Clearly, the exportable oil surplus would be exhausted in less than five years.

Nuclear power was chosen, after consultation with DOE, as the source of the additional generating capacity required after expansion of oil-fired capacity leaves no remaining exportable oil (assuming constant oil production). Solar- or coal-fired power plants would have been other possible alternatives. Table 28 shows the simulated generating capacity for those sources which were specified to vary by case. Thus, the whole installed capacity for the Low Nuclear case was specified to be only 1800 MWe in the year 2000, an additional 16,800 MWe are required in the 2000-2010 period, which is more than the 14,400 MWe of the Medium Nuclear case and nearly as much as the 21,600 MWe of the Comparison Case.

Table 28

CONSTRUCTION OF GENERATING CAPACITY (MWe)

	1978-2000			1978-2010		
	Comparison	Medium Nuclear	Low Nuclear	Comparison	Medium Nuclear	Low Nuclear
Nuclear	12,600	7,500	1,800	34,200	21,900	18,600
Oil-Fired/Combined Cycle	2,850	7,850	15,500	2,850	15,450	19,500
Pumped Storage	<u>2,500</u>	<u>2,500</u>	<u>500</u>	<u>6,500</u>	<u>5,000</u>	<u>4,000</u>
Total of the above	17,950	17,850	17,800	43,550	42,350	42,100

It was also assumed that the fuel required for the additional oil-fired power plants of the Medium Nuclear and Low Nuclear cases would be refined domestically. The sensitivity cases therefore required additional refineries as shown in Table 29.

Table 29

CONSTRUCTION OF REFINERIES (EACH 100 MBPD)

	<u>2000</u>	<u>2010</u>
Comparison Case	5	6
Medium Nuclear Case	6	9
Low Nuclear Case	8	11

6.2 Results of the Cases

Figures 1 and 2 summarize the computed annual and cumulative capital requirements for the nuclear cases. These figures add to the ESPM-desired results of the capital requirements for solar-electric generation, as determined by A.D. Little, Inc. These solar-electric estimates are given in Table 30. Details of the resource requirements computed by the ESPM are given in Table 31 for the Medium Nuclear Case and Table 32 for the Low Nuclear Case.

Table 30

ANNUAL CAPITAL REQUIREMENTS FOR RENEWABLE ENERGY SOURCES

(Millions of Egyptian Pounds, 1978)

<u>1985</u>	<u>1990</u>	<u>2000</u>
2.7	90	200

FIGURE 1
CAPITAL REQUIREMENTS OF THE EGYPTIAN ENERGY INDUSTRY*
(ANNUAL TIME PROFILE)

FIGURE 2
CAPITAL REQUIREMENTS OF THE EGYPTIAN ENERGY INDUSTRY*
(CUMULATIVE 1978-2000)

ENERGY SUPPLY SYSTEM INPUTS
=====

VALUES IN 10E15 JOULES	1975	1982	1985	2000	AVERAGE ANNUAL GROWTH
DOMESTIC PETROLEUM PRODUCTION	448.99	1865.50	2100.82	2100.82	6.37X
DOMESTIC NATURAL GAS PRODUCTION	14.39	125.42	125.42	125.42	9.05X
DOMESTIC COAL PRODUCTION	0.0	0.0	8.00	8.00	-----
NUCLEAR POWER INPUTS	0.0	0.0	0.0	515.42	-----
HYDRO-ELECTRIC POWER INPUTS	78.03	89.97	105.32	99.66	0.98X
GEOTHERMAL GENERATION INPUT	0.0	0.0	0.0	1.29	-----
INPUTS TO SOLAR-ELECTRIC PLANTS	0.0	0.0	0.0	36.70	-----
INPUTS TO BIOGAS PLANTS	0.0	0.0	0.0	18.00	-----
SOLAR ENERGY (NON-ELECTRIC)	0.0	0.0	0.21	10.00	-----
ENERGY FROM CROP RESIDUES	172.00	190.00	200.00	250.00	1.51X
ENERGY FROM WOOD (FOR MEAT)	1.50	1.50	1.50	1.50	0.0 X
ENERGY FROM ANIMAL WASTES	43.00	45.00	46.00	50.00	0.61X
ENERGY FROM HUMAN AND ANIMAL POWER	6.60	7.90	8.30	11.00	2.06X
DOMESTIC ENERGY PRODUCTION	768.50	2325.28	2595.57	3227.79	5.93X
IMPORTED COAL	30.00	44.00	47.00	216.00	8.22X
PETROLEUM IMPORTS	129.45	80.00	123.94	110.63	-0.63X
ENERGY IMPORTS	159.45	124.00	170.94	326.63	2.91X
TOTAL ENERGY EXTRACTION AND IMPORTATION	923.95	2449.28	2766.51	3554.42	5.54X
TOTAL PETROLEUM EXPORTS	243.98	1395.00	1590.59	977.48	5.71X
ENERGY EXPORTS	243.98	1395.00	1590.59	977.48	5.71X
PRODUCTION AND IMPORTS FOR DOMESTIC CONSUMPTION	679.97	1054.28	1175.92	2576.94	5.47X

ESPM-Egypt

ENERGY SUPPLY SYSTEM OUTPUTS
=====

Table 31 (Continued)

VALUES IN 10E15 JOULES	1975	1982	1985	2000	AVERAGE ANNUAL GROWTH
OIL FOR DIRECT USE	264.13	355.17	425.56	823.98	4.66%
HIGH-BTU GAS FOR DIRECT USE	13.67	119.15	69.47	33.92	3.70%
COAL FOR DIRECT USE	30.00	44.00	55.00	224.00	8.37%
ELECTRICITY FOR CONSUMPTION	29.86	66.76	98.02	316.75	9.91%
SOLAR ENERGY (NON-ELECTRIC)	0.0	0.0	0.21	10.00	-----
ENERGY FROM CROP RESIDUES	172.00	190.00	200.00	250.00	1.51%
ENERGY FROM WOOD (FOR HEAT)	1.50	1.50	1.50	1.50	0.0 %
ENERGY FROM ANIMAL WASTES	43.00	45.00	46.00	50.00	0.61%
ENERGY FROM HUMAN AND ANIMAL POWER	6.60	7.90	8.30	11.00	2.06%
DOMESTIC ENERGY CONSUMPTION	560.76	829.48	904.06	1721.15	4.59%
TOTAL PETROLEUM EXPORTS	243.98	1395.00	1590.59	977.48	5.71%
ENERGY EXPORTS	243.98	1395.00	1590.59	977.48	5.71%
DOMESTIC CONSUMPTION AND EXPORTS	804.74	2224.48	2494.65	2698.63	4.96%

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 31 (Continued)

ELECTRIC GENERATING CAPACITY (MWE)

EGYPT - MEDIUM NUCLEAR

	1975	1982	1985	2000	AVERAGE ANNUAL GROWTH
COAL AND COAL/WASTE PLANTS	0.0	0.0	0.0	0.0	-----
OIL-STEAM PLANTS	1420.0	2904.0	2868.0	6117.0	6.02%
GAS-STEAM PLANTS	0.0	0.0	0.0	0.0	-----
LOW-BTU GAS-STEAM PLANTS	0.0	0.0	0.0	0.0	-----
GAS TURBINE PLANTS	137.0	437.0	437.0	0.0	-----
COMBINED CYCLE PLANTS	0.0	0.0	900.0	1800.0	-----
FUEL CELLS	0.0	0.0	0.0	0.0	-----
NUCLEAR POWER PLANTS	0.0	0.0	0.0	7500.0	-----
CONVENTIONAL HYDRO PLANTS	2445.0	2445.0	2445.0	2603.0	0.25%
PUMPED STORAGE PLANTS	0.0	0.0	0.0	2400.0	-----
GEOTHERMAL PLANTS	0.0	0.0	0.0	20.0	-----
TOTAL CAPACITY	4002.0	5786.0	6650.0	20440.0	6.74%

HECHTEL ENERGY SUPPLY PLANNING MODEL

Table 31 (Continued)

SCHEDULE OF ANNUAL ENERGY FACILITIES ADDITIONS TO SUPPLY FUEL MIX: EGYPT - MEDIUM NUCLEAR 1976-2010

FACILITY NAME	1975 TOTALS	1976	1977	1978	1979	1980	1981	1982	TOTAL ADDED (1978- 1982)
1 ONSHORE PRIMARY OIL RECOVERY-(1,000 MBPD)	66.0	17*	17*	17*	18*	17	18	17	87
2 ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	0.0	0	0	0	0	0	0	0	0
3 ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	0.0	0	0	0	0	0	0	0	0
4 OFFSHORE OIL RECOVERY (12.5 MBPD)	11.8	3*	3*	3*	3*	4*	3	3	16
6 HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	0.0	0	0	0	0	0	0	0	0
7 LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	2.0	0	0	0	0	0	0	1	1
19 ONSHORE CONVENTIONAL GAS RECOVERY (100 MMCF/D)	0.4	1*	0	0	1*	0	0	0	1
20 ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	0.0	0	0	0	0	0	0	0	0
21 OFFSHORE GAS RECOVERY (25 MMCF/D)	-0.0	0	0	0	0	0	0	0	0
24 LNG EXPORT (3030 MMCF/D)	0.0	0	0	0	0	0	0	0	0
27 UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	0.0	0	0	0	0	0	0	0	0
37 SURFACE URANIUM MINE (275.4 M TONNES/Y)	0.0	0	0	0	0	0	0	0	0
38 UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	0.0	0	0	0	0	0	0	0	0
39 URANIUM MILL (275.4 M TONNES/Y)	0.0	0	0	0	0	0	0	0	0
42 LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	0.0	0	0	0	0	0	0	0	0
43 LWR FUEL FABRICATION - PU RECYCLE (150 MTH/Y)	0.0	0	0	0	0	0	0	0	0
49 HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	0.0	0	0	0	0	0	0	0	0
50 OIL-FIRED POWER PLANT (800 MWE)	0.0	0	0	0	0	0	0	0	0
51 OIL-FIRED POWER PLANT (600 MWE)	0.0	0	0	0	0	1*	1*	0	2
52 OIL-FIRED POWER PLANT (450 MWE)	3.2	0	0	0	1*	0	0	0	1
53 COAL FIRED POWER PLANT-LOW BTU (800 MWE)	0.0	0	0	0	0	0	0	0	0
54 COAL FIRED POWER PLANT-HIGH BTU (800 MWE)	0.0	0	0	0	0	0	0	0	0
55 COAL FIRED POWER PLANT-LOW BTU (600 MWE)	0.0	0	0	0	0	0	0	0	0
56 COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	0.0	0	0	0	0	0	0	0	0
59 HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	0.0	0	0	0	0	0	0	0	0
60 HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	0.0	0	0	0	0	0	0	0	0
61 COMBINED CYCLE POWER PLANT (400 MWE)	0.0	0	0	0	0	0	0	0	0
62 GAS TURBINE POWER PLANT (133 MWE)	1.0	0	1*	1*	0	0	0	0	1
63 FUEL CELLS (26 MWE)	0.0	0	0	0	0	0	0	0	0
64 LIGHT WATER REACTOR (LWR) (1200 MWE)	0.0	0	0	0	0	0	0	0	0
65 LIGHT WATER REACTOR (LWR) (900 MWE)	0.0	0	0	0	0	0	0	0	0
66 LIGHT WATER REACTOR (LWR) (600 MWE)	0.0	0	0	0	0	0	0	0	0
67 DAM & HYDROELECTRIC POWER PLANT (200 MWE)	12.2	0	0	0	0	0	0	0	0
68 PUMPED STORAGE (500 MWE)	0.0	0	0	0	0	0	0	0	0
69 GEOTHERMAL POWER COMPLEX (200 MWE)	0.0	0	0	0	0	0	0	0	0

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 31 (Continued)

SCHEDULE OF ANNUAL ENERGY FACILITIES ADDITIONS TO SUPPLY FUEL MIX: EGYPT - MEDIUM NUCLEAR

1976-2010

FACILITY NAME	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	TOTAL ADDED (1978- 1993)
1 ONSHORE PRIMARY OIL RECOVERY-(1,000 MBPD)	17	16	16	14	13	14	13	13	14	13	14	244
2 ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	0	0	0	0	0	0	0	0	0	0	0	0
3 ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	0	0	0	0	0	0	0	0	0	0	0	0
4 OFFSHORE OIL RECOVERY (12.5 MBPD)	3	3	3	3	2	3	2	3	2	3	2	45
6 HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	0	0	0	0	0	0	0	0	0	0	0	0
7 LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	0	0	0	1	0	0	0	1	0	0	0	3
19 ONSHORE CONVENTIONAL GAS RECOVERY (100 MMCF/D)	1	0	0	0	0	1	0	0	0	0	1	4
20 ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0	0
21 OFFSHORE GAS RECOVERY (25 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0	0
24 LNG EXPORT (3030 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0	0
27 UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0	0
37 SURFACE URANIUM MINE (275.4 M TONNES/Y)	0	0	0	0	0	0	0	1	0	0	0	1
38 UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0	0
39 URANIUM MILL (275.4 M TONNES/Y)	0	0	0	0	0	0	0	1	0	0	0	1
42 LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	0	0	0	0	0	0	0	0	0	0	0	0
43 LWR FUEL FABRICATION - PU RECYCLE (150 MTH/Y)	0	0	0	0	0	0	0	0	0	0	0	0
49 HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	0	0	0	0	0	0	0	0	0	0	0	0
50 OIL-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
51 OIL-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	1	0	0	0	0	0	3
52 OIL-FIRED POWER PLANT (450 MWE)	0	0	0	0	0	0	0	0	0	0	0	1
53 COAL FIRED POWER PLANT-LOW BTU (800 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
54 COAL FIRED POWER PLANT-HIGH BTU (800 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
55 COAL FIRED POWER PLANT-LOW BTU (600 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
56 COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
59 HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
60 HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
61 COMBINED CYCLE POWER PLANT (400 MWE)	0	1	1	0	0	0	0	0	1	0	0	3
62 GAS TURBINE POWER PLANT (133 MWE)	0	0	0	0	0	0	0	0	0	0	0	1
63 FUEL CELLS (26 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
64 LIGHT WATER REACTOR (LWR) (1200 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
65 LIGHT WATER REACTOR (LWR) (900 MWE)	0	0	0	0	0	0	0	1	0	1	1	3
66 LIGHT WATER REACTOR (LWR) (600 MWE)	0	0	0	1	1	0	0	0	0	0	0	2
67 DAM & HYDROELECTRIC POWER PLANT (200 MWE)	0	0	0	0	0	1	0	0	0	0	0	1
68 PUMPED STORAGE (500 MWE)	0	0	0	0	0	0	0	0	1	0	0	1
69 GEOTHERMAL POWER COMPLEX (200 MWE)	0	0	0	0	0	0	0	0	0	0	0	0

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 31 (Continued)

SCHEDULE OF ANNUAL ENERGY FACILITIES ADDITIONS TO SUPPLY FUEL MIX: EGYPT - MEDIUM NUCLEAR

1976-2010

FACILITY NAME	1994	1995	1996	1997	1998	1999	2000	TOTAL ADDED (1978- 2000)
1 ONSHORE PRIMARY OIL RECOVERY-(1,000 MBPD)	13	14	14	14	14	15	14	342
2 ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	0	0	0	0	0	0	0	0
3 ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	0	0	0	0	0	0	0	0
4 OFFSHORE OIL RECOVERY (12.5 MBPD)	3	2	3	3	2	3	3	64
6 HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	0	0	0	0	0	0	0	0
7 LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	1	0	0	1	0	0	1	6
19 ONSHORE CONVENTIONAL GAS RECOVERY (100 MMCF/D)	0	0	0	0	1	0	0	5
20 ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	0	0	0	0	0	0	0	0
21 OFFSHORE GAS RECOVERY (25 MMCF/D)	0	0	0	0	0	0	0	0
24 LNG EXPORT (3030 MMCF/D)	0	0	0	0	0	0	0	0
27 UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	0	0	0	0	0	0	0	0
37 SURFACE URANIUM MINE (275.4 M TONNES/Y)	0	1	0	0	0	0	0	2
38 UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	0	0	0	0	0	0	0	0
39 URANIUM MILL (275.4 M TONNES/Y)	0	1	0	0	0	0	0	2
42 LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	0	0	0	0	0	0	0	0
43 LWR FUEL FABRICATION - PU RECYCLE (150 MTH/Y)	0	0	0	0	0	0	0	0
49 HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	0	0	0	0	0	0	0	0
50 OIL-FIRED POWER PLANT (800 MWE)	1	0	0	0	0	1	0	2
51 OIL-FIRED POWER PLANT (600 MWE)	0	0	0	1	1	1	1	7
52 OIL-FIRED POWER PLANT (450 MWE)	0	0	0	0	0	0	0	1
53 COAL FIRED POWER PLANT-LOW BTU (800 MWE)	0	0	0	0	0	0	0	0
54 COAL FIRED POWER PLANT-HIGH BTU (800 MWE)	0	0	0	0	0	0	0	0
55 COAL FIRED POWER PLANT-LOW BTU (600 MWE)	0	0	0	0	0	0	0	0
56 COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	0	0	0	0	0	0	0	0
59 HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0
60 HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	0
61 COMBINED CYCLE POWER PLANT (400 MWE)	0	1	0	0	0	0	0	4
62 GAS TURBINE POWER PLANT (133 MWE)	0	0	0	0	0	0	0	1
63 FUEL CELLS (26 MWE)	0	0	0	0	0	0	0	0
64 LIGHT WATER REACTOR (LWR) (1200 MWE)	0	0	1	1	1	0	0	3
65 LIGHT WATER REACTOR (LWR) (900 MWE)	0	0	0	0	0	0	0	0
66 LIGHT WATER REACTOR (LWR) (600 MWE)	0	0	0	0	0	0	0	0
67 DAM & HYDROELECTRIC POWER PLANT (200 MWE)	0	0	0	0	0	0	0	0
68 PUMPED STORAGE (500 MWE)	1	1	0	0	1	0	1	5
69 GEOTHERMAL POWER COMPLEX (200 MWE)	0	0	0	0	0	0	0	0

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

Table 31 (Continued)

BECHTEL ENERGY SUPPLY PLANNING MODEL

SCHEDULE OF ANNUAL ENERGY FACILITIES ADDITIONS TO SUPPLY FUEL MIX: EGYPT - MEDIUM NUCLEAR

1976-2010

FACILITY NAME	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL ADDED (1978- 2010)
1 ONSHORE PRIMARY OIL RECOVERY-(1,000 MBPD)	14	14	14	14	14	14	14	14	14	14	482
2 ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	0	0	0	0	0	0	0	0	0	0	0
3 ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	0	0	0	0	0	0	0	0	0	0	0
4 OFFSHORE OIL RECOVERY (12.5 MBPD)	3	3	3	3	3	3	3	3	3	3	94
6 HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	0	0	0	0	0	0	0	0	0	0	0
7 LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	0	0	1	0	0	1	0	1	0	0	9
19 ONSHORE CONVENTIONAL GAS RECOVERY (100 MMCF/D)	0	0	0	0	0	1	0	0	0	0	6
20 ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0
21 OFFSHORE GAS RECOVERY (25 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0
24 LNG EXPORT (3030 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0
27 UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0
37 SURFACE URANIUM MINE (275.4 M TONNES/Y)	0	0	0	1	0	0	0	0	0	1	4
38 UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0
39 URANIUM MILL (275.4 M TONNES/Y)	0	0	0	1	0	0	0	0	0	1	4
42 LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	0	0	0	0	0	0	0	0	0	0	0
43 LWR FUEL FABRICATION - PU RECYCLE (150 MTH/Y)	0	0	0	0	0	0	0	0	0	0	0
49 HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	0	0	0	0	0	0	0	0	0	0	0
50 OIL-FIRED POWER PLANT (800 MWE)	0	0	0	1	0	0	0	0	1	0	4
51 OIL-FIRED POWER PLANT (600 MWE)	1	1	1	1	1	1	1	1	1	1	17
52 OIL-FIRED POWER PLANT (450 MWE)	0	0	0	0	0	0	0	0	0	0	1
53 COAL FIRED POWER PLANT-LOW BTU (800 MWE)	0	0	0	0	0	0	0	0	0	0	0
54 COAL FIRED POWER PLANT-HIGH BTU (800 MWE)	0	0	0	0	0	0	0	0	0	0	0
55 COAL FIRED POWER PLANT-LOW BTU (600 MWE)	0	0	0	0	0	0	0	0	0	0	0
56 COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	0	0	0	0	0	0	0	0	0	0	0
59 HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0	0	0	0
60 HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	0	0	0	0
61 COMBINED CYCLE POWER PLANT (400 MWE)	0	0	0	0	0	0	0	0	0	0	4
62 GAS TURBINE POWER PLANT (133 MWE)	0	0	0	0	0	0	0	0	0	0	1
63 FUEL CELLS (26 MWE)	0	0	0	0	0	0	0	0	0	0	0
64 LIGHT WATER REACTOR (LWR) (1200 MWE)	1	1	0	1	1	1	1	2	2	2	15
65 LIGHT WATER REACTOR (LWR) (900 MWE)	0	0	0	0	0	0	0	0	0	0	3
66 LIGHT WATER REACTOR (LWR) (600 MWE)	0	0	0	0	0	0	0	0	0	0	2
67 DAM & HYDROELECTRIC POWER PLANT (200 MWE)	0	0	0	0	0	0	0	0	0	0	1
68 PUMPED STORAGE (500 MWE)	0	1	0	1	0	1	0	1	0	1	10
69 GEOTHERMAL POWER COMPLEX (200 MWE)	0	0	0	0	0	0	0	0	0	0	0

- THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 31 (Continued)

SCHEDULE OF ANNUAL TRANSPORTATION ADDITIONS TO SUPPLY FUEL MIX: EGYPT - MEDIUM NUCLEAR

1976-2010

FACILITY NAME	1975 TOTALS	1976	1977	1978	1979	1980	1981	1982	TOTAL ADDED (1978- 1982)
1 CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	0.0	0	0	0	0	0	0	0	0
3 OIL TANKER (90,000 DWT; 620,000 B)	0.0	0	0	0	0	0	0	0	0
4 OIL BARGES (90,000 BBL)	3.0	1*	2*	1*	1	1	0	1	4
5 OIL TANK TRUCK (226 BBL)	290.3	129*	130*	132*	129	129	135	149	674
6 PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	0.5	0	0	0	0	0	0	0	0
7 HOT OIL PIPELINE (40 MB/D, 80.5 KM)	2.4	0	1*	0	0	0	0	0	0
8 REFINED PRODUCTS BULK STATION (69 MB/D)	1.6	0	0	1*	0	0	0	0	1
9 RAIL LINE (64.4 KM, SINGLE TRACK)	0.0	0	0	0	0	0	0	0	0
10 MIXED TRAIN (6556 TONNES)	2.3	0	0	1*	0	0	0	1	2
11 COAL UNIT TRAIN (9,528 TONNES)	0.0	0	0	0	0	0	0	0	0
12 COAL SLURRY PIPELINE (22.69 MM TONNES/Y, 241.4 KM)	0.0	0	0	0	0	0	0	0	0
13 COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	0.0	0	0	0	0	0	0	0	0
14 COAL SLURRY DEWATERING (22.69 MM TONNES/Y)	0.0	0	0	0	0	0	0	0	0
15 COAL BARGES (19,048 TONNES)	0.2	0	0	0	0	0	0	0	0
16 COAL TRUCK (22.7 TONNES)	4.8	1*	1*	1*	1	1	1	1	5
17 GAS PIPELINE (.87 BSCF/D, 241.4 KM)	0.0	0	0	0	0	0	0	0	0
18 GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	0.7	2*	1*	2*	0	1*	0	0	3
20 LNG TANKER (2.6 BCF)	0.0	0	0	0	0	0	0	0	0
21 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	0.5	0	0	0	0	1	0	0	1
22 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	0.0	0	0	0	0	0	0	0	0
23 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	0.2	0	0	0	0	0	0	0	0
24 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	0.0	0	0	0	0	0	0	0	0
25 +-400 KVDC TRANSMISSION LINE (1500 MWE, 1287 KM)	0.0	0	0	0	0	0	0	0	0
26 ELECTRICITY DISTRIBUTION-AERIAL LINES (131.6 MWE)	9.0	1*	1*	1*	2*	2*	3	2	10

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

HECHIEL ENERGY SUPPLY PLANNING MODEL

Table 31 (Continued)

SCHEDULE OF ANNUAL TRANSPORTATION ADDITIONS TO SUPPLY FUEL MIX: EGYPT - MEDIUM NUCLEAR 1976-2010

FACILITY NAME	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	TOTAL ADDED (1978- 1993)
1 CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0	0
3 OIL TANKER (90,000 DWT; 620,000 B)	0	0	0	0	0	0	0	0	0	0	0	0
4 OIL BARGES (90,000 BBL)	0	1	0	1	0	0	0	1	0	0	0	7
5 OIL TANK TRUCK (226 BBL)	167	178	178	176	181	186	187	188	187	185	181	2668
6 PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	1	0	0	0	0	0	0	0	0	0	0	1
7 HOT OIL PIPELINE (40 MB/D, 80.5 KM)	1	0	0	0	1	0	0	0	1	0	0	3
8 REFINED PRODUCTS BULK STATION (69 MB/D)	0	0	0	0	1	0	0	0	0	1	0	3
9 RAIL LINE (64.4 KM, SINGLE TRACK)	0	0	0	0	0	0	0	0	0	0	0	0
10 MIXED TRAIN (6556 TONNES)	0	0	1	0	1	0	1	1	1	0	1	8
11 COAL UNIT TRAIN (9,528 TONNES)	0	0	0	0	0	0	0	0	0	0	0	0
12 COAL SLURRY PIPELINE (22.69 MM TONNES/Y, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0	0
13 COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0	0
14 COAL SLURRY DEMATERING (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0	0
15 COAL BARGES (19,048 TONNES)	0	0	0	0	0	0	0	1	0	0	0	1
16 COAL TRUCK (22.7 TONNES)	2	1	2	2	2	3	3	3	3	3	4	33
17 GAS PIPELINE (.87 BSCF/D, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0	0
18 GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	0	0	0	0	0	0	0	0	0	0	0	3
20 LNG TANKER (2.6 BCF)	0	0	0	0	0	0	0	0	0	0	0	0
21 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	0	0	0	1	0	0	0	1	0	0	0	3
22 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	0	0	0	0	0	0	0	0	0	0	0	0
23 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	1	0	0	0	0	0	0	0	0	0	0	1
24 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	0	0	0	0	0	0	0	0	0	0	0	0
25 +-400 KVDC TRANSMISSION LINE (1500 MWE, 1287 KM)	0	0	0	0	0	0	0	0	0	0	0	0
26 ELECTRICITY DISTRIBUTION-AERIAL LINES (131.6 MWE)	3	4	3	4	3	4	4	4	5	4	5	53

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 31 (Continued)

SCHEDULE OF ANNUAL TRANSPORTATION ADDITIONS TO SUPPLY FUEL MIX: EGYPT - MEDIUM NUCLEAR 1976-2010

FACILITY NAME	1994	1995	1996	1997	1998	1999	2000	TOTAL ADDED (1978- 2000)
1 CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	0	0	0	0	0	0	0	0
3 OIL TANKER (90,000 DWT; 620,000 B)	0	0	0	0	0	0	0	0
4 OIL BARGES (90,000 BBL)	0	0	0	0	0	0	0	7
5 OIL TANK TRUCK (226 BBL)	174	168	159	148	137	123	108	3685
6 PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	0	0	0	0	1	0	0	2
7 HOT OIL PIPELINE (40 MB/D, 80.5 KM)	1	0	1	0	0	1	0	6
8 REFINED PRODUCTS BULK STATION (69 MB/D)	0	1	0	0	0	1	0	5
9 RAIL LINE (64.4 KM, SINGLE TRACK)	0	0	0	0	0	0	0	0
10 MIXED TRAIN (6556 TONNES)	1	1	2	1	1	1	2	17
11 COAL UNIT TRAIN (9,528 TONNES)	0	0	0	0	0	0	0	0
12 COAL SLURRY PIPELINE (22.69 MM TONNES/Y, 241.4 KM)	0	0	0	0	0	0	0	0
13 COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0
14 COAL SLURRY DEWATERING (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0
15 COAL BARGES (19,048 TONNES)	0	0	0	0	0	0	0	1
16 COAL TRUCK (22.7 TONNES)	4	4	5	5	5	5	6	67
17 GAS PIPELINE (.87 BSCF/D, 241.4 KM)	0	0	0	0	0	0	0	0
18 GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	0	0	0	0	0	0	0	3
20 LNG TANKER (2.6 BCF)	0	0	0	0	0	0	0	0
21 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	1	0	0	0	1	0	0	5
22 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	0	0	0	0	0	0	0	0
23 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	1	0	0	0	0	0	0	2
24 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	0	0	0	0	0	0	0	0
25 +-400 KVDC TRANSMISSION LINE (1500 MWE, 1287 KM)	0	0	0	0	0	0	0	0
26 ELECTRICITY DISTRIBUTION-AERIAL LINES(131.6MWE)	4	5	5	5	6	5	6	89

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 3.1 (Continued)

SCHEDULE OF ANNUAL TRANSPORTATION ADDITIONS TO SUPPLY FUEL MIX: EGYPT - MEDIUM NUCLEAR

1976-2010

FACILITY NAME	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL ADDED (1978- 2010)
1 CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0
3 OIL TANKER (90,000 DWT; 620,000 B)	0	0	0	0	0	0	0	0	0	0	0
4 OIL BARGES (90,000 BBL)	0	0	0	0	0	0	0	0	0	0	7
5 OIL TANK TRUCK (226 BBL)	108	108	108	108	108	108	108	108	108	108	4765
6 PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	0	0	0	0	0	1	0	0	0	0	3
7 HOT OIL PIPELINE (40 MB/D, 80.5 KM)	0	0	1	0	0	1	0	0	1	0	9
8 REFINED PRODUCTS BULK STATION (69 MB/D)	0	0	1	0	0	1	0	0	1	0	8
9 RAIL LINE (64.4 KM, SINGLE TRACK)	0	0	0	0	0	0	0	0	0	0	0
10 MIXED TRAIN (6556 TONNES)	2	2	2	2	2	2	2	2	2	2	37
11 COAL UNIT TRAIN (9,528 TONNES)	0	0	0	0	0	0	0	0	0	0	0
12 COAL SLURRY PIPELINE (22.69 MM TONNES/Y, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0
13 COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0
14 COAL SLURRY DEWATERING (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0
15 COAL BARGES (19,048 TONNES)	0	0	0	0	0	0	0	0	0	0	1
16 COAL TRUCK (22.7 TONNES)	6	6	6	6	6	6	6	6	6	6	127
17 GAS PIPELINE (.87 BSCF/D, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0
18 GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	0	0	0	0	0	0	0	0	0	0	3
20 LNG TANKER (2.6 BCF)	0	0	0	0	0	0	0	0	0	0	0
21 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	0	0	0	0	0	1	0	0	0	0	6
22 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	0	0	0	0	0	0	0	0	0	0	0
23 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	0	0	0	0	0	0	0	0	0	0	2
24 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	0	0	0	0	0	0	0	0	0	0	0
25 +-400 KVDC TRANSMISSION LINE (1500 MWE, 1287 KM)	0	0	0	0	0	0	0	0	0	0	0
26 ELECTRICITY DISTRIBUTION-AERIAL LINES (131.6 MWE)	6	6	6	6	6	6	6	6	6	6	149

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

HECHTEL ENERGY SUPPLY PLANNING MODEL

CUMULATIVE CAPITAL REQUIREMENTS (MILLION POUNDS, JAN 1978) OF THE ENERGY INDUSTRY
BY FACILITY GROUPING
EGYPT - MEDIUM NUCLEAR

Table 31 (Continued)

FACILITY	CONSTRUCTION COSTS	OWNER'S COSTS PRIOR TO STARTUP	TOTAL
OIL			
EXPLORATION, DEVELOPMENT, & PRODUCTION	643.2	98.9	742.1
REFINING AND PROCESSING	436.4	70.0	506.4
PIPELINES	25.9	4.4	30.4
TANKERS, BARGES, TRUCKS	116.8	20.4	137.2
BULK STATIONS	1.9	0.3	2.3
OTHER	0.0	0.0	0.0
TOTAL OIL	1224.2	194.1	1418.3
OIL SHALE	0.0	0.0	0.0
GAS			
EXPLORATION, DEVELOPMENT, & PRODUCTION	7.3	1.1	8.4
GEOPRESSURED METHANE	0.0	0.0	0.0
PIPELINES	0.0	0.0	0.0
LNG TANKERS	0.0	0.0	0.0
DISTRIBUTION	12.8	2.2	15.0
OTHER	0.0	0.0	0.0
TOTAL GAS	20.1	3.3	23.4
COAL			
UNDERGROUND MINING	0.0	0.0	0.0
SURFACE MINING	0.0	0.0	0.0
RAIL	11.1	1.9	12.9
PIPELINES	0.0	0.0	0.0
BARGES, TRUCKS	0.6	0.1	0.7
TOTAL COAL	11.6	2.0	13.6
COAL SYNTHETICS			
LIQUEFACTION	0.0	0.0	0.0
METHANOL	0.0	0.0	0.0
SOLVENT REFINING	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.0	0.0	0.0
TOTAL SYNTHETICS	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	0.0	0.0	0.0
SOLAR	0.0	0.0	0.0
ELECTRIC UTILITIES			
COAL-FIRED	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.0	0.0	0.0
NUCLEAR	687.7	77.4	765.2
HYDRO & PUMPED STORAGE	30.9	3.2	34.1
OIL & GAS	353.4	39.9	393.3
GEOTHERMAL	0.0	0.0	0.0
TOTAL GENERATION	1072.0	120.6	1192.6
TRANSMISSION	270.8	31.4	302.2
DISTRIBUTION	233.5	26.6	260.1
TOTAL UTILITIES	1576.3	178.6	1754.9
TOTAL ENERGY INDUSTRY	2832.2	378.0	3210.2

BECHTEL ENERGY SUPPLY PLANNING MODEL

CUMULATIVE CAPITAL REQUIREMENTS (MILLION POUNDS, JAN 1978) OF THE ENERGY INDUSTRY
BY FACILITY GROUPING
EGYPT - MEDIUM NUCLEAR

(1978-2000)

FACILITY	CONSTRUCTION COSTS	OWNER'S COSTS PRIOR TO STARTUP	TOTAL
OIL			
EXPLORATION, DEVELOPMENT, & PRODUCTION	1665.8	256.2	1922.0
REFINING AND PROCESSING	1396.4	224.0	1620.4
PIPELINES	92.9	15.8	108.7
TANKERS, BARGES, TRUCKS	328.8	57.5	386.4
BULK STATIONS	23.2	3.9	27.2
OTHER	0.0	0.0	0.0
TOTAL OIL	3507.1	557.5	4064.6
OIL SHALE	0.0	0.0	0.0
GAS			
EXPLORATION, DEVELOPMENT, & PRODUCTION	20.2	3.1	23.3
GEOPRESSURED METHANE	0.0	0.0	0.0
PIPELINES	0.0	0.0	0.0
LNG TANKERS	0.0	0.0	0.0
DISTRIBUTION	12.8	2.2	15.0
OTHER	0.0	0.0	0.0
TOTAL GAS	33.0	5.3	38.3
COAL			
UNDERGROUND MINING	0.0	0.0	0.0
SURFACE MINING	0.0	0.0	0.0
RAIL	62.7	10.7	73.3
PIPELINES	0.0	0.0	0.0
BARGES, TRUCKS	8.1	1.4	9.5
TOTAL COAL	70.8	12.0	82.9
COAL SYNTHETICS			
LIQUEFACTION	0.0	0.0	0.0
METHANOL	0.0	0.0	0.0
SOLVENT REFINING	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.0	0.0	0.0
TOTAL SYNTHETICS	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	40.2	6.0	46.2
SOLAR	0.0	0.0	0.0
ELECTRIC UTILITIES			
COAL-FIRED	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.0	0.0	0.0
NUCLEAR	4536.5	510.8	5047.3
HYDRO & PUMPED STORAGE	857.2	90.0	947.2
OIL & GAS	1639.9	185.3	1825.2
GEOTHERMAL	0.0	0.0	0.0
TOTAL GENERATION	7033.6	786.1	7819.8
TRANSMISSION	599.9	69.6	669.5
DISTRIBUTION	943.5	107.6	1051.1
TOTAL UTILITIES	8577.1	963.3	9540.4
TOTAL ENERGY INDUSTRY	12228.2	1544.1	13772.3

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 31 (Continued)

GROWTH IN REQUIREMENTS FOR CONSTRUCTOR COST TOTAL ** (MILLION POUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
FOR THE EGYPT - MEDIUM NUCLEAR CASE

CATEGORY	ANNUAL REQUIREMENTS				AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK YEAR	1978- 1980	1980- 1985	1985- 2000	1976- 2000
OIL								
EXPLORATION, DEVELOPMENT, & PRODUCTION	82.	73.	72.	88. (1979)	0.6	-3.9	0.4	-0.5
REFINING AND PROCESSING	0.	65.	61.	87. (1980)	9999.0	-12.9	2.7	9999.0
PIPELINES	9.	0.	4.	21. (1982)	-100.0	9999.0	-100.0	-100.0
TANKERS, BARGES, TRUCKS	14.	9.	14.	19. (1990)	0.0	0.5	-3.3	-2.0
BULK STATIONS	2.	0.	1.	4. (1977)	-100.0	9999.0	-100.0	-100.0
OTHER	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TOTAL OIL	107.	147.	152.	187. (1998)	12.6	-6.8	0.8	1.3
OIL SHALE	0.	0.	0.	0.	0.0	0.0	0.0	0.0
GAS								
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	0.	1.	3. (1978)	0.0	0.0	0.0	0.0
GEOPRESSURED METHANE	0.	0.	0.	0.	0.0	0.0	0.0	0.0
PIPELINES	0.	0.	0.	0.	0.0	0.0	0.0	0.0
LNG TANKERS	0.	0.	0.	0.	0.0	0.0	0.0	0.0
DISTRIBUTION	21.	0.	1.	21. (1976)	-100.0	0.0	0.0	-100.0
OTHER	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TOTAL GAS	21.	0.	1.	21. (1976)	-100.0	0.0	0.0	-100.0
COAL								
UNDERGROUND MINING	0.	0.	0.	0.	0.0	0.0	0.0	0.0
SURFACE MINING	0.	0.	0.	0.	0.0	0.0	0.0	0.0
RAIL	0.	7.	3.	7. (1996)	0.0	9999.0	4.7	9999.0
PIPELINES	0.	0.	0.	0.	0.0	0.0	0.0	0.0
BARGES, TRUCKS	0.	0.	0.	4. (1990)	0.0	14.9	7.6	7.8
TOTAL COAL	0.	8.	3.	8. (1990)	0.0	130.7	4.8	22.6
COAL SYNTHETICS								
LIQUEFACTION	0.	0.	0.	0.	0.0	0.0	0.0	0.0
METHANOL	0.	0.	0.	0.	0.0	0.0	0.0	0.0
SOLVENT REFINING	0.	0.	0.	0.	0.0	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.0	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TOTAL SYNTHETICS	0.	0.	0.	0.	0.0	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	0.	5.	2.	6. (1989)	0.0	0.0	9999.0	9999.0
SOLAR	0.	0.	0.	0.	0.0	0.0	0.0	0.0
ELECTRIC UTILITIES								
COAL-FIRED	0.	0.	0.	0.	0.0	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.0	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.0	0.0	0.0	0.0
NUCLEAR	0.	375.	197.	375. (2000)	9999.0	27.7	7.4	9999.0
HYDRO & PUMPED STORAGE	0.	59.	37.	66. (1991)	0.0	9999.0	5.8	9999.0
OIL & GAS	78.	145.	71.	166. (1996)	-21.4	5.0	9.3	2.6
GEOTHERMAL	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TOTAL GENERATION	78.	580.	306.	580. (2000)	-3.6	23.2	7.6	8.7
TRANSMISSION	0.	0.	26.	127. (1993)	0.0	9999.0	-100.0	0.0
DISTRIBUTION	12.	58.	41.	58. (1999)	20.1	6.7	3.5	6.8
TOTAL UTILITIES	91.	638.	373.	638. (2000)	0.6	23.1	6.1	8.5
TOTAL ENERGY INDUSTRY	219.	797.	532.	797. (2000)	4.1	7.3	4.8	5.5

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CONSTRUCTOR COST TOTAL DOES NOT INCLUDE OWNER'S COSTS.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 3I (Con d)

GROWTH IN REQUIREMENTS FOR CONSTRUCTOR COST TOTAL ## (MILLION EPOUNDS, JANUARY 1978)
 FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
 FOR THE EGYPT - MEDIUM NUCLEAR CASE

RESOURCES	1976	1977	1978	1979	1980	1981	1982
OIL							
EXPLORATION, DEVELOPMENT, & PRODUCTION	82.	85.	87.	88.	84.	82.	81.
REFINING AND PROCESSING	0.	0.	22.	65.	47.	44.	22.
PIPELINES	9.	0.	0.	0.	0.	4.	21.
TANKERS, BARGES, TRUCKS	14.	18.	15.	14.	14.	11.	16.
BULK STATIONS	2.	4.	0.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL OIL	107.	107.	123.	167.	145.	140.	139.
OIL SHALE	0.	0.	0.	0.	0.	0.	0.
GAS							
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	1.	3.	0.	0.	1.	3.
GEOPRESSURED METHANE	0.	0.	0.	0.	0.	0.	0.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
LNG TANKERS	0.	0.	0.	0.	0.	0.	0.
DISTRIBUTION	21.	18.	6.	6.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL GAS	21.	19.	9.	6.	0.	1.	3.
COAL							
UNDERGROUND MINING	0.	0.	0.	0.	0.	0.	0.
SURFACE MINING	0.	0.	0.	0.	0.	0.	0.
RAIL	0.	0.	4.	0.	0.	0.	4.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
BARGES, TRUCKS	0.	0.	0.	0.	0.	0.	0.
TOTAL COAL	0.	0.	4.	0.	0.	0.	4.
COAL SYNTHETICS							
LIQUEFACTION	0.	0.	0.	0.	0.	0.	0.
METHANOL	0.	0.	0.	0.	0.	0.	0.
SOLVENT REFINING	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.	0.	0.
TOTAL SYNTHETICS	0.	0.	0.	0.	0.	0.	0.
NUCLEAR FUEL CYCLE	0.	0.	0.	0.	0.	0.	0.
SOLAR	0.	0.	0.	0.	0.	0.	0.
ELECTRIC UTILITIES							
COAL-FIRED	0.	0.	0.	0.	0.	0.	0.
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.	0.	0.
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.	0.	0.
NUCLEAR	0.	3.	8.	14.	18.	82.	129.
HYDRO & PUMPED STORAGE	0.	0.	0.	0.	0.	0.	0.
OIL & GAS	78.	104.	89.	55.	10.	24.	39.
GEOTHERMAL	0.	0.	0.	0.	0.	0.	0.
TOTAL GENERATION	78.	106.	98.	68.	48.	106.	168.
TRANSMISSION	0.	0.	23.	35.	0.	62.	92.
DISTRIBUTION	12.	16.	22.	23.	25.	28.	33.
TOTAL UTILITIES	91.	122.	143.	127.	93.	196.	294.
TOTAL ENERGY INDUSTRY	219.	248.	279.	300.	278.	338.	440.

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CONSTRUCTOR COST TOTAL DOES NOT INCLUDE OWNER'S COSTS.

Table 31 (Continued)

BECHTEL ENERGY SUPPLY PLANNING MODEL

GROWTH IN REQUIREMENTS FOR CONSTRUCTOR COST TOTAL ** (MILLION POUNDS, JANUARY 1978)
 FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
 FOR THE EGYPT - MEDIUM NUCLEAR CASE

RESOURCES	1983	1984	1985	1986	1987	1988	1989
OIL							
EXPLORATION, DEVELOPMENT, & PRODUCTION	79.	75.	69.	63.	69.	63.	67.
REFINING AND PROCESSING	65.	87.	44.	22.	65.	87.	44.
PIPELINES	0.	0.	2.	9.	0.	0.	2.
TANKERS, BARGES, TRUCKS	14.	18.	15.	18.	15.	15.	15.
BULK STATIONS	0.	0.	2.	4.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL OIL	158.	180.	131.	117.	149.	165.	128.
OIL SHALE	0.	0.	0.	0.	0.	0.	0.
GAS							
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	0.	0.	1.	3.	0.	0.
GEOPRESSURED METHANE	0.	0.	0.	0.	0.	0.	0.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
LNG TANKERS	0.	0.	0.	0.	0.	0.	0.
DISTRIBUTION	0.	0.	0.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL GAS	0.	0.	0.	1.	3.	0.	0.
COAL							
UNDERGROUND MINING	0.	0.	0.	0.	0.	0.	0.
SURFACE MINING	0.	0.	0.	0.	0.	0.	0.
RAIL	0.	0.	4.	0.	4.	0.	4.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
BARGES, TRUCKS	0.	0.	0.	0.	0.	0.	0.
TOTAL COAL	0.	0.	4.	0.	4.	0.	4.
COAL SYNTHETICS							
LIQUEFACTION	0.	0.	0.	0.	0.	0.	0.
METHANOL	0.	0.	0.	0.	0.	0.	0.
SOLVENT REFINING	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.	0.	0.
TOTAL SYNTHETICS	0.	0.	0.	0.	0.	0.	0.
NUCLEAR FUEL CYCLE	0.	0.	0.	5.	3.	4.	6.
SOLAR	0.	0.	0.	0.	0.	0.	0.
ELECTRIC UTILITIES							
COAL-FIRED	0.	0.	0.	0.	0.	0.	0.
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.	0.	0.
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.	0.	0.
NUCLEAR	147.	141.	128.	165.	194.	221.	228.
HYDRO & PUMPED STORAGE	0.	5.	26.	41.	48.	38.	44.
OIL & GAS	41.	37.	38.	31.	30.	18.	27.
GEOTHERMAL	0.	0.	0.	0.	0.	0.	0.
TOTAL GENERATION	188.	183.	192.	237.	271.	277.	299.
TRANSMISSION	0.	23.	35.	0.	0.	23.	35.
DISTRIBUTION	35.	33.	35.	35.	39.	41.	43.
TOTAL UTILITIES	223.	239.	262.	272.	310.	341.	376.
TOTAL ENERGY INDUSTRY	381.	420.	396.	395.	449.	510.	514.

** CONSTRUCTOR COST TOTAL DOES NOT INCLUDE OWNER'S COSTS.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 31 (Cor d)

GROWTH IN REQUIREMENTS FOR CONSTRUCTOR COST TOTAL ## (MILLION POUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
FOR THE EGYPT - MEDIUM NUCLEAR CASE

RESOURCES	1990	1991	1992	1993	1994	1995	1996
OIL							
EXPLORATION, DEVELOPMENT, & PRODUCTION	65.	67.	65.	67.	68.	71.	70.
REFINING AND PROCESSING	22.	65.	87.	65.	65.	87.	65.
PIPELINES	9.	0.	2.	9.	2.	9.	2.
TANKERS, BARGES, TRUCKS	19.	15.	15.	15.	14.	14.	13.
BULK STATIONS	2.	4.	0.	2.	4.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL OIL	117.	152.	169.	159.	153.	181.	150.
OIL SHALE	0.	0.	0.	0.	0.	0.	0.
GAS							
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	1.	3.	0.	0.	0.	1.
GEOPRESSURED METHANE	0.	0.	0.	0.	0.	0.	0.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
LNG TANKERS	0.	0.	0.	0.	0.	0.	0.
DISTRIBUTION	0.	0.	0.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL GAS	0.	1.	3.	0.	0.	0.	1.
COAL							
UNDERGROUND MINING	0.	0.	0.	0.	0.	0.	0.
SURFACE MINING	0.	0.	0.	0.	0.	0.	0.
RAIL	4.	4.	0.	4.	4.	4.	7.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
BARGES, TRUCKS	4.	0.	0.	0.	0.	0.	0.
TOTAL COAL	8.	4.	0.	4.	4.	4.	8.
COAL SYNTHETICS							
LIQUEFACTION	0.	0.	0.	0.	0.	0.	0.
METHANOL	0.	0.	0.	0.	0.	0.	0.
SOLVENT REFINING	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.	0.	0.
TOTAL SYNTHETICS	0.	0.	0.	0.	0.	0.	0.
NUCLEAR FUEL CYCLE	0.	5.	3.	4.	6.	0.	0.
SOLAR	0.	0.	0.	0.	0.	0.	0.
ELECTRIC UTILITIES							
COAL-FIRED	0.	0.	0.	0.	0.	0.	0.
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.	0.	0.
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.	0.	0.
NUCLEAR	196.	208.	283.	324.	301.	246.	222.
HYDRO & PUMPED STORAGE	63.	66.	63.	56.	50.	50.	59.
OIL & GAS	41.	53.	61.	77.	85.	122.	166.
GEOTHERMAL	0.	0.	0.	0.	0.	0.	0.
TOTAL GENERATION	300.	326.	406.	457.	437.	417.	448.
TRANSMISSION	0.	0.	85.	127.	0.	0.	23.
DISTRIBUTION	44.	43.	44.	45.	48.	51.	52.
TOTAL UTILITIES	345.	369.	536.	630.	485.	468.	523.
TOTAL ENERGY INDUSTRY	470.	530.	711.	796.	648.	653.	682.

CONSTRUCTOR COST TOTAL DOES NOT INCLUDE OWNER'S COSTS.

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HECHTEL ENERGY SUPPLY PLANNING MODEL

Table 31 (Continued)

GROWTH IN REQUIREMENTS FOR CONSTRUCTOR COST TOTAL ## (MILLION EPOUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
FOR THE EGYPT - MEDIUM NUCLEAR CASE

RESOURCES	1997	1998	1999	2000	TOTAL 1978-2000
OIL					
EXPLORATION, DEVELOPMENT, & PRODUCTION	69.	75.	73.	73.	1666.
REFINING AND PROCESSING	65.	87.	65.	65.	1396.
PIPELINES	13.	9.	0.	0.	93.
TANKERS, BARGES, TRUCKS	12.	11.	10.	9.	329.
BULK STATIONS	2.	4.	0.	0.	23.
OTHER	0.	0.	0.	0.	0.
TOTAL OIL	161.	187.	148.	147.	3507.
OIL SHALE	0.	0.	0.	0.	0.
GAS					
EXPLORATION, DEVELOPMENT, & PRODUCTION	3.	0.	0.	0.	20.
GEOPRESSURED METHANE	0.	0.	0.	0.	0.
PIPELINES	0.	0.	0.	0.	0.
LNG TANKERS	0.	0.	0.	0.	0.
DISTRIBUTION	0.	0.	0.	0.	13.
OTHER	0.	0.	0.	0.	0.
TOTAL GAS	3.	0.	0.	0.	33.
COAL					
UNDERGROUND MINING	0.	0.	0.	0.	0.
SURFACE MINING	0.	0.	0.	0.	0.
RAIL	4.	4.	4.	7.	63.
PIPELINES	0.	0.	0.	0.	0.
BARGES, TRUCKS	0.	0.	0.	0.	8.
TOTAL COAL	4.	4.	4.	8.	71.
COAL SYNTHETICS					
LIQUEFACTION	0.	0.	0.	0.	0.
METHANOL	0.	0.	0.	0.	0.
SOLVENT REFINING	0.	0.	0.	0.	0.
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.
TOTAL SYNTHETICS	0.	0.	0.	0.	0.
NUCLEAR FUEL CYCLE	0.	0.	0.	5.	40.
SOLAR	0.	0.	0.	0.	0.
ELECTRIC UTILITIES					
COAL-FIRED	0.	0.	0.	0.	0.
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.
NUCLEAR	260.	306.	320.	375.	4537.
HYDRO & PUMPED STORAGE	66.	59.	66.	59.	857.
OIL & GAS	157.	148.	125.	145.	1640.
GEOTHERMAL	0.	0.	0.	0.	0.
TOTAL GENERATION	482.	514.	510.	580.	7034.
TRANSMISSION	35.	0.	0.	0.	600.
DISTRIBUTION	54.	55.	58.	58.	944.
TOTAL UTILITIES	571.	568.	568.	638.	8577.
TOTAL ENERGY INDUSTRY	739.	759.	721.	797.	12228.

CONSTRUCTOR COST TOTAL DOES NOT INCLUDE OWNER'S COSTS.

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Table 31 (Continued)

BECHTEL ENERGY SUPPLY PLANNING MODEL

GROWTH IN CAPITAL REQUIREMENTS* (MILLION EPOUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
EGYPT - MEDIUM NUCLEAR

CATEGORY	-----ANNUAL REQUIREMENTS-----				AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
NON-MANUAL TECHNICAL MANPOWER	12.	70.	45.	70. (2000)	16.3	8.6	5.0	7.5
NON-MANUAL NON-TECHNICAL MANPOWER	1.	14.	8.	14. (2000)	19.7	14.7	6.2	10.1
MANUAL MANPOWER	18.	86.	56.	86. (2000)	11.2	8.8	4.9	6.8
MANPOWER TOTAL	31.	170.	109.	170. (2000)	13.6	9.1	5.0	7.3
WOOD PRODUCTS (20)	2.	11.	7.	11. (2000)	16.9	7.8	4.6	7.2
CHEMICALS & ALLIED PROD. (27,28,30,32)	4.	3.	3.	4. (1976)	-15.5	0.1	1.2	-2.0
PETROLEUM PRODUCTS (31)	6.	9.	6.	9. (1997)	-13.5	5.9	4.6	1.6
GLASS, CLAY & STONE PRODUCTS (35,36)	4.	17.	12.	21. (1993)	11.4	10.8	4.3	6.8
PRIMARY IRON & STEEL PRODUCTS (37)	20.	20.	19.	23. (1998)	-0.9	-4.7	1.8	-0.0
PRIMARY NON-FERROUS METALS (38)	2.	12.	13.	35. (1993)	17.4	25.9	-0.1	7.7
FABRICATED STRUCTURAL PRODUCTS (40) *	5.	38.	30.	62. (1993)	12.9	25.8	2.3	8.6
OTHER FABRICATED PRODUCTS (42)	6.	19.	12.	19. (1998)	6.1	1.3	5.4	4.7
MATERIALS TOTAL	50.	129.	101.	174. (1993)	2.4	9.0	2.8	4.0
HVAC HEATING & COOLING UNITS (52) ++	0.	4.	2.	4. (2000)	44.1	18.2	7.0	14.8
HVAC DUCTWORK & ACCESSORIES (40) *	0.	2.	1.	2. (2000)	35.5	23.0	7.4	14.8
TURBINES (43)	26.	76.	45.	76. (2000)	-8.4	9.6	6.8	4.6
GAS WELDING SETS (47) ++	0.	0.	0.	0. (1979)	0.6	-8.0	1.2	-0.9
ELECTRIC WELDING SETS (53) **	0.	1.	1.	1. (2000)	9.7	5.9	6.5	6.9
CONSTRUCTION, MINING & OIL FIELD EQP (45)	38.	58.	47.	61. (1993)	-2.0	3.9	2.0	1.7
MATERIALS HANDLING EQUIPMENT (46)	0.	3.	2.	3. (2000)	9.7	18.6	6.0	9.1
GENERAL INDUSTRY EQUIPMENT (49)	3.	14.	11.	17. (1998)	36.7	-7.0	4.1	6.4
INSTRUMENTATION & CONTROLS (62)	2.	9.	7.	10. (1998)	24.8	-0.8	4.2	6.3
ELECTRICAL EQUIPMENT (53) **	4.	28.	19.	29. (1993)	21.1	8.0	5.1	8.2
FABRICATED PLATE PRODUCTS (40) *	14.	102.	57.	102. (2000)	21.0	5.5	6.8	8.8
EQUIPMENT TOTAL	88.	297.	191.	297. (2000)	5.7	4.9	5.2	5.2
MISCELLANEOUS MATERIALS & EQUIPMENT	9.	12.	11.	13. (1998)	4.8	-3.8	1.9	1.2
MOBILE FACILITY	14.	16.	17.	26. (1990)	0.0	5.2	-0.7	0.6
OTHER CONSTRUCTOR COSTS	27.	173.	103.	173. (2000)	7.8	12.3	6.8	8.1
CONSTRUCTOR COST TOTAL **	219.	797.	532.	797. (2000)	6.1	7.3	4.8	5.5

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

*BEA (BUREAU OF ECONOMIC ANALYSIS) TWO-DIGIT CATEGORIES ARE IN PARENTHESIS.

* PARTIAL BEA CATEGORY 40. TOTAL IS SUM OF 3 SEPARATE ENTRIES FOR CATEGORY 40.

++ PARTIAL BEA CATEGORY 52. REMAINDER IS PART OF MISCELLANEOUS ENTRY.

** PARTIAL BEA CATEGORY 53. TOTAL IS SUM OF 2 SEPARATE ENTRIES FOR CATEGORY 53.

** CONSTRUCTION CAPITAL COST TOTAL INCLUDES MANPOWER, MATERIALS AND EQUIPMENT SUBTOTALS ABOVE PLUS OTHER (OVERHEAD, PROFIT, ETC.) COSTS. IT EXCLUDES OWNER'S COSTS, (LAND COSTS, INTEREST DURING CONSTRUCTION, ETC.)

Table 31 (Continued)

BECHTEL ENERGY SUPPLY PLANNING MODEL

GROWTH IN MANPOWER REQUIREMENTS (MAN-YEARS)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
EGYPT - MEDIUM NUCLEAR

CATEGORY	-----ANNUAL REQUIREMENTS-----					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
CHEMICAL ENGINEERS	0.	38.	25.	39.	(1994)	9999.0	-24.2	15.8	9999.0
CIVIL ENGINEERS	98.	758.	447.	758.	(2000)	8.7	20.3	5.4	8.9
ELECTRICAL ENGINEERS	89.	610.	400.	610.	(2000)	12.2	17.3	4.6	8.4
MECHANICAL ENGINEERS	65.	487.	283.	487.	(2000)	14.9	9.8	6.8	8.7
MINING ENGINEERS	0.	2.	1.	3.	(1987)	0.0	0.0	9999.0	9999.0
NUCLEAR ENGINEERS	0.	44.	21.	44.	(2000)	9999.0	23.5	6.5	9999.0
GEOLOGICAL ENGINEERS	29.	35.	32.	36.	(1992)	0.6	-0.3	1.1	0.7
PETROLEUM ENGINEERS	29.	25.	26.	32.	(1978)	0.6	-4.7	0.4	-0.7
OTHER ENGINEERS	2.	21.	14.	22.	(1994)	46.6	-18.2	13.5	10.7
ENGINEERS TOTAL	312.	2020.	1250.	2020.	(2000)	11.5	13.7	5.4	8.1
DESIGNERS & DRAFTSMEN	119.	848.	534.	848.	(2000)	16.3	10.6	5.9	8.5
SUPERVISORS & MANAGERS	101.	417.	256.	417.	(2000)	-3.3	17.4	5.1	6.1
NON-MANUAL, TECHNICAL TOTAL	532.	3285.	2039.	3285.	(2000)	10.3	13.3	5.5	7.9
NON-MANUAL, NON-TECHNICAL	351.	2837.	1575.	2837.	(2000)	12.4	15.7	6.1	9.1
NON-MANUAL TOTAL	882.	6122.	3615.	6122.	(2000)	11.2	14.3	5.8	8.4
PIPEFITTERS	777.	3658.	2333.	3929.	(1998)	24.7	-2.5	5.4	6.7
PIPEFITTER/WELDERS	407.	1613.	1013.	1664.	(1998)	15.2	0.3	5.4	5.9
ELECTRICIANS	364.	3339.	1978.	3339.	(2000)	21.5	12.0	6.0	9.7
BOILERMAKERS	309.	1085.	584.	1171.	(1997)	1.3	3.6	7.1	5.4
BOILERMAKER/WELDERS	103.	546.	306.	601.	(1997)	-8.5	23.2	6.8	7.2
IRON WORKERS	165.	1687.	1453.	4099.	(1993)	14.7	42.2	0.1	10.2
CARPENTERS	170.	2146.	1261.	2146.	(2000)	27.2	14.7	6.1	11.1
EQUIPMENT OPERATORS	584.	2129.	1454.	2129.	(2000)	7.8	6.6	4.6	5.5
LINEMEN	167.	1004.	1121.	3123.	(1993)	26.4	27.7	-2.4	7.8
TEAMSTERS & LABORERS	1108.	4112.	2767.	4112.	(2000)	5.5	9.7	4.3	5.6
OTHER	1000.	1795.	1384.	1795.	(2000)	3.3	0.2	3.0	2.5
MANUAL TOTAL	5154.	23115.	15656.	23959.	(1993)	12.5	9.2	4.0	6.5
CONSTRUCTION MANPOWER TOTAL	6036.	29237.	19270.	29237.	(2000)	12.3	10.0	4.4	6.8

• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A GROWTH RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 31. (Continued)

SCHEDULE OF MANPOWER RESOURCES (MAN-YEARS) FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES EGYPT - MEDIUM NUCLEAR

RESOURCES	1976	1977	1978	1979	1980	1981	1982
CHEMICAL ENGINEERS	0.	0.	26.	38.	17.	4.	26.
CIVIL ENGINEERS	98.	122.	213.	205.	137.	244.	295.
ELECTRICAL ENGINEERS	89.	114.	245.	221.	140.	335.	341.
MECHANICAL ENGINEERS	65.	76.	167.	190.	113.	133.	211.
MINING ENGINEERS	0.	0.	0.	0.	0.	0.	0.
NUCLEAR ENGINEERS	0.	1.	3.	5.	6.	8.	11.
GEOLOGICAL ENGINEERS	29.	32.	32.	30.	30.	30.	30.
PETROLEUM ENGINEERS	29.	32.	32.	30.	30.	30.	30.
OTHER ENGINEERS	2.	0.	13.	19.	9.	4.	16.
ENGINEERS TOTAL	312.	376.	729.	738.	481.	789.	959.
DESIGNERS & DRAFTSMEN	119.	142.	339.	368.	217.	315.	430.
SUPERVISORS & MANAGERS	101.	95.	127.	130.	89.	120.	170.
NON-MANUAL, TECHNICAL TOTAL	532.	613.	1194.	1237.	788.	1224.	1559.
NON-MANUAL, NON-TECHNICAL	351.	447.	733.	791.	561.	836.	1154.
NON-MANUAL TOTAL	882.	1059.	1927.	2028.	1348.	2060.	2713.
PIPEFITTERS	777.	1018.	889.	1532.	1879.	1089.	819.
PIPEFITTER/WELDERS	407.	516.	452.	635.	717.	471.	427.
ELECTRICIANS	364.	588.	596.	706.	792.	767.	1089.
BOILERMAKERS	309.	533.	524.	452.	325.	160.	192.
BOILERMAKER/WELDERS	103.	178.	175.	128.	72.	44.	74.
IRON WORKERS	165.	273.	572.	1238.	285.	863.	2125.
CARPENTERS	170.	265.	248.	349.	445.	397.	485.
EQUIPMENT OPERATORS	584.	651.	655.	756.	789.	703.	849.
LINEMEN	167.	243.	620.	1265.	427.	918.	2101.
TEAMSTERS & LABORERS	1108.	1166.	1056.	1524.	1374.	1259.	1730.
OTHER	1000.	1133.	1181.	1147.	1140.	1095.	1224.
MANUAL TOTAL	5154.	6563.	6967.	9731.	8243.	7766.	11114.
CONSTRUCTION MANPOWER TOTAL	6036.	7623.	8894.	11759.	9592.	9826.	13027.

• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 31 (Continued)

SCHEDULE OF MANPOWER RESOURCES (MAN-YEARS) FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES EGYPT - MEDIUM NUCLEAR

RESOURCES	1983	1984	1985	1986	1987	1988	1989
CHEMICAL ENGINEERS	38.	17.	4.	26.	38.	17.	5.
CIVIL ENGINEERS	295.	350.	344.	327.	362.	439.	461.
ELECTRICAL ENGINEERS	270.	344.	311.	266.	293.	407.	401.
MECHANICAL ENGINEERS	244.	215.	181.	217.	260.	254.	248.
MINING ENGINEERS	0.	0.	0.	2.	3.	3.	2.
NUCLEAR ENGINEERS	15.	17.	17.	16.	18.	22.	25.
GEOLOGICAL ENGINEERS	29.	30.	29.	33.	34.	32.	34.
PETROLEUM ENGINEERS	28.	26.	23.	24.	25.	22.	23.
OTHER ENGINEERS	19.	9.	3.	16.	22.	11.	5.
ENGINEERS TOTAL	938.	1007.	914.	925.	1055.	1208.	1205.
DESIGNERS & DRAFTSMEN	443.	423.	360.	410.	485.	502.	472.
SUPERVISORS & MANAGERS	176.	190.	198.	211.	227.	244.	264.
NON-MANUAL, TECHNICAL TOTAL	1557.	1620.	1472.	1546.	1767.	1954.	1941.
NON-MANUAL, NON-TECHNICAL	1168.	1223.	1163.	1115.	1263.	1443.	1572.
NON-MANUAL TOTAL	2725.	2844.	2635.	2660.	3030.	3397.	3513.
PIPEFITTERS	1860.	2612.	1656.	985.	2033.	2766.	1812.
PIPEFITTER/WELDERS	787.	1057.	728.	495.	867.	1121.	793.
ELECTRICIANS	1324.	1688.	1395.	1181.	1748.	2071.	1757.
BOILERMAKERS	358.	461.	387.	292.	330.	384.	298.
BOILERMAKER/WELDERS	110.	152.	205.	233.	261.	218.	229.
IRON WORKERS	584.	1091.	1661.	627.	881.	1335.	1854.
CARPENTERS	781.	1053.	884.	780.	1201.	1402.	1179.
EQUIPMENT OPERATORS	927.	1101.	1086.	1189.	1482.	1519.	1468.
LINEMEN	594.	862.	1449.	577.	669.	954.	1599.
TEAMSTERS & LABORERS	1775.	2327.	2184.	1807.	2528.	2918.	2728.
OTHER	1237.	1300.	1150.	1082.	1255.	1262.	1217.
MANUAL TOTAL	10336.	13704.	12783.	9249.	13254.	15949.	14933.
CONSTRUCTION MANPOWER TOTAL	13060.	16547.	15418.	11909.	16284.	19346.	18447.

• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 31 (Continued)

SCHEDULE OF MANPOWER RESOURCES (MAN-YEARS) FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES EGYPT - MEDIUM NUCLEAR

RESOURCES	1990	1991	1992	1993	1994	1995	1996
CHEMICAL ENGINEERS	26.	38.	17.	30.	39.	17.	30.
CIVIL ENGINEERS	470.	469.	588.	619.	586.	566.	627.
ELECTRICAL ENGINEERS	376.	371.	610.	590.	472.	463.	553.
MECHANICAL ENGINEERS	295.	318.	312.	372.	397.	334.	380.
MINING ENGINEERS	0.	2.	3.	3.	2.	0.	0.
NUCLEAR ENGINEERS	26.	23.	23.	28.	31.	30.	26.
GEOLOGICAL ENGINEERS	30.	34.	36.	34.	34.	31.	33.
PETROLEUM ENGINEERS	23.	25.	24.	23.	24.	24.	25.
OTHER ENGINEERS	15.	21.	12.	19.	22.	10.	16.
ENGINEERS TOTAL	1260.	1301.	1626.	1718.	1608.	1474.	1689.
DESIGNERS & DRAFTSMEN	538.	581.	668.	730.	700.	599.	719.
SUPERVISORS & MANAGERS	286.	285.	305.	340.	345.	318.	345.
NON-MANUAL, TECHNICAL TOTAL	2084.	2167.	2599.	2788.	2652.	2392.	2753.
NON-MANUAL, NON-TECHNICAL	1663.	1640.	1824.	2147.	2121.	2027.	2115.
NON-MANUAL TOTAL	3748.	3807.	4423.	4935.	4773.	4419.	4868.
PIPEFITTERS	1381.	2411.	3165.	2598.	3148.	3922.	3087.
PIPEFITTER/WELDERS	681.	1042.	1308.	1165.	1376.	1657.	1381.
ELECTRICIANS	1783.	2121.	2535.	2820.	2928.	3074.	2804.
BOILERMAKERS	302.	535.	670.	573.	699.	1047.	1148.
BOILERMAKER/WELDERS	307.	361.	412.	409.	397.	475.	565.
IRON WORKERS	955.	1099.	2149.	4099.	1512.	1521.	1739.
CARPENTERS	1225.	1439.	1682.	1795.	1955.	1980.	1760.
EQUIPMENT OPERATORS	1459.	1687.	1895.	1905.	1934.	1895.	1878.
LINEMEN	761.	745.	1554.	3123.	837.	837.	1197.
TEAMSTERS & LABORERS	2518.	2958.	3639.	4006.	3678.	3902.	3626.
OTHER	1232.	1358.	1481.	1466.	1606.	1709.	1684.
MANUAL TOTAL	12604.	15755.	20490.	23959.	20069.	22018.	20868.
CONSTRUCTION MANPOWER TOTAL	16351.	19562.	24913.	28894.	24843.	26437.	25736.

INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

Table 31 (Continued)

HECHTEL ENERGY SUPPLY PLANNING MODEL

SCHEDULE OF MANPOWER RESOURCES (MAN-YEARS)
 FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
 EGYPT - MEDIUM NUCLEAR

RESOURCES	1997	1998	1999	2000	TOTAL 1978-2000
CHEMICAL ENGINEERS	38.	17.	30.	38.	579.
CIVIL ENGINEERS	638.	601.	688.	758.	10281.
ELECTRICAL ENGINEERS	541.	490.	553.	610.	9204.
MECHANICAL ENGINEERS	403.	351.	424.	407.	6505.
MINING ENGINEERS	0.	0.	0.	2.	20.
NUCLEAR ENGINEERS	27.	32.	39.	44.	490.
GEOLOGICAL ENGINEERS	34.	33.	33.	35.	739.
PETROLEUM ENGINEERS	26.	25.	25.	25.	594.
OTHER ENGINEERS	22.	10.	15.	21.	330.
ENGINEERS TOTAL	1730.	1559.	1806.	2020.	26742.
DESIGNERS & DRAFTSMEN	755.	632.	751.	848.	12286.
SUPERVISORS & MANAGERS	373.	340.	384.	417.	5880.
NON-MANUAL, TECHNICAL TOTAL	2858.	2531.	2941.	3285.	46906.
NON-MANUAL, NON-TECHNICAL	2186.	2142.	2508.	2837.	36231.
NON-MANUAL TOTAL	5045.	4673.	5449.	6122.	83137.
PIPEFITTERS	3252.	3929.	3182.	3650.	53662.
PIPEFITTER/WELDERS	1421.	1664.	1434.	1613.	23289.
ELECTRICIANS	2745.	3072.	3167.	3339.	45499.
BOILERMAKERS	1171.	1128.	918.	1085.	13438.
BOILERMAKER/WELDERS	601.	538.	537.	546.	7048.
IRON WORKERS	2371.	1541.	1630.	1687.	33418.
CARPENTERS	1755.	1980.	2080.	2146.	28999.
EQUIPMENT OPERATORS	2054.	2043.	2045.	2129.	33446.
LINEMEN	1783.	912.	1004.	1004.	25793.
TEAMSTERS & LABORERS	4011.	4039.	3950.	4112.	63646.
OTHER	1734.	1775.	1712.	1795.	31842.
MANUAL TOTAL	22697.	22620.	21660.	23115.	360081.
CONSTRUCTION MANPOWER TOTAL	27941.	27293.	27109.	29237.	443218.

• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

BECHTEL ENERGY SUPPLY PLANNING MODEL

GROWTH IN REQUIREMENTS FOR CONSTRUCTION MANPOWER TOTAL (MAN-YEARS/YEAR)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
FOR THE EGYPT - MEDIUM NUCLEAR CASE

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1974- 1980	1980- 1985	1985- 2000	1976- 2000
OIL									
EXPLORATION, DEVELOPMENT, & PRODUCTION	1602.	1375.	1403.	1686.	(1978)	0.8	-4.4	0.3	-0.6
REFINING AND PROCESSING	0.	3400.	2913.	4770.	(1980)	9999.0	-17.2	4.1	9999.0
PIPELINES	215.	0.	115.	547.	(1982)	-100.0	9999.0	-100.0	-100.0
TANKERS, BARGES, TRUCKS	0.	0.	0.	0.		0.0	0.0	0.0	0.0
BULK STATIONS	68.	0.	29.	96.	(1977)	-100.0	9999.0	-100.0	-100.0
OTHER	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TOTAL OIL	1885.	4775.	4459.	6508.	(1998)	35.9	-12.4	2.5	3.9
OIL SHALE	0.	0.	0.	0.		0.0	0.0	0.0	0.0
GAS									
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	0.	26.	88.	(1978)	0.0	0.0	0.0	0.0
GEOPRESSURED METHANE	0.	0.	0.	0.		0.0	0.0	0.0	0.0
PIPELINES	0.	0.	0.	0.		0.0	0.0	0.0	0.0
LNG TANKERS	0.	0.	0.	0.		0.0	0.0	0.0	0.0
DISTRIBUTION	1047.	0.	25.	1047.	(1976)	-100.0	0.0	0.0	-100.0
OTHER	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TOTAL GAS	1047.	0.	51.	1047.	(1976)	-100.0	0.0	0.0	-100.0
COAL									
UNDERGROUND MINING	0.	0.	0.	0.		0.0	0.0	0.0	0.0
SURFACE MINING	0.	0.	0.	0.		0.0	0.0	0.0	0.0
RAIL	0.	0.	0.	0.		0.0	0.0	0.0	0.0
PIPELINES	0.	0.	0.	0.		0.0	0.0	0.0	0.0
BARGES, TRUCKS	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TOTAL COAL	0.	0.	0.	0.		0.0	0.0	0.0	0.0
COAL SYNTHETICS									
LIQUEFACTION	0.	0.	0.	0.		0.0	0.0	0.0	0.0
METHANOL	0.	0.	0.	0.		0.0	0.0	0.0	0.0
SOLVENT REFINING	0.	0.	0.	0.		0.0	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TOTAL SYNTHETICS	0.	0.	0.	0.		0.0	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	0.	151.	95.	409.	(1989)	0.0	0.0	9999.0	9999.0
SOLAR	0.	0.	0.	0.		0.0	0.0	0.0	0.0
ELECTRIC UTILITIES									
COAL-FIRED	0.	0.	0.	0.		0.0	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.		0.0	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
NUCLEAR	0.	12890.	6861.	12890.	(2000)	9999.0	38.8	6.4	9999.0
HYDRO & PUMPED STORAGE	0.	2129.	1398.	2558.	(1997)	0.0	9999.0	4.8	9999.0
OIL & GAS	2513.	5968.	2836.	7137.	(1996)	-25.6	17.4	8.7	3.7
GEOTHERMAL	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TOTAL GENERATION	2513.	20986.	11095.	20986.	(2000)	-8.6	34.9	6.8	9.2
TRANSMISSION	0.	0.	1250.	6575.	(1993)	0.0	9999.0	-100.0	0.0
DISTRIBUTION	591.	3324.	2320.	3324.	(1999)	24.4	6.8	3.5	7.5
TOTAL UTILITIES	3104.	24310.	14664.	24669.	(1993)	0.5	30.7	4.8	9.0
TOTAL ENERGY INDUSTRY	6036.	29237.	19271.	29237.	(2000)	12.3	10.0	4.4	6.8

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BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 31 (Continued)

GROWTH IN SELECTED MATERIALS AND EQUIPMENT ITEMS REQUIRED
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
EGYPT - MEDIUM NUCLEAR

CATEGORY		ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
		1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
CEMENT	(TONNES)	18060.	82471.	51811.	82471.	(2000)	7.3	8.5	5.7	6.5
CONCRETE (INCLUDES CEMENT)	(TONNES)	97828.	725692.	430548.	725692.	(2000)	11.5	13.5	6.4	8.7
BENTONITE (IN DRILLING MUD)	(TONNES)	2719.	2300.	2399.	2971.	(1978)	0.9	-4.7	0.3	-0.7
BARITE (IN DRILLING MUD)	(TONNES)	2636.	2277.	2339.	2893.	(1978)	0.8	-4.5	0.3	-0.6
CARBON STEEL	(TONNES)	47453.	97792.	74030.	120375.	(1993)	-1.8	7.0	3.1	3.1
ALLOY STEEL	(TONNES)	2636.	8707.	5836.	8707.	(2000)	10.2	1.9	4.8	5.1
STAINLESS STEEL	(TONNES)	184.	2585.	1481.	2585.	(2000)	48.1	-1.4	7.9	11.6
STEEL TOTAL	(TONNES)	50272.	109084.	81346.	130326.	(1993)	-0.7	6.5	3.3	3.3
COPPER	(TONNES)	459.	3499.	2444.	5063.	(1993)	24.4	11.4	4.2	8.8
ALUMINUM	(TONNES)	636.	1481.	2920.	11818.	(1993)	6.8	36.0	-6.2	3.6
MANGANESE	(TONNES)	380.	831.	616.	946.	(1993)	0.1	5.6	3.4	3.3
CHROMIUM	(TONNES)	133.	713.	450.	713.	(2000)	22.2	-0.3	6.1	7.2
NICKEL	(TONNES)	8.	103.	60.	103.	(2000)	42.8	0.2	7.5	11.1
CAST IRON	(TONNES)	563.	2633.	1686.	2633.	(2000)	21.1	-1.2	5.7	6.6
STEEL CASTINGS	(TONNES)	386.	1639.	978.	1639.	(2000)	10.2	8.3	4.5	6.2
ALUMINUM CASTINGS	(TONNES)	35.	138.	88.	138.	(2000)	11.5	3.2	5.4	5.9
BRASS & BRONZE CASTINGS	(TONNES)	33.	214.	132.	214.	(2000)	29.0	-2.7	6.8	8.1
IRON & STEEL FORGINGS	(TONNES)	345.	1406.	861.	1406.	(2000)	6.0	10.0	4.7	6.0
STRUCTURAL STEEL SHAPES	(TONNES)	2338.	11752.	9830.	23438.	(1993)	16.7	19.9	0.6	7.0
STEEL PLATE < 3.8 CM THICK	(TONNES)	3996.	16406.	11870.	19288.	(1993)	16.2	5.1	3.8	6.1
STEEL PLATE > 3.8 CM THICK	(TONNES)	2.	2254.	1254.	2254.	(2000)	192.3	25.8	10.1	33.2
PIPE, CARBON STEEL	(TONNES)	18076.	13307.	10603.	20125.	(1997)	-20.4	-2.4	5.0	-1.3
PIPE, ALLOY & STAINLESS STEEL	(TONNES)	98.	3263.	1760.	3263.	(2000)	52.3	15.9	7.5	15.7
OIL COUNTRY TUBULAR GOODS	(TONNES)	16166.	13892.	14414.	18061.	(1978)	0.8	-4.6	0.3	-0.6
REINFORCING BAR (REBAR)	(TONNES)	1092.	14063.	7928.	14063.	(2000)	18.5	20.9	6.4	11.2
VALVES, CARBON STEEL	(TONNES)	229.	1000.	683.	1068.	(1998)	31.1	-11.9	7.1	6.3
VALVES, ALLOY & STAINLESS STEEL	(TONNES)	7.	307.	174.	307.	(2000)	89.4	1.9	7.8	17.0
STEAM TURBOGENERATORS	(MEGAWATTS)	331.	1778.	892.	1778.	(2000)	-3.2	12.8	8.4	7.3
STEAM TURBINES (EXCL TRBGNS)	(MEGAWATTS)	7.	39.	21.	39.	(2000)	11.3	-0.7	8.8	7.1
GAS TURBOGENERATORS	(MEGAWATTS)	136.	3.	42.	161.	(1982)	-34.0	-35.3	1.0	-14.3
DRAGLINES	(CUBIC METERS)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
DRILL RIGS, ONSHORE	(RIG YEARS)	16.	14.	14.	18.	(1978)	1.0	-5.0	0.7	-0.4
DRILL RIGS, OFFSHORE	(RIG YEARS)	5.	5.	4.	5.	(1979)	0.0	-2.8	1.0	0.0
DRILL BITS	(NUMBER)	1358.	1195.	1234.	1494.	(1978)	0.7	-1.8	-0.5	-0.5
PUMPS & DRIVERS > 745 MGAWTS	(MEGAWATTS)	9.	97.	53.	97.	(2000)	22.9	8.1	7.8	10.2
PUMPS & DRIVERS < 745 MGAWTS	(MEGAWATTS)	21.	29.	26.	32.	(1998)	7.7	-7.3	2.6	1.3
AXIAL COMPRESSORS > 3727 MGAWTS	(MGAWTS)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
CENTRIF COMP & DRV > 7455 MW	(MGAWTS)	0.	19.	13.	19.	(1979)	9999.0	-24.2	9.7	9999.0
CENTRIF COMP & DRV < 7455 MW	(MGAWTS)	1.	4.	3.	4.	(1979)	34.7	-18.5	6.8	4.9
HEAT EXCHANGERS	(SQUARE METERS)	8355.	91168.	56627.	91168.	(2000)	60.4	-14.2	8.8	10.5
NON-NUC PRESS VESS < 3.8 CM WALL	(TONNES)	70.	2062.	1481.	2094.	(1998)	133.6	-22.9	9.0	15.2
NON-NUC PRESS VESS 3.8-10 CM W	(TONNES)	4.	4.	4.	4.	(1979)	0.0	-2.8	1.0	0.0
NON-NUC PRESS VESS > 10 CM WALL	(TONNES)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
BOILERS	(TONNES STEAM PER HOUR)	981656.	2751350.	1309781.	2869426.	(1997)	-6.3	-2.4	9.9	4.4
NUCLEAR STEAM SUPPLY SYSTEMS	(MEGAWATTS)	0.	928.	501.	928.	(2000)	9999.0	23.8	7.2	9999.0

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A G H RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

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BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 31 (Continue

GROWTH IN ANNUAL COSTS (MILLION POUNDS JANUARY 1978)
FOR THE OPERATION AND MAINTENANCE OF ENERGY-RELATED FACILITIES
EGYPT - MEDIUM NUCLEAR

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
NON-MANUAL TECHNICAL MANPOWER	3.	17.	10.	17.	(2000)	11.9	6.1	6.5	7.3
NON-MANUAL NON-TECHNICAL MANPOWER	1.	3.	2.	3.	(2000)	12.0	5.3	6.8	7.3
MANUAL MANPOWER	9.	41.	26.	41.	(2000)	13.5	6.1	5.0	6.6
MANPOWER TOTAL	13.	62.	37.	62.	(2000)	13.0	6.1	5.4	6.8
WOOD PRODUCTS (20)	1.	5.	2.	5.	(2000)	5.2	10.9	7.8	8.0
CHEMICALS & ALLIED PROD. (27,28,30,32)	8.	32.	18.	32.	(2000)	-0.7	6.5	7.5	5.9
PETROLEUM PRODUCTS (31)	4.	14.	12.	15.	(1998)	19.3	4.6	1.8	5.1
GLASS, CLAY & STONE PRODUCTS (35,36)	1.	2.	1.	2.	(2000)	0.4	5.7	5.8	4.9
PRIMARY IRON & STEEL PRODUCTS (37)	1.	9.	5.	9.	(2000)	20.1	2.3	8.6	9.1
PRIMARY NON-FERROUS METALS (38)	0.	4.	2.	4.	(2000)	9.5	11.8	7.8	8.9
FABRICATED STRUCTURAL PRODUCTS (40) *	0.	4.	2.	4.	(2000)	14.7	5.8	8.0	8.6
OTHER FABRICATED PRODUCTS (42)	2.	10.	5.	10.	(2000)	6.4	8.4	7.2	7.3
MATERIALS TOTAL	18.	80.	47.	80.	(2000)	8.4	6.0	6.1	6.5
HVAC HEATING & COOLING UNITS (52) ++	0.	0.	0.	0.	(1980)	25.3	-0.3	-0.3	3.6
HVAC DUCTWORK & ACCESSORIES (40) *	0.	0.	0.	0.	(1980)	25.3	-0.3	-0.3	3.6
TURBINES (43)	0.	4.	2.	4.	(2000)	14.5	5.9	10.5	10.2
GAS WELDING SETS (47) ++	1.	7.	3.	7.	(2000)	1.1	3.9	10.9	7.8
ELECTRIC WELDING SETS (53) **	0.	0.	0.	0.		0.0	0.0	0.0	0.0
CONSTRUCTION, MINING & OIL FIELD EOP (45)	0.	2.	1.	2.	(2000)	15.6	7.7	11.0	11.1
MATERIALS HANDLING EQUIPMENT (46)	0.	0.	0.	0.	(2000)	21.4	17.7	8.8	12.7
GENERAL INDUSTRY EQUIPMENT (49)	4.	11.	6.	11.	(2000)	-2.2	4.6	6.8	4.8
INSTRUMENTATION & CONTROLS (62)	1.	4.	3.	4.	(2000)	7.9	3.1	5.8	5.6
ELECTRICAL EQUIPMENT (53) **	3.	15.	8.	15.	(2000)	6.6	8.8	7.6	7.7
FABRICATED PLATE PRODUCTS (40) *	0.	0.	0.	0.		0.0	0.0	0.0	0.0
EQUIPMENT TOTAL	8.	37.	19.	37.	(2000)	4.0	6.2	7.5	6.6
ELECTRICITY	5.	15.	8.	15.	(2000)	-3.5	6.7	6.9	5.1
NATURAL GAS	0.	0.	0.	0.	(2000)	14.7	12.7	19.5	17.2
WATER	2.	19.	8.	19.	(2000)	8.6	7.6	11.9	10.4
UTILITY TOTAL	6.	35.	17.	35.	(2000)	0.4	7.1	9.3	7.3
RENTS, ROYALTIES, ETC.	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TAXES	0.	0.	0.	0.		0.0	0.0	0.0	0.0
SERVICES & MISCELLANEOUS	10.	50.	29.	50.	(2000)	11.5	5.5	6.1	6.9
ANNUAL OPERATING COST (EX FUEL)	54.	257.	146.	257.	(2000)	8.8	6.1	6.4	6.7

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

#BEA (BUREAU OF ECONOMIC ANALYSIS) TWO-DIGIT CATEGORIES ARE IN PARENTHESIS.

* PARTIAL BEA CATEGORY 40. TOTAL IS SUM OF 3 SEPARATE ENTRIES FOR CATEGORY 40.

++ PARTIAL BEA CATEGORY 52. REMAINDER IS PART OF MISCELLANEOUS ENTRY.

** PARTIAL BEA CATEGORY 53. TOTAL IS SUM OF 2 SEPARATE ENTRIES FOR CATEGORY 53.

HECHTEL ENERGY SUPPLY PLANNING MODEL

Table 31 (Continued)

GROWTH IN MANPOWER REQUIREMENTS (MAN-YEARS) FOR THE OPERATION AND MAINTENANCE OF ENERGY-RELATED FACILITIES EGYPT - MEDIUM NUCLEAR

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
CHEMICAL ENGINEERS	30.	94.	52.	94.	(2000)	-4.5	6.7	7.0	4.9
CIVIL ENGINEERS	21.	102.	60.	102.	(2000)	12.6	5.1	6.0	6.9
ELECTRICAL ENGINEERS	34.	234.	123.	234.	(2000)	14.7	8.3	6.7	8.3
MECHANICAL ENGINEERS	34.	170.	95.	170.	(2000)	8.9	6.7	6.4	6.9
MINING ENGINEERS	0.	7.	3.	7.	(1995)	0.0	0.0	9999.0	9999.0
NUCLEAR ENGINEERS	0.	15.	5.	15.	(1998)	0.0	0.0	9999.0	9999.0
GEOLOGICAL ENGINEERS	0.	4.	1.	4.	(1995)	0.0	0.0	9999.0	9999.0
PETROLEUM ENGINEERS	0.	0.	0.	0.		0.0	0.0	0.0	0.0
OTHER ENGINEERS	31.	125.	81.	125.	(2000)	10.8	4.8	5.1	6.0
ENGINEERS TOTAL	150.	750.	420.	750.	(2000)	9.1	6.5	6.5	6.9
DESIGNERS & DRAFTSMEN	30.	154.	84.	154.	(2000)	8.7	7.0	6.8	7.1
SUPERVISORS & MANAGERS	400.	1636.	1095.	1636.	(2000)	14.3	5.8	4.0	6.0
OTHER TECHNICAL	74.	404.	213.	404.	(2000)	5.1	7.3	8.0	7.3
NON-MANUAL, TECHNICAL TOTAL	653.	2945.	1812.	2945.	(2000)	11.9	6.1	5.2	6.5
NON-MANUAL, NON-TECHNICAL	224.	1216.	679.	1216.	(2000)	12.0	5.3	6.8	7.3
NON-MANUAL TOTAL	877.	4161.	2491.	4161.	(2000)	12.0	5.9	5.6	6.7
PIPEFITTERS	200.	619.	403.	619.	(2000)	9.9	3.1	4.1	4.8
WELDERS	77.	363.	213.	363.	(2000)	13.6	6.3	5.1	6.7
ELECTRICIANS	222.	1289.	671.	1289.	(2000)	9.4	8.3	6.9	7.6
BOILERMAKERS	25.	79.	44.	79.	(2000)	-4.5	6.7	7.0	4.9
MECHANICS	796.	3024.	2172.	3024.	(2000)	15.2	5.7	3.3	5.7
MACHINISTS	202.	729.	542.	729.	(2000)	15.7	5.5	2.9	5.5
IRONWORKERS	14.	33.	21.	33.	(2000)	0.0	2.3	5.0	3.6
CARPENTERS	28.	67.	42.	67.	(2000)	-2.7	4.0	5.3	3.6
EQUIPMENT OPERATORS	88.	838.	411.	838.	(2000)	11.4	13.6	8.2	9.8
OTHER OPERATORS	858.	4702.	2381.	4702.	(2000)	3.6	7.5	8.3	7.3
METER READERS	351.	2015.	1226.	2015.	(2000)	19.6	5.7	5.2	7.6
TEAMSTERS & LABORERS	1848.	6616.	5055.	6616.	(2000)	16.1	6.1	2.6	5.5
LINEMEN	61.	595.	295.	595.	(2000)	11.7	14.1	8.1	9.9
OTHER	512.	2602.	1572.	2602.	(2000)	14.9	5.2	5.6	7.0
MANUAL TOTAL	5195.	22735.	14637.	22735.	(2000)	13.5	6.1	4.6	6.3
MANPOWER TOTAL	6072.	26896.	17120.	26896.	(2000)	13.3	6.1	4.7	6.4

• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A GROWTH RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

BECHTEL ENERGY SUPPLY PLANNING MODEL

CUMULATIVE CAPITAL REQUIREMENTS (MILLION POUNDS, JAN 1978) OF THE ENERGY INDUSTRY
BY FACILITY GROUPING
EGYPT - MEDIUM NUCLEAR/IMPORTS

(1978-1985)

Table 31 (Continued)

FACILITY	CONSTRUCTION COSTS	OWNER'S COSTS PRIOR TO STARTUP	TOTAL
OIL			
EXPLORATION, DEVELOPMENT, & PRODUCTION	581.0	89.4	670.3
REFINING AND PROCESSING	314.3	50.4	364.7
PIPELINES	21.3	3.6	25.0
TANKERS, BARGES, TRUCKS	107.0	18.7	125.7
BULK STATIONS	1.5	0.2	1.7
OTHER	0.0	0.0	0.0
TOTAL OIL	1025.0	162.4	1187.4
OIL SHALE	0.0	0.0	0.0
GAS			
EXPLORATION, DEVELOPMENT, & PRODUCTION	6.5	1.0	7.6
GEOPRESSURED METHANE	0.0	0.0	0.0
PIPELINES	0.0	0.0	0.0
LNG TANKERS	0.0	0.0	0.0
DISTRIBUTION	6.8	1.2	8.0
OTHER	0.0	0.0	0.0
TOTAL GAS	13.4	2.2	15.5
COAL			
UNDERGROUND MINING	0.0	0.0	0.0
SURFACE MINING	0.0	0.0	0.0
RAIL	3.6	0.6	4.4
PIPELINES	0.0	0.0	0.0
BARGES, TRUCKS	0.5	0.1	0.6
TOTAL COAL	4.3	0.7	5.0
COAL SYNTHETICS			
LIQUEFACTION	0.0	0.0	0.0
METHANOL	0.0	0.0	0.0
SOLVENT REFINING	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.0	0.0	0.0
TOTAL SYNTHETICS	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	0.0	0.0	0.0
SOLAR	0.0	0.0	0.0
ELECTRIC UTILITIES			
COAL-FIRED	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.0	0.0	0.0
NUCLEAR	582.7	65.6	648.3
HYDRO & PUMPED STORAGE	21.6	2.3	23.9
OIL & GAS	270.3	30.5	300.8
GEOTHERMAL	0.0	0.0	0.0
TOTAL GENERATION	874.6	98.4	973.0
TRANSMISSION	203.6	23.6	227.2
DISTRIBUTION	151.6	17.3	168.9
TOTAL UTILITIES	1229.8	139.3	1369.2
TOTAL ENERGY INDUSTRY	2272.5	304.6	2577.1

Table 31 (Continued)

BECHTEL ENERGY SUPPLY PLANNING MODEL

CUMULATIVE CAPITAL REQUIREMENTS (MILLION POUNDS, JAN 1978) OF THE ENERGY INDUSTRY
BY FACILITY GROUPING
EGYPT - MEDIUM NUCLEAR/IMPORTS

(1978-2000)

FACILITY	CONSTRUCTION COSTS	OWNER'S COSTS PRIOR TO STARTUP	TOTAL
OIL			
EXPLORATION, DEVELOPMENT, & PRODUCTION	1504.8	231.4	1736.3
REFINING AND PROCESSING	1005.7	161.3	1167.0
PIPELINES	77.0	13.1	90.1
TANKERS, BARGES, TRUCKS	301.3	52.7	354.1
BULK STATIONS	17.6	3.0	20.6
OTHER	0.0	0.0	0.0
TOTAL OIL	2906.4	461.6	3368.0
OIL SHALE	0.0	0.0	0.0
GAS			
EXPLORATION, DEVELOPMENT, & PRODUCTION	18.1	2.8	20.9
GEOPRESSURED METHANE	0.0	0.0	0.0
PIPELINES	0.0	0.0	0.0
LNG TANKERS	0.0	0.0	0.0
DISTRIBUTION	6.8	1.2	8.0
OTHER	0.0	0.0	0.0
TOTAL GAS	24.9	3.9	28.9
COAL			
UNDERGROUND MINING	0.0	0.0	0.0
SURFACE MINING	0.0	0.0	0.0
RAIL	21.3	3.6	25.0
PIPELINES	0.0	0.0	0.0
BARGES, TRUCKS	7.4	1.3	8.7
TOTAL COAL	28.8	4.9	33.7
COAL SYNTHETICS			
LIQUEFACTION	0.0	0.0	0.0
METHANOL	0.0	0.0	0.0
SOLVENT REFINING	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.0	0.0	0.0
TOTAL SYNTHETICS	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	26.7	4.0	30.7
SOLAR	0.0	0.0	0.0
ELECTRIC UTILITIES			
COAL-FIRED	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.0	0.0	0.0
NUCLEAR	3846.9	433.2	4280.1
HYDRO & PUMPED STORAGE	423.9	44.5	468.5
OIL & GAS	1221.4	138.0	1359.4
GEOTHERMAL	0.0	0.0	0.0
TOTAL GENERATION	5492.2	615.7	6107.9
TRANSMISSION	449.9	52.2	502.1
DISTRIBUTION	612.8	69.9	682.7
TOTAL UTILITIES	6554.9	737.7	7292.6
TOTAL ENERGY INDUSTRY	9541.8	1212.1	10753.9

BECHTEL ENERGY SUPPLY PLANNING MODEL

GROWTH IN CAPITAL REQUIREMENTS* (MILLION POUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
EGYPT - MEDIUM NUCLEAR/IMPORTS •

CATEGORY	-----ANNUAL REQUIREMENTS-----					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
NON-MANUAL TECHNICAL MANPOWER	11.	64.	42.	64.	(2000)	16.0	9.2	5.1	7.7
NON-MANUAL NON-TECHNICAL MANPOWER	0.	7.	4.	7.	(2000)	26.5	18.8	6.8	12.3
MANUAL MANPOWER	9.	49.	31.	49.	(2000)	11.8	9.7	5.2	7.2
MANPOWER TOTAL	21.	121.	76.	121.	(2000)	14.4	9.7	5.2	7.6
WOOD PRODUCTS (20)	1.	4.	2.	4.	(2000)	11.2	11.2	6.5	8.3
CHEMICALS & ALLIED PROD. (27,28,30,32)	4.	2.	3.	4.	(1976)	-15.5	0.1	1.2	-2.0
PETROLEUM PRODUCTS (31)	2.	3.	3.	3.	(2000)	1.2	0.5	3.0	2.2
GLASS, CLAY & STONE PRODUCTS (35,36)	2.	13.	9.	16.	(1993)	6.9	16.0	4.2	7.0
PRIMARY IRON & STEEL PRODUCTS (37)	17.	17.	16.	19.	(1997)	0.2	-4.3	1.6	0.1
PRIMARY NON-FERROUS METALS (38)	2.	11.	12.	32.	(1993)	17.5	25.9	-0.1	7.7
FABRICATED STRUCTURAL PRODUCTS (40) *	4.	33.	26.	55.	(1993)	13.9	26.5	2.2	8.8
OTHER FABRICATED PRODUCTS (42)	32.	109.	71.	109.	(2000)	8.4	2.9	5.2	5.2
MATERIALS TOTAL	36.	99.	80.	144.	(1993)	3.2	10.4	2.6	4.3
HVAC HEATING & COOLING UNITS (52) ++	0.	4.	2.	4.	(2000)	44.1	18.2	7.0	14.8
HVAC DUCTWORK & ACCESSORIES (40) *	0.	1.	1.	1.	(2000)	48.9	24.9	7.4	17.0
TURBINES (43)	22.	70.	42.	70.	(2000)	-7.3	9.6	6.8	4.9
GAS WELDING SETS (47) ++	0.	0.	0.	0.	(1979)	0.6	-8.0	1.2	-0.9
ELECTRIC WELDING SETS (53) **	0.	1.	1.	1.	(2000)	9.8	5.9	6.5	6.9
CONSTRUCTION, MINING & OIL FIELD EQP (45)	32.	32.	30.	33.	(1982)	-2.1	0.8	0.4	0.0
MATERIALS HANDLING EQUIPMENT (46)	0.	2.	1.	2.	(2000)	9.8	18.6	6.0	9.1
GENERAL INDUSTRY EQUIPMENT (49)	3.	12.	9.	13.	(1998)	33.5	-6.5	4.2	6.2
INSTRUMENTATION & CONTROLS (62)	2.	9.	6.	10.	(1998)	24.8	-0.8	4.2	6.3
ELECTRICAL EQUIPMENT (53) **	4.	24.	16.	26.	(1993)	18.8	8.8	5.1	8.0
FABRICATED PLATE PRODUCTS (40) *	12.	93.	52.	93.	(2000)	21.0	5.5	6.8	8.8
EQUIPMENT TOTAL	76.	249.	161.	249.	(2000)	5.8	4.2	5.1	5.1
MISCELLANEOUS MATERIALS & EQUIPMENT	8.	11.	10.	12.	(1998)	5.3	-3.8	1.9	1.3
MOBILE FACILITY	13.	11.	14.	22.	(1990)	0.0	2.4	-2.0	-0.7
OTHER CONSTRUCTOR COSTS	20.	126.	75.	126.	(2000)	8.7	12.6	6.4	8.0
CONSTRUCTOR COST TOTAL ##	174.	617.	415.	620.	(1993)	6.3	7.1	4.6	5.4

• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

#BEA (BUREAU OF ECONOMIC ANALYSIS) TWO-DIGIT CATEGORIES ARE IN PARENTHESIS.

* PARTIAL BEA CATEGORY 40, TOTAL IS SUM OF 3 SEPARATE ENTRIES FOR CATEGORY 40.

++ PARTIAL BEA CATEGORY 52, REMAINDER IS PART OF MISCELLANEOUS ENTRY.

** PARTIAL BEA CATEGORY 53, TOTAL IS SUM OF 2 SEPARATE ENTRIES FOR CATEGORY 53.

CONSTRUCTION CAPITAL COST TOTAL INCLUDES MANPOWER, MATERIALS AND EQUIPMENT SUBTOTALS ABOVE PLUS OTHER (OVERHEAD, PROFIT, ETC.) COSTS. IT EXCLUDES OWNER'S COSTS. (LAND COSTS, INTEREST DURING CONSTRUCTION, ETC.)

Table 31 (Continued)

HECHTEL ENERGY SUPPLY PLANNING MODEL

GROWTH IN MANPOWER REQUIREMENTS (MAN-YEARS)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
EGYPT - MEDIUM NUCLEAR/IMPORTS •

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
CHEMICAL ENGINEERS	0.	14.	9.	15.	(1994)	9999.0	-24.2	15.8	9999.0
CIVIL ENGINEERS	42.	534.	293.	534.	(2000)	20.9	20.7	5.8	11.2
ELECTRICAL ENGINEERS	37.	429.	252.	429.	(2000)	22.5	19.0	5.2	10.7
MECHANICAL ENGINEERS	32.	344.	188.	344.	(2000)	22.2	13.9	6.4	10.5
MINING ENGINEERS	0.	1.	0.	1.	(1987)	0.0	0.0	9999.0	9999.0
NUCLEAR ENGINEERS	0.	44.	21.	44.	(2000)	9999.0	23.5	6.5	9999.0
GEOLOGICAL ENGINEERS	29.	28.	28.	32.	(1978)	0.6	-3.0	0.7	-0.1
PETROLEUM ENGINEERS	29.	25.	26.	32.	(1978)	0.6	-4.7	0.4	-0.7
OTHER ENGINEERS	1.	8.	5.	8.	(1997)	41.1	-17.3	13.2	10.0
ENGINEERS TOTAL	170.	1427.	823.	1427.	(2000)	17.1	14.7	5.6	9.3
DESIGNERS & DRAFTSMEN	61.	555.	325.	555.	(2000)	20.4	13.2	5.8	9.6
SUPERVISORS & MANAGERS	56.	285.	166.	285.	(2000)	3.8	15.3	5.3	7.0
NON-MANUAL, TECHNICAL TOTAL	287.	2267.	1314.	2267.	(2000)	15.6	14.4	5.6	9.0
NON-MANUAL, NON-TECHNICAL	11.	350.	174.	350.	(2000)	51.9	19.9	6.3	15.7
NON-MANUAL TOTAL	297.	2617.	1489.	2617.	(2000)	17.6	15.0	5.7	9.5
PIPEFITTERS	127.	780.	482.	781.	(1995)	23.8	3.0	5.6	7.9
PIPEFITTER/WELDERS	72.	357.	220.	357.	(2000)	14.3	5.5	5.5	6.9
ELECTRICIANS	55.	766.	443.	766.	(2000)	24.5	19.0	6.1	11.6
BOILERMAKERS	44.	183.	99.	184.	(1997)	2.1	6.8	7.0	6.1
BOILERMAKER/WELDERS	15.	92.	52.	94.	(1997)	-6.8	25.8	6.7	8.0
IRON WORKERS	23.	399.	294.	725.	(1993)	20.4	43.4	1.9	12.5
CARPENTERS	24.	507.	290.	507.	(2000)	32.4	22.5	6.2	13.5
EQUIPMENT OPERATORS	122.	409.	281.	409.	(2000)	6.4	6.6	4.4	5.2
LINEMEN	24.	143.	160.	445.	(1993)	26.4	27.7	-2.4	7.8
TEAMSTERS & LABORERS	180.	851.	549.	851.	(2000)	6.5	13.0	4.7	6.7
OTHER	263.	430.	344.	430.	(2000)	2.6	-0.0	2.6	2.1
MANUAL TOTAL	949.	4917.	3214.	4917.	(2000)	11.7	11.7	4.4	7.1
CONSTRUCTION MANPOWER TOTAL	1246.	7535.	4703.	7535.	(2000)	13.2	12.7	4.8	7.8

• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A GROWTH RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 31 (Continued)

GROWTH IN ANNUAL COSTS (MILLION POUNDS JANUARY 1978) FOR THE OPERATION AND MAINTENANCE OF ENERGY-RELATED FACILITIES EGYPT - MEDIUM NUCLEAR/IMPORTS *

CATEGORY	ANNUAL REQUIREMENTS-----					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
NON-MANUAL TECHNICAL MANPOWER	0.	2.	1.	2.	(1998)	0.0	0.0	9999.0	9999.0
NON-MANUAL NON-TECHNICAL MANPOWER	0.	0.	0.	0.		0.0	0.0	0.0	0.0
MANUAL MANPOWER	0.	1.	0.	1.	(1998)	0.0	0.0	9999.0	9999.0
MANPOWER TOTAL	0.	3.	1.	3.	(1998)	0.0	0.0	9999.0	9999.0
WOOD PRODUCTS (20)	0.	0.	0.	0.	(1998)	0.0	0.0	9999.0	9999.0
CHEMICALS & ALLIED PROD. (27,28,30,32)	4.	18.	10.	18.	(2000)	1.0	6.4	7.4	6.1
PETROLEUM PRODUCTS (31)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
GLASS, CLAY & STONE PRODUCTS (35,36)	0.	0.	0.	0.	(2000)	12.4	14.0	8.0	10.0
PRIMARY IRON & STEEL PRODUCTS (37)	0.	6.	2.	6.	(1999)	23.7	0.3	15.7	13.6
PRIMARY NON-FERROUS METALS (38)	0.	1.	0.	1.	(2000)	6.2	6.3	6.4	6.3
FABRICATED STRUCTURAL PRODUCTS (40) *	0.	1.	0.	1.	(1998)	0.0	0.0	9999.0	9999.0
OTHER FABRICATED PRODUCTS (42)	1.	5.	2.	5.	(2000)	5.7	8.8	9.5	8.7
MATERIALS TOTAL	6.	31.	16.	31.	(2000)	3.2	6.3	9.1	7.5
HVAC HEATING & COOLING UNITS (52) ++	0.	0.	0.	0.	(1980)	24.3	-0.3	-0.3	3.6
HVAC DUCTWORK & ACCESSORIES (40) *	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TURBINES (43)	0.	4.	2.	4.	(2000)	14.5	5.9	10.5	10.2
GAS WELDING SETS (47) ++	0.	0.	0.	0.		0.0	0.0	0.0	0.0
ELECTRIC WELDING SETS (53) **	0.	0.	0.	0.		0.0	0.0	0.0	0.0
CONSTRUCTION, MINING & OIL FIELD EOP (45)	0.	0.	0.	0.	(2000)	15.7	7.7	7.7	9.0
MATERIALS HANDLING EQUIPMENT (46)	0.	0.	0.	0.	(2000)	21.4	17.7	8.8	12.7
GENERAL INDUSTRY EQUIPMENT (49)	1.	4.	2.	4.	(2000)	-0.7	2.5	6.5	4.4
INSTRUMENTATION & CONTROLS (62)	1.	4.	2.	4.	(2000)	7.9	3.1	5.8	5.6
ELECTRICAL EQUIPMENT (53) **	1.	8.	4.	8.	(2000)	4.9	7.8	8.2	7.6
FABRICATED PLATE PRODUCTS (40) *	0.	0.	0.	0.		0.0	0.0	0.0	0.0
EQUIPMENT TOTAL	4.	20.	10.	20.	(2000)	5.5	5.1	7.7	6.8
ELECTRICITY	0.	0.	0.	0.		0.0	0.0	0.0	0.0
NATURAL GAS	0.	0.	0.	0.		0.0	0.0	0.0	0.0
WATER	0.	0.	0.	0.		0.0	0.0	0.0	0.0
UTILITY TOTAL	0.	0.	0.	0.		0.0	0.0	0.0	0.0
RENTS, ROYALTIES, ETC.	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TAXES	0.	0.	0.	0.		0.0	0.0	0.0	0.0
SERVICES & MISCELLANEOUS	1.	6.	4.	6.	(2000)	10.5	5.8	5.9	6.7
ANNUAL OPERATING COST (EX FUEL)	11.	60.	31.	60.	(2000)	5.0	5.8	8.5	7.3

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A GROWTH RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

#BEA (BUREAU OF ECONOMIC ANALYSIS) TWO-DIGIT CATEGORIES ARE IN PARENTHESIS.

* PARTIAL BEA CATEGORY 40, TOTAL IS SUM OF 3 SEPARATE ENTRIES FOR CATEGORY 40.

++ PARTIAL BEA CATEGORY 52, REMAINDER IS PART OF MISCELLANEOUS ENTRY.

** PARTIAL BEA CATEGORY 53, TOTAL IS SUM OF 2 SEPARATE ENTRIES FOR CATEGORY 53.

E N E R G Y S U P P L Y S Y S T E M I N P U T S
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VALUES IN 10E15 JOULES	1975	1982	1985	2000	AVERAGE ANNUAL GROWTH
DOMESTIC PETROLEUM PRODUCTION	448.99	1865.50	2100.82	2100.82	6.37%
DOMESTIC NATURAL GAS PRODUCTION	14.39	125.42	125.42	125.42	9.05%
DOMESTIC COAL PRODUCTION	0.0	0.0	8.00	8.00	-----
NUCLEAR POWER INPUTS	0.0	0.0	0.0	130.57	-----
HYDRO-ELECTRIC POWER INPUTS	78.03	89.97	105.32	99.66	0.98%
GEO THERMAL GENERATION INPUT	0.0	0.0	0.0	1.29	-----
INPUTS TO SOLAR-ELECTRIC PLANTS	0.0	0.0	0.0	36.70	-----
INPUTS TO BIOGAS PLANTS	0.0	0.0	0.0	18.00	-----
SOLAR ENERGY (NON-ELECTRIC)	0.0	0.0	0.21	10.00	-----
ENERGY FROM CROP RESIDUES	172.00	190.00	200.00	250.00	1.51%
ENERGY FROM WOOD (FOR HEAT)	1.50	1.50	1.50	1.50	0.0 %
ENERGY FROM ANIMAL WASTES	43.00	45.00	46.00	50.00	0.61%
ENERGY FROM HUMAN AND ANIMAL POWER	6.60	7.90	8.30	11.00	2.06%
DOMESTIC ENERGY PRODUCTION	764.50	2325.28	2595.57	2842.95	5.39%
IMPORTED COAL	30.00	44.00	47.00	216.00	8.22%
PETROLEUM IMPORTS	129.45	80.00	123.94	110.63	-0.63%
ENERGY IMPORTS	159.45	124.00	170.94	326.63	2.91%
TOTAL ENERGY EXTRACTION AND IMPORTATION	923.95	2449.28	2766.51	3169.58	5.05%
TOTAL PETROLEUM EXPORTS	243.98	1395.00	1556.55	577.41	3.51%
ENERGY EXPORTS	243.98	1395.00	1556.55	577.41	3.51%
PRODUCTION AND IMPORTS FOR DOMESTIC CONSUMPTION	679.97	1054.28	1209.96	2592.17	5.50%

ENERGY SUPPLY SYSTEM OUTPUTS
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Table 32 Continued

VALUES IN 10E15 JOULES	1975	1982	1985	2000	AVERAGE ANNUAL GROWTH
OIL FOR DIRECT USE	264.13	355.17	425.56	823.98	4.66%
HIGH-BTU GAS FOR DIRECT USE	13.67	119.15	94.31	33.98	3.71%
COAL FOR DIRECT USE	30.00	44.00	55.00	224.00	8.37%
ELECTRICITY FOR CONSUMPTION	29.86	66.76	98.02	316.75	9.91%
SOLAR ENERGY (NON-ELECTRIC)	0.0	0.0	0.21	10.00	-----
ENERGY FROM CROP RESIDUES	172.00	190.00	200.00	250.00	1.51%
ENERGY FROM WOOD (FOR HEAT)	1.50	1.50	1.50	1.50	0.0 %
ENERGY FROM ANIMAL WASTES	43.00	45.00	46.00	50.00	0.61%
ENERGY FROM HUMAN AND ANIMAL POWER	6.60	7.90	8.30	11.00	2.06%
DOMESTIC ENERGY CONSUMPTION	560.76	829.48	928.90	1721.21	4.59%
TOTAL PETROLEUM EXPORTS	243.98	1395.00	1556.55	577.41	3.51%
ENERGY EXPORTS	243.98	1395.00	1556.55	577.41	3.51%
DOMESTIC CONSUMPTION AND EXPORTS	804.74	2224.48	2485.44	2298.62	4.29%

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 32 Continued

ELECTRIC GENERATING CAPACITY (MWE)

EGYPT - LOW NUCLEAR

	1975	1982	1985	2000	AVERAGE ANNUAL GROWTH
COAL AND COAL/WASTE PLANTS	0.0	0.0	0.0	0.0	-----
OIL-STEAM PLANTS	1420.0	2904.0	3318.0	13769.0	9.51%
GAS-STEAM PLANTS	0.0	0.0	0.0	0.0	-----
LOW-BTU GAS-STEAM PLANTS	0.0	0.0	0.0	0.0	-----
GAS TURBINE PLANTS	137.0	437.0	437.0	0.0	-----
COMBINED CYCLE PLANTS	0.0	0.0	450.0	1800.0	-----
FUEL CELLS	0.0	0.0	0.0	0.0	-----
NUCLEAR POWER PLANTS	0.0	0.0	0.0	1900.0	-----
CONVENTIONAL HYDRO PLANTS	2445.0	2445.0	2445.0	2603.0	0.25%
PUMPED STORAGE PLANTS	0.0	0.0	0.0	300.0	-----
GEOTHERMAL PLANTS	0.0	0.0	0.0	20.0	-----
TOTAL CAPACITY	4002.0	5786.0	6650.0	20392.0	6.73%

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 32 Continued

SCHEDULE OF ANNUAL ENERGY FACILITIES ADDITIONS TO SUPPLY FUEL MIX: EGYPT - LOW NUCLEAR

1976-2010

FACILITY NAME	1975 TOTALS	1976	1977	1978	1979	1980	1981	1982	TOTAL ADDED (1978- 1982)
1 ONSHORE PRIMARY OIL RECOVERY-(1,000 MBPD)	66.0	17*	17*	17*	18*	17	18	17	87
2 ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	0.0	0	0	0	0	0	0	0	0
3 ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	0.0	0	0	0	0	0	0	0	0
4 OFFSHORE OIL RECOVERY (12.5 MBPD)	11.8	3*	3*	3*	3*	4*	3	3	16
6 HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	0.0	0	0	0	0	0	0	0	0
7 LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	2.0	0	0	0	0	0	0	1	1
19 ONSHORE CONVENTIONAL GAS RECOVERY (100 MMCF/D)	0.4	1*	0	0	1*	0	0	0	1
20 ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	0.0	0	0	0	0	0	0	0	0
21 OFFSHORE GAS RECOVERY (25 MMCF/D)	-0.0	0	0	0	0	0	0	0	0
24 LNG EXPORT (3030 MMCF/D)	0.0	0	0	0	0	0	0	0	0
27 UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	0.0	0	0	0	0	0	0	0	0
37 SURFACE URANIUM MINE (275.4 M TONNES/Y)	0.0	0	0	0	0	0	0	0	0
38 UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	0.0	0	0	0	0	0	0	0	0
39 URANIUM MILL (275.4 M TONNES/Y)	0.0	0	0	0	0	0	0	0	0
42 LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	0.0	0	0	0	0	0	0	0	0
43 LWR FUEL FABRICATION - PU RECYCLE (150 MTH/Y)	0.0	0	0	0	0	0	0	0	0
49 HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	0.0	0	0	0	0	0	0	0	0
50 OIL-FIRED POWER PLANT (800 MWE)	0.0	0	0	0	0	0	0	0	0
51 OIL-FIRED POWER PLANT (600 MWE)	0.0	0	0	0	0	1*	1*	0	2
52 OIL-FIRED POWER PLANT (450 MWE)	3.2	0	0	0	1*	0	0	0	1
53 COAL FIRED POWER PLANT-LOW BTU (800 MWE)	0.0	0	0	0	0	0	0	0	0
54 COAL FIRED POWER PLANT-HIGH BTU (800 MWE)	0.0	0	0	0	0	0	0	0	0
55 COAL FIRED POWER PLANT-LOW BTU (600 MWE)	0.0	0	0	0	0	0	0	0	0
56 COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	0.0	0	0	0	0	0	0	0	0
59 HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	0.0	0	0	0	0	0	0	0	0
60 HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	0.0	0	0	0	0	0	0	0	0
61 COMBINED CYCLE POWER PLANT (400 MWE)	0.0	0	0	0	0	0	0	0	0
62 GAS TURBINE POWER PLANT (133 MWE)	1.0	0	1*	1*	0	0	0	0	1
63 FUEL CELLS (26 MWE)	0.0	0	0	0	0	0	0	0	0
64 LIGHT WATER REACTOR (LWR) (1200 MWE)	0.0	0	0	0	0	0	0	0	0
65 LIGHT WATER REACTOR (LWR) (900 MWE)	0.0	0	0	0	0	0	0	0	0
66 LIGHT WATER REACTOR (LWR) (600 MWE)	0.0	0	0	0	0	0	0	0	0
67 DAM & HYDROELECTRIC POWER PLANT (200 MWE)	12.2	0	0	0	0	0	0	0	0
68 PUMPED STORAGE (500 MWE)	0.0	0	0	0	0	0	0	0	0
69 GEOTHERMAL POWER COMPLEX (200 MWE)	0.0	0	0	0	0	0	0	0	0

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

BECHTEL ENERGY SUPPLY PLANNING MODEL

SCHEDULE OF ANNUAL ENERGY FACILITIES ADDITIONS TO SUPPLY FUEL MIX: EGYPT - LOW NUCLEAR

1976-2010

Table 32 Continued

FACILITY NAME	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	TOTAL ADDED (1976- 1993)
1 ONSHORE PRIMARY OIL RECOVERY-(1,000 MBPD)	17	16	16	14	13	14	13	13	14	13	14	244
2 ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	0	0	0	0	0	0	0	0	0	0	0	0
3 ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	0	0	0	0	0	0	0	0	0	0	0	0
4 OFFSHORE OIL RECOVERY (12.5 MBPD)	3	3	3	3	2	3	2	3	2	3	2	45
6 HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	0	0	0	0	0	0	0	0	0	0	0	0
7 LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	0	0	0	1	0	0	1	0	0	1	0	4
19 ONSHORE CONVENTIONAL GAS RECOVERY (100 MMCF/D)	1	0	0	0	0	1	0	0	0	0	1	4
20 ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0	0
21 OFFSHORE GAS RECOVERY (25 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0	0
24 LNG EXPORT (3030 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0	0
27 UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0	0
37 SURFACE URANIUM MINE (275.4 M TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0	0
38 UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0	0
39 URANIUM MILL (275.4 M TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0	0
42 LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	0	0	0	0	0	0	0	0	0	0	0	0
43 LWR FUEL FABRICATION - PU RECYCLE (150 MTM/Y)	0	0	0	0	0	0	0	0	0	0	0	0
49 HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	0	0	0	0	0	0	0	0	0	0	0	0
50 OIL-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0	1	1	1	3
51 OIL-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	0	0	0	0	2
52 OIL-FIRED POWER PLANT (450 MWE)	0	0	1	0	0	0	0	0	0	0	0	2
53 COAL FIRED POWER PLANT-LOW BTU (800 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
54 COAL FIRED POWER PLANT-HIGH BTU (800 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
55 COAL FIRED POWER PLANT-LOW BTU (600 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
56 COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
59 HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
60 HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
61 COMBINED CYCLE POWER PLANT (400 MWE)	0	1	0	0	0	0	0	1	0	1	1	4
62 GAS TURBINE POWER PLANT (133 MWE)	0	0	0	0	0	0	0	0	0	0	0	1
63 FUEL CELLS (26 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
64 LIGHT WATER REACTOR (LWR) (1200 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
65 LIGHT WATER REACTOR (LWR) (900 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
66 LIGHT WATER REACTOR (LWR) (600 MWE)	0	0	0	1*	0	1	1	0	0	0	0	3
67 DAM & HYDROELECTRIC POWER PLANT (200 MWE)	0	0	0	0	0	1	0	0	0	0	0	1
68 PUMPED STORAGE (500 MWE)	0	0	0	0	0	0	1	0	0	0	0	1
69 GEOTHERMAL POWER COMPLEX (200 MWE)	0	0	0	0	0	0	0	0	0	0	0	0

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 32 Continued

SCHEDULE OF ANNUAL ENERGY FACILITIES ADDITIONS TO SUPPLY FUEL MIX: EGYPT - LOW NUCLEAR

1976-2010

FACILITY NAME	1994	1995	1996	1997	1998	1999	2000	TOTAL ADDED (1978- 2000)
1 ONSHORE PRIMARY OIL RECOVERY-(1,000 MBPD)	13	14	14	14	14	15	14	342
2 ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	0	0	0	0	0	0	0	0
3 ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	0	0	0	0	0	0	0	0
4 OFFSHORE OIL RECOVERY (12.5 MBPD)	3	2	3	3	2	3	3	64
6 HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	0	0	0	0	0	0	0	0
7 LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	1	0	1	0	1	0	1	8
19 ONSHORE CONVENTIONAL GAS RECOVERY (100 MMCF/D)	0	0	0	0	1	0	0	5
20 ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	0	0	0	0	0	0	0	0
21 OFFSHORE GAS RECOVERY (25 MMCF/D)	0	0	0	0	0	0	0	0
24 LNG EXPORT (3030 MMCF/D)	0	0	0	0	0	0	0	0
27 UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	0	0	0	0	0	0	0	0
37 SURFACE URANIUM MINE (275.4 M TONNES/Y)	0	0	0	1	0	0	0	1
38 UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	0	0	0	0	0	0	0	0
39 URANIUM MILL (275.4 M TONNES/Y)	0	0	0	1	0	0	0	1
42 LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	0	0	0	0	0	0	0	0
43 LWR FUEL FABRICATION - PU RECYCLE (150 MTH/Y)	0	0	0	0	0	0	0	0
49 HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	0	0	0	0	0	0	0	0
50 OIL-FIRED POWER PLANT (800 MWE)	1	1	1	2	3	1	2	14
51 OIL-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	1	0	3
52 OIL-FIRED POWER PLANT (450 MWE)	0	0	0	0	0	0	0	2
53 COAL FIRED POWER PLANT-LOW BTU (800 MWE)	0	0	0	0	0	0	0	0
54 COAL FIRED POWER PLANT-HIGH BTU (800 MWE)	0	0	0	0	0	0	0	0
55 COAL FIRED POWER PLANT-LOW BTU (600 MWE)	0	0	0	0	0	0	0	0
56 COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	0	0	0	0	0	0	0	0
59 HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0
60 HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	0
61 COMBINED CYCLE POWER PLANT (400 MWE)	0	0	0	0	0	0	0	4
62 GAS TURBINE POWER PLANT (133 MWE)	0	0	0	0	0	0	0	1
63 FUEL CELLS (26 MWE)	0	0	0	0	0	0	0	0
64 LIGHT WATER REACTOR (LWR) (1200 MWE)	0	0	0	0	0	0	0	0
65 LIGHT WATER REACTOR (LWR) (900 MWE)	0	0	0	0	0	0	0	0
66 LIGHT WATER REACTOR (LWR) (600 MWE)	0	0	0	0	0	0	0	3
67 DAM & HYDROELECTRIC POWER PLANT (200 MWE)	0	0	0	0	0	0	0	1
68 PUMPED STORAGE (500 MWE)	0	0	0	0	0	0	0	1
69 GEOTHERMAL POWER COMPLEX (200 MWE)	0	0	0	0	0	0	0	0

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

B E C H T E L E N E R G Y S U P P L Y P L A N N I N G M O D E L

Table 32. Continued

SCHEDULE OF ANNUAL ENERGY FACILITIES ADDITIONS TO SUPPLY FUEL MIX: EGYPT - LOW NUCLEAR

1976-2010

FACILITY NAME	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL ADDED (1978- 2010)
1 ONSHORE PRIMARY OIL RECOVERY-(1,000 MBPD)	14	14	14	14	14	14	14	14	14	14	482
2 ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	0	0	0	0	0	0	0	0	0	0	0
3 ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	0	0	0	0	0	0	0	0	0	0	0
4 OFFSHORE OIL RECOVERY (12.5 MBPD)	3	3	3	3	3	3	3	3	3	3	94
6 HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	0	0	0	0	0	0	0	0	0	0	0
7 LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	0	1	0	0	1	0	0	1	0	0	11
19 ONSHORE CONVENTIONAL GAS RECOVERY (100 MMCF/D)	0	0	0	0	0	1	0	0	0	0	6
20 ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0
21 OFFSHORE GAS RECOVERY (25 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0
24 LNG EXPORT (3030 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0
27 UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0
37 SURFACE URANIUM MINE (275.4 M TONNES/Y)	0	0	0	1	0	0	0	0	0	1	3
38 UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0
39 URANIUM MILL (275.4 M TONNES/Y)	0	0	0	1	0	0	0	0	0	1	3
42 LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	0	0	0	0	0	0	0	0	0	0	0
43 LWR FUEL FABRICATION - PU RECYCLE (150 MTH/Y)	0	0	0	0	0	0	0	0	0	0	0
49 HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	0	0	0	0	0	0	0	0	0	0	0
50 OIL-FIRED POWER PLANT (800 MWE)	1	1	1	1	1	0	0	0	0	0	14
51 OIL-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	0	0	0	3
52 OIL-FIRED POWER PLANT (450 MWE)	0	0	0	0	0	0	0	0	0	0	2
53 COAL FIRED POWER PLANT-LOW BTU (800 MWE)	0	0	0	0	0	0	0	0	0	0	0
54 COAL FIRED POWER PLANT-HIGH BTU (800 MWE)	0	0	0	0	0	0	0	0	0	0	0
55 COAL FIRED POWER PLANT-LOW BTU (600 MWE)	0	0	0	0	0	0	0	0	0	0	0
56 COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	0	0	0	0	0	0	0	0	0	0	0
59 HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0	0	0	0
60 HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	0	0	0	0
61 COMBINED CYCLE POWER PLANT (400 MWE)	0	0	0	0	0	0	0	0	0	0	4
62 GAS TURBINE POWER PLANT (133 MWE)	0	0	0	0	0	0	0	0	0	0	1
63 FUEL CELLS (26 MWE)	0	0	0	0	0	0	0	0	0	0	0
64 LIGHT WATER REACTOR (LWR) (1200 MWE)	1	1	1	1	1	1	2	2	2	2	14
65 LIGHT WATER REACTOR (LWR) (900 MWE)	0	0	0	0	0	0	0	0	0	0	0
66 LIGHT WATER REACTOR (LWR) (600 MWE)	0	0	0	0	0	0	0	0	0	0	0
67 DAM & HYDROELECTRIC POWER PLANT (200 MWE)	0	0	0	0	0	0	0	0	0	0	0
68 PUMPED STORAGE (500 MWE)	0	1	0	1	0	1	1	1	1	1	1
69 GEOTHERMAL POWER COMPLEX (200 MWE)	0	0	0	0	0	0	0	0	0	0	0

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

HECHTEL ENERGY SUPPLY PLANNING MODEL

SCHEDULE OF ANNUAL TRANSPORTATION ADDITIONS TO SUPPLY FUEL MIX: EGYPT - LOW NUCLEAR

1976-2010

Table 32 Continued

FACILITY NAME	1975 TOTALS	1976	1977	1978	1979	1980	1981	1982	TOTAL ADDED (1976- 1982)
1 CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	0.0	0	0	0	0	0	0	0	0
3 OIL TANKER (90,000 DWT, 620,000 B)	0.0	0	0	0	0	0	0	0	0
4 OIL BARGES (90,000 BBL)	3.0	1*	2*	1*	1	1	0	1	4
5 OIL TANK TRUCK (226 BBL)	290.3	128*	130*	132*	130	129	135	149	675
6 PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	0.5	0	0	0	0	0	0	0	0
7 HOT OIL PIPELINE (40 MB/D, 80.5 KM)	2.4	0	0	1*	0	0	0	0	1
8 REFINED PRODUCTS BULK STATION (69 MB/D)	1.6	0	0	0	1*	0	0	0	1
9 RAIL LINE (64.4 KM, SINGLE TRACK)	0.0	0	0	0	0	0	0	0	0
10 MIXED TRAIN (6556 TONNES)	2.3	0	0	1*	0	0	0	1	2
11 COAL UNIT TRAIN (9,528 TONNES)	0.0	0	0	0	0	0	0	0	0
12 COAL SLURRY PIPELINE (22.69 MM TONNES/Y, 241.4 KM)	0.0	0	0	0	0	0	0	0	0
13 COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	0.0	0	0	0	0	0	0	0	0
14 COAL SLURRY DEWATERING (22.69 MM TONNES/Y)	0.0	0	0	0	0	0	0	0	0
15 COAL BARGES (19,048 TONNES)	0.2	0	0	0	0	0	0	0	0
16 COAL TRUCK (22.7 TONNES)	4.8	1*	1*	1*	1	1	1	1	5
17 GAS PIPELINE (.87 BSCF/D, 241.4 KM)	0.0	0	0	0	0	0	0	0	0
18 GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	0.7	2*	1*	1*	1*	0	1*	0	3
20 LNG TANKER (2.6 BCF)	0.0	0	0	0	0	0	0	0	0
21 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	0.5	0	0	0	0	1	0	0	1
22 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	0.0	0	0	0	0	0	0	0	0
23 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	0.2	0	0	0	0	0	0	0	0
24 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	0.0	0	0	0	0	0	0	0	0
25 --400 KVDC TRANSMISSION LINE (1500 MWE, 1287 KM)	0.0	0	0	0	0	0	0	0	0
26 ELECTRICITY DISTRIBUTION-AERIAL LINES (131.6 MWE)	9.0	1*	1*	1*	2*	2*	3	2	10

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 32 Continued

SCHEDULE OF ANNUAL TRANSPORTATION ADDITIONS TO SUPPLY FUEL MIX: EGYPT - LOW NUCLEAR

1976-2010

FACILITY NAME	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	TOTAL ADDED (1978- 1993)
1 CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0	0
3 OIL TANKER (90,000 DWT; 620,000 B)	0	0	0	0	0	0	0	0	0	0	0	0
4 OIL BARGES (90,000 BBL)	0	1	0	1	0	0	1	0	0	0	0	7
5 OIL TANK TRUCK (226 BBL)	167	179	178	177	182	187	189	190	189	187	183	2683
6 PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	1	0	0	0	0	0	0	0	0	0	0	1
7 HOT OIL PIPELINE (40 MB/D, 80.5 KM)	1	0	0	1	0	0	1	0	1	0	1	6
8 REFINED PRODUCTS BULK STATION (69 MB/D)	0	0	0	1	0	0	0	1	0	0	1	4
9 RAIL LINE (64.4 KM, SINGLE TRACK)	0	0	0	0	0	0	0	0	0	0	0	0
10 MIXED TRAIN (6556 TONNES)	0	0	1	0	1	0	1	1	1	0	1	8
11 COAL UNIT TRAIN (9,528 TONNES)	0	0	0	0	0	0	0	0	0	0	0	0
12 COAL SLURRY PIPELINE (22.69 MM TONNES/Y, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0	0
13 COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0	0
14 COAL SLURRY DEWATERING (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0	0
15 COAL BARGES (19,048 TONNES)	0	0	0	0	0	0	0	1	0	0	0	1
16 COAL TRUCK (22.7 TONNES)	2	1	2	2	2	3	3	3	3	3	4	33
17 GAS PIPELINE (.87 BSCF/D, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0	0
18 GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	0	0	0	0	0	0	0	0	0	0	0	3
20 LNG TANKER (2.6 BCF)	0	0	0	0	0	0	0	0	0	0	0	0
21 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	0	0	0	1	0	0	0	1	0	0	0	3
22 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	0	0	0	0	0	0	0	0	0	0	0	0
23 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	1	0	0	0	0	0	0	0	0	0	0	1
24 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	0	0	0	0	0	0	0	0	0	0	0	0
25 +/-400 KVDC TRANSMISSION LINE (1500 MWE, 1287 KM)	0	0	0	0	0	0	0	0	0	0	0	0
26 ELECTRICITY DISTRIBUTION-AERIAL LINES(131.6MWE)	3	4	3	4	3	4	4	4	5	4	5	53

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

HECHTEL ENERGY SUPPLY PLANNING MODEL

SCHEDULE OF ANNUAL TRANSPORTATION ADDITIONS TO SUPPLY FUEL MIX: EGYPT - LOW NUCLEAR

1976-2010

Table 32 Continued

FACILITY NAME	1994	1995	1996	1997	1998	1999	2000	TOTAL ADDED (1978- 2000)
1 CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	0	0	0	0	0	0	0	0
3 OIL TANKER (90,000 DWT, 620,000 B)	0	0	0	0	0	0	0	0
4 OIL BARGES (90,000 BBL)	0	0	0	0	0	0	0	7
5 OIL TANK TRUCK (226 BBL)	178	170	162	152	140	127	112	3724
6 PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	0	1	0	0	0	0	0	2
7 HOT OIL PIPELINE (40 MB/D, 80.5 KM)	0	1	0	1	1	0	1	10
8 REFINED PRODUCTS BULK STATION (69 MB/D)	0	0	1	0	1	0	1	7
9 RAIL LINE (64.4 KM, SINGLE TRACK)	0	0	0	0	0	0	0	0
10 MIXED TRAIN (6556 TONNES)	1	1	2	1	1	1	2	17
11 COAL UNIT TRAIN (9,528 TONNES)	0	0	0	0	0	0	0	0
12 COAL SLURRY PIPELINE (22.69 MM TONNES/Y, 241.4 KM)	0	0	0	0	0	0	0	0
13 COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0
14 COAL SLURRY DEWATERING (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0
15 COAL BARGES (19,048 TONNES)	0	0	0	0	0	0	0	1
16 COAL TRUCK (22.7 TONNES)	4	4	5	5	5	5	6	67
17 GAS PIPELINE (1.87 BSCF/D, 241.4 KM)	0	0	0	0	0	0	0	0
18 GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	0	0	0	0	0	0	0	3
20 LNG TANKER (2.6 BCF)	0	0	0	0	0	0	0	0
21 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	1	0	0	0	1	0	0	5
22 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	0	0	0	0	0	0	0	0
23 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	1	0	0	0	0	0	0	2
24 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	0	0	0	0	0	0	0	0
25 +-400 KVDC TRANSMISSION LINE (1500 MWE, 1287 KM)	0	0	0	0	0	0	0	0
26 ELECTRICITY DISTRIBUTION-AERIAL LINES (131.6 MWE)	4	5	5	5	6	5	6	89

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

HECHTEL ENERGY SUPPLY PLANNING MODEL

Table 32 Continued

SCHEDULE OF ANNUAL TRANSPORTATION ADDITIONS TO SUPPLY FUEL MIX: EGYPT - LOW NUCLEAR

1976-2010

FACILITY NAME	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL ADDED (1978- 2010)
1 CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0
3 OIL TANKER (90,000 DWT, 620,000 B)	0	0	0	0	0	0	0	0	0	0	0
4 OIL BARGES (90,000 BBL)	0	0	0	0	0	0	0	0	0	0	7
5 OIL TANK TRUCK (226 BBL)	112	112	112	112	112	112	112	112	112	112	4844
6 PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	0	0	0	0	0	1	0	0	0	0	3
7 HOT OIL PIPELINE (40 MB/D, 80.5 KM)	1	1	1	1	1	1	1	1	1	1	20
8 REFINED PRODUCTS BULK STATION (69 MB/D)	0	1	0	1	0	1	0	1	0	1	12
9 RAIL LINE (64.4 KM, SINGLE TRACK)	0	0	0	0	0	0	0	0	0	0	0
10 MIXED TRAIN (6556 TONNES)	2	2	2	2	2	2	2	2	2	2	37
11 COAL UNIT TRAIN (9,528 TONNES)	0	0	0	0	0	0	0	0	0	0	0
12 COAL SLURRY PIPELINE (22.69 MM TONNES/Y, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0
13 COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0
14 COAL SLURRY DEMATERING (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0
15 COAL BARGES (19,048 TONNES)	0	0	0	0	0	0	0	0	0	0	1
16 COAL TRUCK (22.7 TONNES)	6	6	6	6	6	6	6	6	6	6	127
17 GAS PIPELINE (1.87 BSCF/D, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0
18 GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	0	0	0	0	0	0	0	0	0	0	3
20 LNG TANKER (2.6 BCF)	0	0	0	0	0	0	0	0	0	0	0
21 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	0	0	0	0	0	1	0	0	0	0	6
22 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	0	0	0	0	0	0	0	0	0	0	0
23 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	0	0	0	0	0	0	0	0	0	0	2
24 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	0	0	0	0	0	0	0	0	0	0	0
25 +-400 KVOC TRANSMISSION LINE (1500 MWE, 1287 KM)	0	0	0	0	0	0	0	0	0	0	0
26 ELECTRICITY DISTRIBUTION-AERIAL LINES (131.6MWE)	6	6	6	6	6	6	6	6	6	6	149

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 32 Continued

CUMULATIVE CAPITAL REQUIREMENTS (MILLION POUNDS, JAN 1978) OF THE ENERGY INDUSTRY
BY FACILITY GROUPING
EGYPT - LOW NUCLEAR

(1978-1985)

FACILITY	CONSTRUCTION COSTS	OWNER'S COSTS PRIOR TO STARTUP	TOTAL
OIL			
EXPLORATION, DEVELOPMENT, & PRODUCTION	643.2	98.9	742.1
REFINING AND PROCESSING	458.2	73.5	531.7
PIPELINES	35.4	6.0	41.4
TANKERS, BARGES, TRUCKS	116.9	20.5	137.4
BULK STATIONS	9.7	1.6	11.3
OTHER	0.0	0.0	0.0
TOTAL OIL	1263.3	200.5	1463.8
OIL SHALE	0.0	0.0	0.0
GAS			
EXPLORATION, DEVELOPMENT, & PRODUCTION	7.3	1.1	8.4
GEOPRESSURED METHANE	0.0	0.0	0.0
PIPELINES	0.0	0.0	0.0
LNG TANKERS	0.0	0.0	0.0
DISTRIBUTION	24.6	4.2	28.7
OTHER	0.0	0.0	0.0
TOTAL GAS	31.9	5.3	37.2
COAL			
UNDERGROUND MINING	0.0	0.0	0.0
SURFACE MINING	0.0	0.0	0.0
RAIL	11.1	1.9	12.9
PIPELINES	0.0	0.0	0.0
BARGES, TRUCKS	0.6	0.1	0.7
TOTAL COAL	11.6	2.0	13.6
COAL SYNTHETICS			
LIQUEFACTION	0.0	0.0	0.0
METHANOL	0.0	0.0	0.0
SOLVENT REFINING	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.0	0.0	0.0
TOTAL SYNTHETICS	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	0.0	0.0	0.0
SOLAR	0.0	0.0	0.0
ELECTRIC UTILITIES			
COAL-FIRED	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.0	0.0	0.0
NUCLEAR	662.7	74.6	737.3
HYDRO & PUMPED STORAGE	77.8	8.2	85.9
OIL & GAS	330.1	37.3	367.4
GEOTHERMAL	0.0	0.0	0.0
TOTAL GENERATION	1070.6	120.1	1190.7
TRANSMISSION	270.8	31.4	302.2
DISTRIBUTION	233.5	26.6	260.1
TOTAL UTILITIES	1574.9	178.1	1753.0
TOTAL ENERGY INDUSTRY	2881.7	385.9	3267.6

HECHTEL ENERGY SUPPLY PLANNING MODEL

CUMULATIVE CAPITAL REQUIREMENTS (MILLION EPOUNDS, JAN 1978) OF THE ENERGY INDUSTRY
BY FACILITY GROUPING
EGYPT - LOW NUCLEAR

Table 32 Continued

(1978-2000)			
FACILITY	CONSTRUCTION COSTS	OWNER'S COSTS PRIOR TO STARTUP	TOTAL
OIL			
EXPLORATION, DEVELOPMENT, & PRODUCTION	1665.8	256.2	1922.0
REFINING AND PROCESSING	1920.0	308.0	2228.0
PIPELINES	138.9	23.6	162.5
TANKERS, BARGES, TRUCKS	332.0	58.1	390.1
BULK STATIONS	40.6	6.9	47.5
OTHER	0.0	0.0	0.0
TOTAL OIL	4097.4	652.8	4750.2
OIL SHALE	0.0	0.0	0.0
GAS			
EXPLORATION, DEVELOPMENT, & PRODUCTION	20.2	3.1	23.3
GEOPRESSURED METHANE	0.0	0.0	0.0
PIPELINES	0.0	0.0	0.0
LNG TANKERS	0.0	0.0	0.0
DISTRIBUTION	24.6	4.2	28.7
OTHER	0.0	0.0	0.0
TOTAL GAS	44.8	7.3	52.0
COAL			
UNDERGROUND MINING	0.0	0.0	0.0
SURFACE MINING	0.0	0.0	0.0
RAIL	62.7	10.7	73.3
PIPELINES	0.0	0.0	0.0
BARGES, TRUCKS	8.1	1.4	9.5
TOTAL COAL	70.8	12.0	82.9
COAL SYNTHETICS			
LIQUEFACTION	0.0	0.0	0.0
METHANOL	0.0	0.0	0.0
SOLVENT REFINING	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.0	0.0	0.0
TOTAL SYNTHETICS	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	22.4	3.4	25.8
SOLAR	0.0	0.0	0.0
ELECTRIC UTILITIES			
COAL-FIRED	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.0	0.0	0.0
NUCLEAR	2722.7	306.6	3029.2
HYDRO & PUMPED STORAGE	357.0	37.5	394.5
OIL & GAS	3055.2	345.2	3400.5
GEOTHERMAL	0.0	0.0	0.0
TOTAL GENERATION	6134.9	689.3	6824.2
TRANSMISSION	599.9	69.6	669.5
DISTRIBUTION	943.5	107.6	1051.1
TOTAL UTILITIES	7678.4	866.5	8544.8
TOTAL ENERGY INDUSTRY	11913.7	1541.9	13455.7

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 32 Continued

GROWTH IN REQUIREMENTS FOR CONSTRUCTOR COST TOTAL ## (MILLION POUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
FOR THE EGYPT - LOW NUCLEAR CASE

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
OIL									
EXPLORATION, DEVELOPMENT, & PRODUCTION	82.	73.	72.	88.	(1979)	0.6	-3.9	0.4	-0.5
REFINING AND PROCESSING	0.	87.	83.	109.	(1991)	9999.0	-5.6	1.9	9999.0
PIPELINES	2.	11.	6.	21.	(1982)	-100.0	9999.0	1.1	8.2
TANKERS, BARGES, TRUCKS	14.	9.	14.	19.	(1989)	0.1	0.5	-3.0	-1.8
BULK STATIONS	0.	2.	2.	4.	(1978)	0.0	9999.0	-4.5	9999.0
OTHER	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TOTAL OIL	98.	182.	178.	214.	(1994)	17.4	-2.7	0.8	2.6
OIL SHALE	0.	0.	0.	0.		0.0	-0.0	0.0	0.0
GAS									
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	0.	1.	3.	(1978)	0.0	0.0	0.0	0.0
GEOPRESSURED METHANE	0.	0.	0.	0.		0.0	0.0	0.0	0.0
PIPELINES	0.	0.	0.	0.		0.0	0.0	0.0	0.0
LNG TANKERS	0.	0.	0.	0.		0.0	0.0	0.0	0.0
DISTRIBUTION	19.	0.	1.	19.	(1976)	-24.0	-100.0	0.0	-100.0
OTHER	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TOTAL GAS	19.	0.	2.	19.	(1976)	-24.0	-100.0	0.0	-100.0
COAL									
UNDERGROUND MINING	0.	0.	0.	0.		0.0	0.0	0.0	0.0
SURFACE MINING	0.	0.	0.	0.		0.0	0.0	0.0	0.0
RAIL	0.	7.	3.	7.	(1996)	0.0	9999.0	4.7	9999.0
PIPELINES	0.	0.	0.	0.		0.0	0.0	0.0	0.0
BARGES, TRUCKS	0.	0.	0.	4.	(1990)	0.0	14.9	7.6	7.8
TOTAL COAL	0.	8.	3.	8.	(1990)	0.0	130.7	4.8	22.6
COAL SYNTHETICS									
LIQUEFACTION	0.	0.	0.	0.		0.0	0.0	0.0	0.0
METHANOL	0.	0.	0.	0.		0.0	0.0	0.0	0.0
SOLVENT REFINING	0.	0.	0.	0.		0.0	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TOTAL SYNTHETICS	0.	0.	0.	0.		0.0	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	0.	5.	1.	6.	(1996)	0.0	0.0	9999.0	9999.0
SOLAR	0.	0.	0.	0.		0.0	0.0	0.0	0.0
ELECTRIC UTILITIES									
COAL-FIRED	0.	0.	0.	0.		0.0	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.		0.0	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
NUCLEAR	0.	491.	118.	491.	(2000)	9999.0	31.0	8.4	9999.0
HYDRO & PUMPED STORAGE	0.	59.	16.	60.	(1986)	0.0	9999.0	0.7	9999.0
OIL & GAS	78.	146.	133.	316.	(1996)	-18.9	-100.0	9999.0	2.6
GEO THERMAL	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TOTAL GENERATION	78.	697.	267.	697.	(2000)	-2.2	22.7	8.7	9.5
TRANSMISSION	0.	0.	26.	127.	(1993)	0.0	9999.0	-100.0	0.0
DISTRIBUTION	12.	58.	41.	58.	(1999)	20.1	6.7	3.5	6.8
TOTAL UTILITIES	91.	755.	334.	755.	(2000)	1.7	22.7	7.1	9.2
TOTAL ENERGY INDUSTRY	207.	949.	518.	949.	(2000)	8.6	8.6	5.3	6.5

CONSTRUCTOR COST TOTAL DOES NOT INCLUDE OWNER'S COSTS.

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HECHTEL ENERGY SUPPLY PLANNING MODEL

Table 32 Continued

GROWTH IN REQUIREMENTS FOR CONSTRUCTOR COST TOTAL ## (MILLION EPOUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
FOR THE EGYPT - LOW NUCLEAR CASE

RESOURCES	1976	1977	1978	1979	1980	1981	1982
OIL							
EXPLORATION, DEVELOPMENT, & PRODUCTION	82.	85.	87.	88.	84.	82.	81.
REFINING AND PROCESSING	0.	0.	22.	65.	97.	44.	22.
PIPELINES	2.	9.	0.	0.	0.	4.	21.
TANKERS, BARGES, TRUCKS	14.	18.	15.	14.	14.	11.	16.
BULK STATIONS	0.	2.	4.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL OIL	98.	114.	127.	167.	185.	140.	139.
OIL SHALE	0.	0.	0.	0.	0.	0.	0.
GAS							
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	1.	3.	0.	0.	1.	3.
GEOPRESSURED METHANE	0.	0.	0.	0.	0.	0.	0.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
LNG TANKERS	0.	0.	0.	0.	0.	0.	0.
DISTRIBUTION	19.	15.	12.	6.	6.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL GAS	19.	16.	15.	6.	6.	1.	3.
COAL							
UNDERGROUND MINING	0.	0.	0.	0.	0.	0.	0.
SURFACE MINING	0.	0.	0.	0.	0.	0.	0.
RAIL	0.	0.	4.	0.	0.	0.	4.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
BARGES, TRUCKS	0.	0.	0.	0.	0.	0.	0.
TOTAL COAL	0.	0.	4.	0.	0.	0.	4.
COAL SYNTHETICS							
LIQUEFACTION	0.	0.	0.	0.	0.	0.	0.
METHANOL	0.	0.	0.	0.	0.	0.	0.
SOLVENT REFINING	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.	0.	0.
TOTAL SYNTHETICS	0.	0.	0.	0.	0.	0.	0.
NUCLEAR FUEL CYCLE	0.	0.	0.	0.	0.	0.	0.
SOLAR	0.	0.	0.	0.	0.	0.	0.
ELECTRIC UTILITIES							
COAL-FIRED	0.	0.	0.	0.	0.	0.	0.
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.	0.	0.
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.	0.	0.
NUCLEAR	0.	3.	5.	11.	38.	62.	111.
HYDRO & PUMPED STORAGE	0.	0.	0.	0.	0.	0.	0.
OIL & GAS	78.	104.	89.	55.	34.	36.	54.
GEOTHERMAL	0.	0.	0.	0.	0.	0.	0.
TOTAL GENERATION	78.	106.	95.	66.	72.	99.	165.
TRANSMISSION	0.	0.	23.	35.	0.	62.	92.
DISTRIBUTION	12.	16.	22.	23.	25.	28.	33.
TOTAL UTILITIES	91.	122.	140.	124.	97.	188.	290.
TOTAL ENERGY INDUSTRY	207.	253.	285.	298.	289.	330.	436.

CONSTRUCTOR COST TOTAL DOES NOT INCLUDE OWNER'S COSTS.

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B F C H I E L E N E R G Y S U P P L Y P L A N N I N G M O D E L

Table 32 Continued

GROWTH IN REQUIREMENTS FOR CONSTRUCTOR COST TOTAL ## (MILLION POUNDS, JANUARY 1978)
 FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
 FOR THE EGYPT - LOW NUCLEAR CASE

RESOURCES	1983	1984	1985	1986	1987	1988	1989
OIL							
EXPLORATION, DEVELOPMENT, & PRODUCTION	79.	75.	69.	63.	69.	63.	67.
REFINING AND PROCESSING	65.	87.	65.	65.	87.	65.	65.
PIPELINES	0.	2.	9.	0.	2.	9.	2.
TANKERS, BARGES, TRUCKS	14.	18.	15.	18.	15.	15.	19.
BULK STATIONS	0.	2.	4.	0.	0.	2.	4.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL OIL	158.	184.	162.	147.	173.	155.	158.
OIL SHALE	0.	0.	0.	0.	0.	0.	0.
GAS							
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	0.	0.	1.	3.	0.	0.
GEOPRESSURED METHANE	0.	0.	0.	0.	0.	0.	0.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
LNG TANKERS	0.	0.	0.	0.	0.	0.	0.
DISTRIBUTION	0.	0.	0.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL GAS	0.	0.	0.	1.	3.	0.	0.
COAL							
UNDERGROUND MINING	0.	0.	0.	0.	0.	0.	0.
SURFACE MINING	0.	0.	0.	0.	0.	0.	0.
RAIL	0.	0.	4.	0.	4.	0.	4.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
BARGES, TRUCKS	0.	0.	0.	0.	0.	0.	0.
TOTAL COAL	0.	0.	4.	0.	4.	0.	4.
COAL SYNTHETICS							
LIQUEFACTION	0.	0.	0.	0.	0.	0.	0.
METHANOL	0.	0.	0.	0.	0.	0.	0.
SOLVENT REFINING	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.	0.	0.
TOTAL SYNTHETICS	0.	0.	0.	0.	0.	0.	0.
NUCLEAR FUEL CYCLE	0.	0.	0.	0.	0.	0.	0.
SOLAR	0.	0.	0.	0.	0.	0.	0.
ELECTRIC UTILITIES							
COAL-FIRED	0.	0.	0.	0.	0.	0.	0.
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.	0.	0.
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.	0.	0.
NUCLEAR	138.	151.	146.	89.	43.	14.	0.
HYDRO & PUMPED STORAGE	3.	21.	54.	60.	41.	16.	0.
OIL & GAS	42.	20.	0.	12.	50.	106.	156.
GEOTHERMAL	0.	0.	0.	0.	0.	0.	0.
TOTAL GENERATION	183.	193.	200.	161.	135.	135.	156.
TRANSMISSION	0.	23.	35.	0.	0.	23.	35.
DISTRIBUTION	35.	33.	35.	35.	39.	41.	43.
TOTAL UTILITIES	217.	249.	270.	196.	174.	200.	234.
TOTAL ENERGY INDUSTRY	375.	433.	436.	345.	353.	355.	395.

CONSTRUCTOR COST TOTAL DOES NOT INCLUDE OWNER'S COSTS.

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HECHTEL ENERGY SUPPLY PLANNING MODEL

Table 32 Continued

GROWTH IN REQUIREMENTS FOR CONSTRUCTOR COST TOTAL ## (MILLION POUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
FOR THE EGYPT - LOW NUCLEAR CASE

RESOURCES	1990	1991	1992	1993	1994	1995	1996
OIL							
EXPLORATION, DEVELOPMENT, & PRODUCTION	65.	67.	65.	67.	68.	71.	70.
REFINING AND PROCESSING	109.	109.	109.	109.	109.	109.	109.
PIPELINES	9.	2.	9.	4.	21.	2.	11.
TANKERS, BARGES, TRUCKS	16.	16.	15.	15.	15.	14.	13.
BULK STATIONS	0.	2.	4.	0.	2.	4.	2.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL OIL	199.	196.	202.	195.	214.	199.	205.
OIL SHALE	0.	0.	0.	0.	0.	0.	0.
GAS							
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	1.	3.	0.	0.	0.	1.
GEOPRESSURED METHANE	0.	0.	0.	0.	0.	0.	0.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
LNG TANKERS	0.	0.	0.	0.	0.	0.	0.
DISTRIBUTION	0.	0.	0.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL GAS	0.	1.	3.	0.	0.	0.	1.
COAL							
UNDERGROUND MINING	0.	0.	0.	0.	0.	0.	0.
SURFACE MINING	0.	0.	0.	0.	0.	0.	0.
RAIL	4.	4.	0.	4.	4.	4.	7.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
BARGES, TRUCKS	4.	0.	0.	0.	0.	0.	0.
TOTAL COAL	8.	4.	0.	4.	4.	4.	8.
COAL SYNTHETICS							
LIQUEFACTION	0.	0.	0.	0.	0.	0.	0.
METHANOL	0.	0.	0.	0.	0.	0.	0.
SOLVENT REFINING	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.	0.	0.
TOTAL SYNTHETICS	0.	0.	0.	0.	0.	0.	0.
NUCLEAR FUEL CYCLE	0.	0.	0.	5.	3.	4.	6.
SOLAR	0.	0.	0.	0.	0.	0.	0.
ELECTRIC UTILITIES							
COAL-FIRED	0.	0.	0.	0.	0.	0.	0.
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.	0.	0.
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.	0.	0.
NUCLEAR	0.	0.	5.	14.	28.	79.	162.
HYDRO & PUMPED STORAGE	0.	0.	0.	0.	0.	0.	3.
OIL & GAS	185.	182.	167.	184.	250.	305.	316.
GEOTHERMAL	0.	0.	0.	0.	0.	0.	0.
TOTAL GENERATION	185.	182.	172.	198.	278.	384.	481.
TRANSMISSION	0.	0.	85.	127.	0.	0.	23.
DISTRIBUTION	44.	43.	44.	45.	48.	51.	52.
TOTAL UTILITIES	230.	225.	301.	370.	326.	434.	556.
TOTAL ENERGY INDUSTRY	437.	426.	507.	574.	548.	641.	777.

CONSTRUCTOR COST TOTAL DOES NOT INCLUDE OWNER'S COSTS.

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HECHTEL ENERGY SUPPLY PLANNING MODEL

Table 32 Continued

GROWTH IN REQUIREMENTS FOR CONSTRUCTOR COST TOTAL ## (MILLION POUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
FOR THE EGYPT - LOW NUCLEAR CASE

RESOURCES	1997	1998	1999	2000	TOTAL 1978-2000
OIL					
EXPLORATION, DEVELOPMENT, & PRODUCTION	69.	75.	73.	73.	1666.
REFINING AND PROCESSING	109.	109.	109.	87.	1920.
PIPELINES	9.	2.	11.	11.	139.
TANKERS, BARGES, TRUCKS	13.	12.	10.	9.	332.
BULK STATIONS	4.	2.	4.	2.	41.
OTHER	0.	0.	0.	0.	0.
TOTAL OIL	203.	199.	207.	182.	4097.
OIL SHALE	0.	0.	0.	0.	0.
GAS					
EXPLORATION, DEVELOPMENT, & PRODUCTION	3.	0.	0.	0.	20.
GEOPRESSURED METHANE	0.	0.	0.	0.	0.
PIPELINES	0.	0.	0.	0.	0.
LNG TANKERS	0.	0.	0.	0.	0.
DISTRIBUTION	0.	0.	0.	0.	25.
OTHER	0.	0.	0.	0.	0.
TOTAL GAS	3.	0.	0.	0.	45.
COAL					
UNDERGROUND MINING	0.	0.	0.	0.	0.
SURFACE MINING	0.	0.	0.	0.	0.
RAIL	4.	4.	4.	7.	63.
PIPELINES	0.	0.	0.	0.	0.
BARGES, TRUCKS	0.	0.	0.	0.	8.
TOTAL COAL	4.	4.	4.	8.	71.
COAL SYNTHETICS					
LIQUEFACTION	0.	0.	0.	0.	0.
METHANOL	0.	0.	0.	0.	0.
SOLVENT REFINING	0.	0.	0.	0.	0.
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.
TOTAL SYNTHETICS	0.	0.	0.	0.	0.
NUCLEAR FUEL CYCLE	0.	0.	0.	5.	22.
SOLAR	0.	0.	0.	0.	0.
ELECTRIC UTILITIES					
COAL-FIRED	0.	0.	0.	0.	0.
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.
NUCLEAR	287.	394.	454.	491.	2723.
HYDRO & PUMPED STORAGE	16.	34.	50.	59.	357.
OIL & GAS	282.	208.	175.	146.	3055.
GEOTHERMAL	0.	0.	0.	0.	0.
TOTAL GENERATION	585.	636.	679.	697.	6135.
TRANSMISSION	35.	0.	0.	0.	600.
DISTRIBUTION	54.	55.	58.	58.	944.
TOTAL UTILITIES	674.	691.	737.	755.	7678.
TOTAL ENERGY INDUSTRY	885.	894.	948.	949.	11914.

CONSTRUCTOR COST TOTAL DOES NOT INCLUDE OWNER'S COSTS.

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BECHTEL ENERGY SUPPLY PLANNING MODEL

GROWTH IN CAPITAL REQUIREMENTS* (MILLION POUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
EGYPT - LOW NUCLEAR

Table 32 Continued

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
NON-MANUAL TECHNICAL MANPOWER	11.	85.	40.	85.	(2000)	18.8	11.0	5.4	8.7
NON-MANUAL NON-TECHNICAL MANPOWER	1.	17.	6.	17.	(2000)	20.8	16.0	7.3	11.3
MANUAL MANPOWER	17.	104.	54.	104.	(1999)	14.0	9.7	5.6	7.8
MANPOWER TOTAL	30.	206.	101.	206.	(2000)	16.2	10.6	5.7	8.4
WOOD PRODUCTS (20)	2.	12.	7.	12.	(2000)	17.2	8.1	5.1	7.7
CHEMICALS & ALLIED PROD. (27,28,30,32)	3.	5.	3.	5.	(2000)	-4.6	9.3	1.5	2.0
PETROLEUM PRODUCTS (31)	6.	10.	6.	10.	(1999)	-6.7	4.4	4.4	2.4
GLASS, CLAY & STONE PRODUCTS (35,36)	4.	21.	11.	21.	(2000)	12.9	12.3	5.1	7.8
PRIMARY IRON & STEEL PRODUCTS (37)	19.	24.	21.	26.	(1997)	3.2	-3.3	2.1	1.1
PRIMARY NON-FERROUS METALS (38)	2.	14.	12.	32.	(1993)	18.6	25.7	0.8	8.4
FABRICATED STRUCTURAL PRODUCTS (40) *	5.	45.	24.	45.	(2000)	14.5	29.4	2.4	9.5
OTHER FABRICATED PRODUCTS (42)	6.	24.	13.	25.	(1999)	12.4	2.4	6.1	6.3
MATERIALS TOTAL	45.	156.	98.	156.	(2000)	6.7	10.5	3.2	5.3
HVAC HEATING & COOLING UNITS (52) ++	0.	6.	2.	6.	(2000)	51.4	21.4	7.7	16.9
HVAC DUCTWORK & ACCESSORIES (40) *	0.	2.	1.	2.	(2000)	38.1	24.5	8.5	16.3
TURBINES (43)	26.	89.	47.	91.	(1999)	-7.5	9.1	7.8	5.3
GAS WELDING SETS (47) ++	0.	0.	0.	0.	(1980)	4.7	-7.4	1.0	-0.2
ELECTRIC WELDING SETS (53) **	0.	1.	1.	1.	(1999)	17.2	7.5	7.5	9.1
CONSTRUCTION, MINING & OIL FIELD EQP (45)	36.	64.	46.	64.	(2000)	0.2	5.1	2.0	2.4
MATERIALS HANDLING EQUIPMENT (46)	0.	3.	1.	3.	(1999)	10.9	18.1	7.0	9.9
GENERAL INDUSTRY EQUIPMENT (49)	3.	18.	14.	21.	(1997)	42.9	-2.6	4.1	8.2
INSTRUMENTATION & CONTROLS (62)	2.	12.	8.	13.	(1999)	34.7	3.2	4.3	8.6
ELECTRICAL EQUIPMENT (53) **	4.	32.	18.	32.	(2000)	22.4	9.8	5.4	9.0
FABRICATED PLATE PRODUCTS (40) *	13.	125.	61.	129.	(1999)	23.3	5.0	8.2	9.9
EQUIPMENT TOTAL	84.	352.	198.	360.	(1999)	7.6	5.7	5.9	6.1
MISCELLANEOUS MATERIALS & EQUIPMENT	9.	13.	11.	14.	(1999)	6.3	-2.3	2.0	1.8
MOBILE FACILITY	14.	16.	17.	23.	(1990)	0.1	5.2	-0.6	0.7
OTHER CONSTRUCTOR COSTS	26.	205.	93.	205.	(2000)	10.1	13.8	7.3	9.1
CONSTRUCTOR COST TOTAL **	207.	949.	518.	949.	(2000)	8.6	8.6	5.3	6.5

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

#BEA (BUREAU OF ECONOMIC ANALYSIS) TWO-DIGIT CATEGORIES ARE IN PARENTHESIS.

* PARTIAL BEA CATEGORY 40. TOTAL IS SUM OF 3 SEPARATE ENTRIES FOR CATEGORY 40.

++ PARTIAL BEA CATEGORY 52. REMAINDER IS PART OF MISCELLANEOUS ENTRY.

** PARTIAL BEA CATEGORY 53. TOTAL IS SUM OF 2 SEPARATE ENTRIES FOR CATEGORY 53.

** CONSTRUCTION CAPITAL COST TOTAL INCLUDES MANPOWER, MATERIALS AND EQUIPMENT SUBTOTALS ABOVE PLUS OTHER (OVERHEAD, PROFIT, ETC.) COSTS. IT EXCLUDES OWNER'S COSTS. (LAND COSTS, INTEREST DURING CONSTRUCTION, ETC.)

H F C H I F L E N E R G Y S U P P L Y P L A N N I N G M O D E L

Table 32 Continued

GROWTH IN MANPOWER REQUIREMENTS (MAN-YEARS)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
EGYPT - LOW NUCLEAR

CATEGORY	ANNUAL REQUIREMENTS				AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
CHEMICAL ENGINEERS	0.	17.	33.	44. (1996)	9999.0	11.8	-3.7	9999.0
CIVIL ENGINEERS	96.	857.	407.	857. (2000)	11.0	15.6	7.2	9.5
ELECTRICAL ENGINEERS	87.	684.	386.	684. (2000)	13.9	13.2	6.3	9.0
MECHANICAL ENGINEERS	62.	509.	284.	541. (1999)	17.7	10.9	6.4	9.1
MINING ENGINEERS	0.	2.	0.	3. (1994)	0.0	0.0	9999.0	9999.0
NUCLEAR ENGINEERS	0.	58.	14.	58. (2000)	9999.0	11.1	12.0	9999.0
GEOLOGICAL ENGINEERS	29.	35.	29.	35. (2000)	0.6	-0.0	1.2	0.8
PETROLEUM ENGINEERS	29.	25.	26.	32. (1978)	0.6	-4.7	0.4	-0.7
OTHER ENGINEERS	1.	13.	19.	28. (1994)	71.2	14.5	-1.6	11.4
ENGINEERS TOTAL	305.	2200.	1197.	2201. (1999)	13.4	11.9	6.3	8.6
DESIGNERS & DRAFTSMEN	115.	864.	537.	928. (1999)	18.5	12.7	5.1	8.8
SUPERVISORS & MANAGERS	96.	467.	228.	467. (2000)	0.3	15.4	5.9	6.8
NON-MANUAL, TECHNICAL TOTAL	515.	3531.	1963.	3586. (1999)	12.5	12.6	5.9	8.3
NON-MANUAL, NON-TECHNICAL	344.	3295.	1447.	3295. (2000)	14.8	9.5	8.7	9.9
NON-MANUAL TOTAL	859.	6825.	3410.	6825. (2000)	13.5	11.3	7.1	9.0
PIPEFITTERS	725.	4977.	2757.	5031. (1999)	27.9	-6.0	8.7	8.4
PIPEFITTER/WELDERS	379.	2153.	1159.	2176. (1999)	18.5	-3.5	8.6	7.5
ELECTRICIANS	355.	4291.	1879.	4291. (2000)	22.2	10.8	8.1	10.9
BOILERMAKERS	309.	1297.	937.	2144. (1996)	1.3	-12.4	14.6	6.2
BOILERMAKER/WELDERS	103.	613.	340.	686. (1996)	-8.5	23.9	7.4	7.7
IRON WORKERS	147.	2191.	1339.	3346. (1993)	18.0	42.4	1.8	11.9
CARPENTERS	159.	2809.	1072.	2809. (2000)	29.6	16.1	7.5	12.7
EQUIPMENT OPERATORS	536.	2484.	1335.	2484. (2000)	10.9	9.0	4.7	6.6
LINEMEN	167.	1004.	1121.	3123. (1993)	26.4	27.7	-2.4	7.8
TEAMSTERS & LABORERS	965.	5179.	2641.	5179. (2000)	11.6	9.5	5.4	7.3
OTHER	977.	2082.	1447.	2099. (1999)	4.0	-0.9	4.4	3.2
MANUAL TOTAL	4822.	29081.	16029.	29081. (2000)	15.2	8.1	5.8	7.8
CONSTRUCTION MANPOWER TOTAL	5681.	35906.	19439.	35906. (2000)	14.9	8.6	6.0	8.0

• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A GROWTH RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 32 Continued

SCHEDULE OF MANPOWER RESOURCES (MAN-YEARS) FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES EGYPT - LOW NUCLEAR

RESOURCES	1976	1977	1978	1979	1980	1981	1982
CHEMICAL ENGINEERS	0.	0.	26.	38.	17.	4.	26.
CIVIL ENGINEERS	96.	124.	206.	196.	146.	261.	297.
ELECTRICAL ENGINEERS	87.	115.	238.	214.	147.	347.	335.
MECHANICAL ENGINEERS	62.	79.	164.	185.	119.	143.	208.
MINING ENGINEERS	0.	0.	0.	0.	0.	0.	0.
NUCLEAR ENGINEERS	0.	1.	2.	4.	6.	9.	10.
GEOLOGICAL ENGINEERS	29.	32.	32.	30.	30.	30.	30.
PETROLEUM ENGINEERS	29.	32.	32.	30.	30.	30.	30.
OTHER ENGINEERS	1.	2.	13.	19.	9.	4.	16.
ENGINEERS TOTAL	305.	384.	712.	716.	503.	829.	953.
DESIGNERS & DRAFTSMEN	115.	146.	334.	361.	226.	329.	426.
SUPERVISORS & MANAGERS	96.	105.	133.	130.	97.	127.	174.
NON-MANUAL, TECHNICAL TOTAL	515.	635.	1179.	1207.	826.	1285.	1553.
NON-MANUAL, NON-TECHNICAL	344.	449.	694.	745.	598.	902.	1128.
NON-MANUAL TOTAL	859.	1084.	1874.	1952.	1424.	2187.	2682.
PIPEFITTERS	725.	1010.	955.	1544.	1937.	1100.	888.
PIPEFITTER/WELDERS	379.	511.	488.	641.	746.	475.	455.
ELECTRICIANS	355.	591.	603.	707.	793.	733.	1083.
BOILERMAKERS	309.	533.	524.	452.	325.	225.	315.
BOILERMAKER/WELDERS	103.	178.	175.	128.	72.	64.	113.
IRON WORKERS	147.	269.	594.	1238.	286.	841.	2115.
CARPENTERS	159.	271.	257.	349.	448.	359.	454.
EQUIPMENT OPERATORS	536.	680.	687.	760.	812.	702.	861.
LINEMEN	167.	243.	620.	1265.	427.	918.	2101.
TEAMSTERS & LABORERS	965.	1203.	1192.	1549.	1497.	1231.	1725.
OTHER	977.	1142.	1200.	1148.	1143.	1099.	1245.
MANUAL TOTAL	4822.	6631.	7296.	9780.	8486.	7746.	11357.
CONSTRUCTION MANPOWER TOTAL	5681.	7715.	9170.	11731.	9911.	9934.	14039.

• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

MECHTEL ENERGY SUPPLY PLANNING MODEL

SCHEDULE OF MANPOWER RESOURCES (MAN-YEARS) FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES EGYPT - LOW NUCLEAR

Table 32 Continued

RESOURCES	1983	1984	1985	1986	1987	1988	1989
CHEMICAL ENGINEERS	38.	17.	30.	38.	17.	30.	38.
CIVIL ENGINEERS	281.	304.	301.	281.	248.	296.	303.
ELECTRICAL ENGINEERS	242.	294.	273.	228.	217.	327.	323.
MECHANICAL ENGINEERS	223.	179.	200.	208.	154.	207.	236.
MINING ENGINEERS	0.	0.	0.	0.	0.	0.	0.
NUCLEAR ENGINEERS	11.	12.	11.	9.	5.	1.	0.
GEOLOGICAL ENGINEERS	31.	32.	30.	30.	29.	24.	23.
PETROLEUM ENGINEERS	28.	26.	23.	24.	25.	22.	23.
OTHER ENGINEERS	19.	10.	17.	19.	10.	17.	20.
ENGINEERS TOTAL	873.	872.	884.	838.	704.	924.	968.
DESIGNERS & DRAFTSMEN	419.	376.	411.	410.	315.	436.	472.
SUPERVISORS & MANAGERS	182.	185.	199.	191.	157.	163.	163.
NON-MANUAL, TECHNICAL TOTAL	1475.	1433.	1494.	1439.	1176.	1523.	1603.
NON-MANUAL, NON-TECHNICAL	994.	933.	941.	868.	758.	896.	1015.
NON-MANUAL TOTAL	2468.	2366.	2435.	2307.	1934.	2418.	2618.
PIPEFITTERS	1979.	2535.	1420.	1651.	2222.	1463.	2088.
PIPEFITTER/WELDERS	841.	1025.	625.	685.	871.	627.	875.
ELECTRICIANS	1414.	1669.	1327.	1392.	1402.	1005.	1232.
BOILERMAKERS	439.	384.	168.	205.	421.	601.	923.
BOILERMAKER/WELDERS	136.	155.	211.	261.	286.	265.	286.
IRON WORKERS	629.	1110.	1676.	723.	665.	772.	1480.
CARPENTERS	828.	1080.	944.	1023.	962.	549.	575.
EQUIPMENT OPERATORS	957.	1172.	1251.	1340.	1425.	1061.	1016.
LINEMEN	594.	862.	1449.	577.	669.	954.	1599.
TEAMSTERS & LABORERS	1851.	2408.	2353.	2229.	2410.	1790.	2036.
OTHER	1271.	1289.	1090.	1060.	1186.	1084.	1247.
MANUAL TOTAL	10938.	13691.	12513.	11146.	12519.	10171.	13358.
CONSTRUCTION MANPOWER TOTAL	13406.	16057.	14948.	13453.	14454.	12589.	15976.

• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

HECHTEL ENERGY SUPPLY PLANNING MODEL

SCHEDULE OF MANPOWER RESOURCES (MAN-YEARS) FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES EGYPT - LOW NUCLEAR

Table 32 Continued

RESOURCES	1990	1991	1992	1993	1994	1995	1996
CHEMICAL ENGINEERS	43.	43.	43.	43.	43.	43.	44.
CIVIL ENGINEERS	305.	286.	415.	440.	465.	561.	671.
ELECTRICAL ENGINEERS	292.	274.	529.	498.	415.	490.	619.
MECHANICAL ENGINEERS	249.	240.	290.	311.	347.	401.	460.
MINING ENGINEERS	0.	0.	0.	2.	3.	3.	2.
NUCLEAR ENGINEERS	0.	0.	2.	6.	11.	16.	22.
GEOLOGICAL ENGINEERS	23.	25.	24.	26.	28.	29.	31.
PETROLEUM ENGINEERS	23.	25.	24.	23.	24.	24.	25.
OTHER ENGINEERS	23.	22.	23.	25.	28.	25.	26.
ENGINEERS TOTAL	958.	914.	1351.	1373.	1364.	1592.	1900.
DESIGNERS & DRAFTSMEN	477.	458.	630.	632.	623.	709.	834.
SUPERVISORS & MANAGERS	175.	166.	198.	217.	257.	293.	353.
NON-MANUAL, TECHNICAL TOTAL	1610.	1537.	2179.	2223.	2244.	2594.	3086.
NON-MANUAL, NON-TECHNICAL	1027.	967.	1298.	1555.	1702.	2047.	2388.
NON-MANUAL TOTAL	2637.	2504.	3477.	3778.	3947.	4641.	5474.
PIPEFITTERS	2926.	2949.	2836.	2913.	3495.	4191.	4688.
PIPEFITTER/WELDERS	1177.	1192.	1143.	1173.	1439.	1753.	1978.
ELECTRICIANS	1573.	1587.	1580.	1777.	1979.	2559.	3097.
BOILERMAKERS	1172.	1191.	1095.	1160.	1570.	2013.	2144.
BOILERMAKER/WELDERS	354.	360.	328.	349.	485.	636.	686.
IRON WORKERS	631.	653.	1524.	3346.	839.	1144.	1744.
CARPENTERS	782.	789.	751.	777.	988.	1306.	1660.
EQUIPMENT OPERATORS	1197.	1181.	1195.	1269.	1532.	1687.	1907.
LINEMEN	761.	745.	1554.	3123.	837.	837.	1197.
TEAMSTERS & LABORERS	2280.	2241.	2425.	2847.	2837.	3180.	3841.
OTHER	1372.	1394.	1406.	1363.	1612.	1811.	1998.
MANUAL TOTAL	14226.	14282.	15837.	20095.	17613.	21117.	24939.
CONSTRUCTION MANPOWER TOTAL	16863.	16787.	19314.	23873.	21560.	25758.	30413.

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

H E C H I E L E N E R G Y S U P P L Y P L A N N I N G M O D E L

SCHEDULE OF MANPOWER RESOURCES (MAN-YEARS)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
EGYPT - LOW NUCLEAR

Table 32 Continued

RESOURCES	1997	1998	1999	2000	TOTAL 1978-2000
CHEMICAL ENGINEERS	43.	43.	43.	17.	765.
CIVIL ENGINEERS	695.	730.	821.	857.	9365.
ELECTRICAL ENGINEERS	616.	603.	666.	684.	8870.
MECHANICAL ENGINEERS	467.	490.	541.	509.	6532.
MINING ENGINEERS	0.	0.	0.	2.	11.
NUCLEAR ENGINEERS	30.	40.	50.	58.	313.
GEOLOGICAL ENGINEERS	30.	30.	31.	35.	664.
PETROLEUM ENGINEERS	26.	25.	25.	25.	594.
OTHER ENGINEERS	23.	22.	24.	13.	427.
ENGINEERS TOTAL	1930.	1984.	2201.	2200.	27542.
DESIGNERS & DRAFTSMEN	837.	849.	928.	864.	12358.
SUPERVISORS & MANAGERS	368.	398.	457.	467.	5250.
NON-MANUAL, TECHNICAL TOTAL	3134.	3231.	3586.	3531.	45149.
NON-MANUAL, NON-TECHNICAL	2587.	2777.	3161.	3295.	33275.
NON-MANUAL TOTAL	5722.	6009.	6747.	6825.	78424.
PIPEFITTERS	4766.	4852.	5031.	4977.	63406.
PIPEFITTER/WELDERS	2033.	2084.	2176.	2153.	26655.
ELECTRICIANS	3402.	3793.	4236.	4291.	43228.
BOILERMAKERS	1911.	1607.	1407.	1297.	21550.
BOILERMAKER/WELDERS	648.	607.	609.	613.	7827.
IRON WORKERS	2594.	1867.	2143.	2191.	30804.
CARPENTERS	1939.	2321.	2717.	2809.	24667.
EQUIPMENT OPERATORS	1886.	2018.	2309.	2484.	30711.
LINEMEN	1783.	912.	1004.	1004.	25793.
TEAMSTERS & LABORERS	4242.	4384.	5021.	5179.	60750.
OTHER	2047.	2038.	2099.	2082.	33284.
MANUAL TOTAL	27251.	26484.	28751.	29081.	368676.
CONSTRUCTION MANPOWER TOTAL	32973.	32493.	35498.	35906.	447101.

• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

BECHTEL ENERGY SUPPLY PLANNING MODEL

GROWTH IN REQUIREMENTS FOR CONSTRUCTION MANPOWER TOTAL (MAN-YEARS/YEAR)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
FOR THE EGYPT - LOW NUCLEAR CASE

Table 32 Continued

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
OIL									
EXPLORATION, DEVELOPMENT, & PRODUCTION	1602.	1375.	1403.	1686.	(1978)	0.8	-4.4	0.3	-0.6
REFINING AND PROCESSING	0.	4770.	4035.	5259.	(1990)	9999.0	-13.2	4.8	9999.0
PIPELINES	76.	291.	169.	547.	(1982)	-100.0	9999.0	2.0	5.8
TANKERS, BARGES, TRUCKS	0.	0.	0.	0.		0.0	0.0	0.0	0.0
BULK STATIONS	0.	68.	50.	96.	(1978)	0.0	9999.0	-2.3	9999.0
OTHER	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TOTAL OIL	1677.	6504.	5657.	7190.	(1994)	39.9	-9.1	3.3	5.8
OIL SHALE	0.	0.	0.	0.		0.0	0.0	0.0	0.0
GAS									
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	0.	26.	88.	(1978)	0.0	0.0	0.0	0.0
GEOPRESSURED METHANE	0.	0.	0.	0.		0.0	0.0	0.0	0.0
PIPELINES	0.	0.	0.	0.		0.0	0.0	0.0	0.0
LNG TANKERS	0.	0.	0.	0.		0.0	0.0	0.0	0.0
DISTRIBUTION	900.	0.	50.	900.	(1976)	-26.9	-100.0	0.0	-100.0
OTHER	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TOTAL GAS	900.	0.	76.	900.	(1976)	-26.9	-100.0	0.0	-100.0
COAL									
UNDERGROUND MINING	0.	0.	0.	0.		0.0	0.0	0.0	0.0
SURFACE MINING	0.	0.	0.	0.		0.0	0.0	0.0	0.0
RAIL	0.	0.	0.	0.		0.0	0.0	0.0	0.0
PIPELINES	0.	0.	0.	0.		0.0	0.0	0.0	0.0
BARGES, TRUCKS	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TOTAL COAL	0.	0.	0.	0.		0.0	0.0	0.0	0.0
COAL SYNTHETICS									
LIQUEFACTION	0.	0.	0.	0.		0.0	0.0	0.0	0.0
METHANOL	0.	0.	0.	0.		0.0	0.0	0.0	0.0
SOLVENT REFINING	0.	0.	0.	0.		0.0	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TOTAL SYNTHETICS	0.	0.	0.	0.		0.0	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	0.	151.	51.	409.	(1996)	0.0	0.0	9999.0	9999.0
SOLAR	0.	0.	0.	0.		0.0	0.0	0.0	0.0
ELECTRIC UTILITIES									
COAL-FIRED	0.	0.	0.	0.		0.0	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.		0.0	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
NUCLEAR	0.	17448.	3957.	17448.	(2000)	9999.0	37.1	8.9	9999.0
HYDRO & PUMPED STORAGE	0.	2164.	585.	2303.	(1986)	0.0	9999.0	1.0	9999.0
OIL & GAS	2513.	6314.	5544.	14192.	(1996)	-24.6	-100.0	9999.0	3.9
GEOTHERMAL	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TOTAL GENERATION	2513.	25926.	10086.	25926.	(2000)	-7.8	29.9	9.4	10.2
TRANSMISSION	0.	0.	1250.	6575.	(1993)	0.0	9999.0	-100.0	0.0
DISTRIBUTION	591.	3324.	2320.	3324.	(1999)	24.4	6.8	3.5	7.5
TOTAL UTILITIES	3104.	29250.	13655.	29250.	(2000)	1.0	27.7	6.8	9.8
TOTAL ENERGY INDUSTRY	5681.	35906.	19439.	35906.	(2000)	14.9	8.6	6.0	8.0

BECHTEL ENERGY SUPPLY PLANNING MODEL

GROWTH IN SELECTED MATERIALS AND EQUIPMENT ITEMS REQUIRED
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
EGYPT - LOW NUCLEAR

Table 32 Continued

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
CEMENT (TONNES)	17501.	98235.	41650.	98235.	(2000)	7.4	13.4	5.5	7.5
CONCRETE (INCLUDES CEMENT) (TONNES)	92608.	874352.	331856.	874352.	(2000)	12.0	20.0	6.1	9.8
BENTONITE (IN DRILLING MUD) (TONNES)	2719.	2300.	2399.	2971.	(1978)	0.9	-4.7	0.3	-0.7
BARITE (IN DRILLING MUD) (TONNES)	2636.	2277.	2339.	2893.	(1978)	0.8	-4.5	0.3	-0.6
CARBON STEEL (TONNES)	40065.	116145.	72016.	116313.	(1997)	2.8	9.9	3.3	4.5
ALLOY STEEL (TONNES)	2595.	10002.	5637.	10002.	(2000)	10.4	3.2	5.4	5.8
STAINLESS STEEL (TONNES)	178.	3116.	1436.	3167.	(1999)	48.3	2.5	8.1	12.7
STEEL TOTAL (TONNES)	42838.	129263.	79088.	129263.	(2000)	3.7	9.3	3.5	4.7
COPPER (TONNES)	430.	4099.	2336.	4115.	(1997)	25.8	14.2	4.6	9.8
ALUMINUM (TONNES)	624.	1670.	2881.	11505.	(1993)	7.1	36.6	-5.5	4.2
MANGANESE (TONNES)	325.	976.	600.	976.	(2000)	4.4	8.8	3.5	4.7
CHROMIUM (TONNES)	131.	833.	438.	843.	(1999)	22.2	2.7	6.3	8.0
NICKEL (TONNES)	8.	124.	57.	125.	(1999)	43.4	4.7	7.5	12.1
CAST IRON (TONNES)	494.	2914.	1755.	2914.	(2000)	25.1	4.3	4.5	7.7
STEEL CASTINGS (TONNES)	360.	1738.	995.	1738.	(2000)	12.2	11.5	3.9	6.8
ALUMINUM CASTINGS (TONNES)	31.	154.	90.	154.	(2000)	15.3	7.1	4.8	6.9
BRASS & BRONZE CASTINGS (TONNES)	31.	236.	144.	236.	(1999)	31.0	1.0	6.1	8.8
IRON & STEEL FORGINGS (TONNES)	314.	1522.	819.	1522.	(2000)	8.8	14.8	3.8	6.8
STRUCTURAL STEEL SHAPES (TONNES)	2270.	13869.	9376.	19893.	(1993)	16.9	21.8	1.3	7.8
STEEL PLATE < 3.8 CM THICK (TONNES)	3320.	18471.	11717.	18609.	(1997)	21.5	11.3	2.7	7.4
STEEL PLATE > 3.8 CM THICK (TONNES)	2.	2708.	637.	2708.	(2000)	177.8	50.7	6.4	34.2
PIPE, CARBON STEEL (TONNES)	12259.	18498.	13426.	24535.	(1994)	-9.5	2.4	4.7	1.7
PIPE, ALLOY & STAINLESS STEEL (TONNES)	98.	4206.	1271.	4206.	(2000)	48.0	21.4	8.5	16.9
OIL COUNTRY TUBULAR GOODS (TONNES)	16166.	13892.	14410.	18061.	(1978)	0.8	-4.6	0.3	-0.6
REINFORCING BAR (REBAR) (TONNES)	921.	17331.	5963.	17331.	(2000)	21.5	28.7	6.1	13.0
VALVES, CARBON STEEL (TONNES)	162.	1147.	851.	1323.	(1997)	43.1	-4.5	5.2	8.5
VALVES, ALLOY & STAINLESS STEEL (TONNES)	7.	382.	147.	382.	(2000)	87.0	7.5	7.8	18.1
STEAM TURBOGENERATORS (MEGAWATTS)	331.	2060.	1032.	2311.	(1997)	-2.6	5.6	11.7	7.9
STEAM TURBINES (EXCL TRBGENS) (MEGAWATTS)	7.	43.	27.	53.	(1997)	12.0	-5.4	11.1	7.6
GAS TURBOGENERATORS (MEGAWATTS)	136.	3.	42.	160.	(1990)	-34.0	-35.3	1.0	-14.3
DRAGLINES (CUBIC METERS)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
DRILL RIGS, ONSHORE (RIG YEARS)	16.	14.	14.	18.	(1978)	1.0	-5.0	0.7	-0.4
DRILL RIGS, OFFSHORE (RIG YEARS)	5.	5.	4.	5.	(1979)	0.0	-2.8	1.0	0.0
DRILL BITS (NUMBER)	1358.	1195.	1233.	1494.	(1978)	0.7	-1.8	-0.5	-0.5
PUMPS & DRIVERS > 745 MGAWTS (MEGAWATTS)	8.	122.	49.	122.	(2000)	27.8	11.4	8.6	12.2
PUMPS & DRIVERS < 745 MGAWTS (MEGAWATTS)	20.	31.	29.	36.	(1996)	9.7	-4.5	2.1	1.9
AXIAL COMPRESSORS > 3727 MGAWTS (MGAWTS)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
CENTRIF COMP & DRV > 7455 MW (MGAWTS)	0.	19.	18.	23.	(1990)	9999.0	-12.9	4.7	9999.0
CENTRIF COMP & DRV < 7455 MW (MGAWTS)	1.	4.	4.	5.	(1997)	38.9	-11.2	3.7	5.4
HEAT EXCHANGERS (SQUARE METERS)	7053.	101360.	70209.	113900.	(1999)	67.2	-7.6	6.9	11.7
NON-NUC PRESS VESS < 3.8 CM WALL (TONNES)	54.	2077.	2012.	2601.	(1997)	148.4	-12.2	4.4	16.4
NON-NUC PRESS VESS 3.8-10 CM W (TONNES)	4.	4.	4.	4.	(1979)	0.0	-2.8	1.0	0.0
NON-NUC PRESS VESS > 10 CM WALL (TONNES)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
BOILERS (TONNES STEAM PER HOUR)	981656.	2681732.	2376654.	5479778.	(1996)	-3.9	-28.4	20.8	4.3
NUCLEAR STEAM SUPPLY SYSTEMS (MEGAWATTS)	0.	1233.	301.	1233.	(2000)	9999.0	33.0	8.2	9999.0

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* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A GROWTH RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

BECHTEL ENERGY SUPPLY PLANNING MODEL

GROWTH IN ANNUAL COSTS (MILLION EPOUNDS JANUARY 1978)
FOR THE OPERATION AND MAINTENANCE OF ENERGY-RELATED FACILITIES
EGYPT - LOW NUCLEAR

Table 32 Continued

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
NON-MANUAL TECHNICAL MANPOWER	3.	16.	9.	16.	(2000)	11.3	6.8	6.1	7.1
NON-MANUAL NON-TECHNICAL MANPOWER	1.	3.	2.	3.	(2000)	12.0	5.9	6.9	7.5
MANUAL MANPOWER	9.	43.	26.	43.	(2000)	12.8	6.7	5.1	6.7
MANPOWER TOTAL	13.	62.	37.	62.	(2000)	12.4	6.7	5.4	6.8
WOOD PRODUCTS (20)	1.	5.	3.	5.	(2000)	5.2	10.9	8.0	8.1
CHEMICALS & ALLIED PROD. (27,28,30,32)	8.	36.	19.	36.	(2000)	-0.8	6.6	8.4	6.4
PETROLEUM PRODUCTS (31)	4.	14.	12.	14.	(1997)	18.9	5.0	1.6	5.0
GLASS, CLAY & STONE PRODUCTS (35,36)	1.	2.	1.	2.	(2000)	0.4	5.4	7.4	5.8
PRIMARY IRON & STEEL PRODUCTS (37)	1.	8.	4.	8.	(2000)	17.4	5.2	7.1	8.4
PRIMARY NON-FERROUS METALS (38)	0.	4.	2.	4.	(2000)	9.4	11.7	7.9	8.9
FABRICATED STRUCTURAL PRODUCTS (40) *	0.	5.	2.	5.	(2000)	14.6	7.9	9.4	9.9
OTHER FABRICATED PRODUCTS (42)	2.	12.	6.	12.	(2000)	6.0	8.0	8.6	8.1
MATERIALS TOTAL	18.	86.	48.	86.	(2000)	7.9	6.4	6.6	6.8
HVAC HEATING & COOLING UNITS (52) ++	0.	0.	0.	0.	(1981)	20.2	3.1	-0.3	3.6
HVAC DUCTWORK & ACCESSORIES (40) *	0.	0.	0.	0.	(1981)	20.2	3.1	-0.3	3.6
TURBINES (43)	0.	5.	2.	5.	(2000)	14.5	8.0	10.1	10.4
GAS WELDING SETS (47) ++	1.	6.	3.	6.	(2000)	1.1	4.9	9.5	7.1
ELECTRIC WELDING SETS (53) **	0.	0.	0.	0.		0.0	0.0	0.0	0.0
CONSTRUCTION, MINING & OIL FIELD EOP (45)	0.	2.	1.	2.	(2000)	15.6	8.4	10.7	11.0
MATERIALS HANDLING EQUIPMENT (46)	0.	0.	0.	0.	(2000)	21.4	12.2	8.8	11.5
GENERAL INDUSTRY EQUIPMENT (49)	4.	12.	7.	12.	(2000)	-2.2	4.7	7.6	5.3
INSTRUMENTATION & CONTROLS (62)	1.	5.	3.	5.	(2000)	6.5	4.3	6.1	5.8
ELECTRICAL EQUIPMENT (53) **	3.	16.	8.	16.	(2000)	6.6	8.6	8.0	7.9
FABRICATED PLATE PRODUCTS (40) *	0.	0.	0.	0.		0.0	0.0	0.0	0.0
EQUIPMENT TOTAL	8.	39.	20.	39.	(2000)	3.7	6.5	7.9	6.9
ELECTRICITY	5.	20.	10.	20.	(2000)	-3.5	6.7	8.9	6.3
NATURAL GAS	0.	0.	0.	0.	(2000)	14.7	11.1	17.0	15.4
WATER	2.	17.	8.	17.	(2000)	8.6	8.4	10.8	9.9
UTILITY TOTAL	6.	38.	17.	38.	(2000)	0.4	7.4	9.7	7.6
RENTS, ROYALTIES, ETC.	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TAXES	0.	0.	0.	0.		0.0	0.0	0.0	0.0
SERVICES & MISCELLANEOUS	10.	48.	28.	48.	(2000)	11.1	6.4	5.7	6.7
ANNUAL OPERATING COST (EX FUEL)	54.	267.	148.	267.	(2000)	8.4	6.6	6.6	6.9

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

#BEA (BUREAU OF ECONOMIC ANALYSIS) TWO-DIGIT CATEGORIES ARE IN PARENTHESIS.

* PARTIAL BEA CATEGORY 40. TOTAL IS SUM OF 3 SEPARATE ENTRIES FOR CATEGORY 40.

++ PARTIAL BEA CATEGORY 52. REMAINDER IS PART OF MISCELLANEOUS ENTRY.

** PARTIAL BEA CATEGORY 53. TOTAL IS SUM OF 2 SEPARATE ENTRIES FOR CATEGORY 53.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 32 Continued

GROWTH IN MANPOWER REQUIREMENTS (MAN-YEARS) FOR THE OPERATION AND MAINTENANCE OF ENERGY-RELATED FACILITIES EGYPT - LOW NUCLEAR

CATEGORY	ANNUAL REQUIREMENTS				AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
CHEMICAL ENGINEERS	30.	125.	62.	125. (2000)	-4.5	6.7	9.0	6.2
CIVIL ENGINEERS	21.	102.	60.	102. (2000)	10.1	7.0	6.0	6.9
ELECTRICAL ENGINEERS	34.	302.	138.	302. (2000)	14.3	9.1	8.3	9.5
MECHANICAL ENGINEERS	34.	178.	96.	178. (2000)	7.9	6.4	7.1	7.1
MINING ENGINEERS	0.	4.	1.	4. (1997)	0.0	0.0	9999.0	9999.0
NUCLEAR ENGINEERS	0.	4.	2.	4. (1989)	0.0	0.0	9999.0	9999.0
GEOLOGICAL ENGINEERS	0.	2.	0.	2. (1997)	0.0	0.0	9999.0	9999.0
PETROLEUM ENGINEERS	0.	0.	0.	0.	0.0	0.0	0.0	0.0
OTHER ENGINEERS	31.	125.	80.	125. (2000)	10.8	4.8	5.1	6.0
ENGINEERS TOTAL	150.	842.	439.	842. (2000)	8.4	7.0	7.4	7.5
DESIGNERS & DRAFTSMEN	30.	181.	90.	181. (2000)	7.4	8.1	7.9	7.8
SUPERVISORS & MANAGERS	400.	1840.	1142.	1840. (2000)	13.5	6.6	4.8	6.6
OTHER TECHNICAL	74.	364.	199.	364. (2000)	5.1	7.3	7.2	6.9
NON-MANUAL, TECHNICAL TOTAL	653.	3226.	1869.	3226. (2000)	11.3	6.8	5.8	6.9
NON-MANUAL, NON-TECHNICAL	224.	1270.	652.	1270. (2000)	12.0	5.9	6.9	7.5
NON-MANUAL TOTAL	877.	4497.	2521.	4497. (2000)	11.5	6.6	6.1	7.0
PIPEFITTERS	200.	887.	469.	887. (2000)	8.1	5.0	6.4	6.4
WELDERS	77.	543.	248.	543. (2000)	13.6	6.9	7.7	8.5
ELECTRICIANS	222.	1671.	754.	1671. (2000)	9.4	9.0	8.5	8.8
BOILERMAKERS	25.	105.	52.	105. (2000)	-4.5	6.7	9.0	6.2
MECHANICS	795.	3277.	2198.	3277. (2000)	14.6	6.2	3.9	6.1
MACHINISTS	202.	811.	554.	811. (2000)	15.1	6.0	3.6	6.0
IRONWORKERS	14.	30.	21.	30. (2000)	0.0	2.3	4.2	3.1
CARPENTERS	28.	86.	48.	86. (2000)	-2.7	4.0	7.0	4.7
EQUIPMENT OPERATORS	88.	838.	411.	838. (2000)	11.4	13.6	8.2	9.8
OTHER OPERATORS	858.	4924.	2345.	4924. (2000)	3.6	7.7	8.6	7.6
METER READERS	351.	2015.	1220.	2015. (2000)	16.5	7.9	5.2	7.6
TEAMSTERS & LABORERS	1845.	7053.	5136.	7053. (2000)	15.7	6.5	3.0	5.7
LINEMEN	61.	595.	295.	595. (2000)	11.7	14.1	8.1	9.9
OTHER	512.	2354.	1492.	2354. (2000)	13.9	5.7	5.0	6.6
MANUAL TOTAL	5190.	24351.	14831.	24351. (2000)	12.8	6.7	5.0	6.7
MANPOWER TOTAL	6067.	28848.	17353.	28848. (2000)	12.6	6.7	5.2	6.7

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A GROWTH RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

BECHTEL ENERGY SUPPLY PLANNING MODEL

CUMULATIVE CAPITAL REQUIREMENTS (MILLION POUNDS, JAN 1978) OF THE ENERGY INDUSTRY
BY FACILITY GROUPING
EGYPT - LOW NUCLEAR/IMPORTS

Table 32 Continued

(1978-1985)

FACILITY	CONSTRUCTION COSTS	OWNER'S COSTS PRIOR TO STARTUP	TOTAL
OIL			
EXPLORATION, DEVELOPMENT, & PRODUCTION	581.0	89.4	670.3
REFINING AND PROCESSING	330.0	52.9	382.9
PIPELINES	29.2	5.0	34.2
TANKERS, BARGES, TRUCKS	107.1	18.7	125.9
BULK STATIONS	7.3	1.2	8.6
OTHER	0.0	0.0	0.0
TOTAL OIL	1054.6	167.2	1221.9
OIL SHALE	0.0	0.0	0.0
GAS			
EXPLORATION, DEVELOPMENT, & PRODUCTION	6.5	1.0	7.6
GEOPRESSURED METHANE	0.0	0.0	0.0
PIPELINES	0.0	0.0	0.0
LNG TANKERS	0.0	0.0	0.0
DISTRIBUTION	13.1	2.2	15.3
OTHER	0.0	0.0	0.0
TOTAL GAS	19.6	3.2	22.9
COAL			
UNDERGROUND MINING	0.0	0.0	0.0
SURFACE MINING	0.0	0.0	0.0
RAIL	3.8	0.6	4.4
PIPELINES	0.0	0.0	0.0
BARGES, TRUCKS	0.5	0.1	0.6
TOTAL COAL	4.3	0.7	5.0
COAL SYNTHETICS			
LIQUEFACTION	0.0	0.0	0.0
METHANOL	0.0	0.0	0.0
SOLVENT REFINING	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.0	0.0	0.0
TOTAL SYNTHETICS	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	0.0	0.0	0.0
SOLAR	0.0	0.0	0.0
ELECTRIC UTILITIES			
COAL-FIRED	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.0	0.0	0.0
NUCLEAR	561.3	63.2	624.5
HYDRO & PUMPED STORAGE	43.9	4.6	48.5
OIL & GAS	246.2	27.8	274.1
GEOTHERMAL	0.0	0.0	0.0
TOTAL GENERATION	851.4	95.6	947.1
TRANSMISSION	203.6	23.6	227.2
DISTRIBUTION	151.6	17.3	168.9
TOTAL UTILITIES	1206.6	136.5	1343.2
TOTAL ENERGY INDUSTRY	2285.2	307.7	2592.9

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 32 Continued

CUMULATIVE CAPITAL REQUIREMENTS (MILLION EPOUNDS, JAN 1978) OF THE ENERGY INDUSTRY
BY FACILITY GROUPING
EGYPT - LOW NUCLEAR/IMPORTS

(1978-2000)

FACILITY	CONSTRUCTION COSTS	OWNER'S COSTS PRIOR TO STARTUP	TOTAL
OIL			
EXPLORATION, DEVELOPMENT, & PRODUCTION	1504.8	231.4	1736.3
REFINING AND PROCESSING	1382.8	221.8	1604.6
PIPELINES	115.6	19.6	135.2
TANKERS, BARGES, TRUCKS	304.3	53.2	357.5
BULK STATIONS	30.8	5.2	36.0
OTHER	0.0	0.0	0.0
TOTAL OIL	3338.2	531.4	3869.6
OIL SHALE	0.0	0.0	0.0
GAS			
EXPLORATION, DEVELOPMENT, & PRODUCTION	18.1	2.8	20.9
GEOPRESSURED METHANE	0.0	0.0	0.0
PIPELINES	0.0	0.0	0.0
LNG TANKERS	0.0	0.0	0.0
DISTRIBUTION	13.1	2.2	15.3
OTHER	0.0	0.0	0.0
TOTAL GAS	31.2	5.0	36.2
COAL			
UNDERGROUND MINING	0.0	0.0	0.0
SURFACE MINING	0.0	0.0	0.0
RAIL	21.3	3.6	25.0
PIPELINES	0.0	0.0	0.0
BARGES, TRUCKS	7.4	1.3	8.7
TOTAL COAL	28.8	4.9	33.7
COAL SYNTHETICS			
LIQUEFACTION	0.0	0.0	0.0
METHANOL	0.0	0.0	0.0
SOLVENT REFINING	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.0	0.0	0.0
TOTAL SYNTHETICS	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	14.9	2.2	17.1
SOLAR	0.0	0.0	0.0
ELECTRIC UTILITIES			
COAL-FIRED	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.0	0.0	0.0
NUCLEAR	2308.3	259.9	2568.2
HYDRO & PUMPED STORAGE	186.8	19.6	206.4
OIL & GAS	2246.3	253.8	2500.1
GEOTHERMAL	0.0	0.0	0.0
TOTAL GENERATION	4741.3	533.4	5274.7
TRANSMISSION	449.9	52.2	502.1
DISTRIBUTION	612.8	69.9	682.7
TOTAL UTILITIES	5804.0	655.4	6459.4
TOTAL ENERGY INDUSTRY	9217.1	1198.9	10416.0

HECHTEL ENERGY SUPPLY PLANNING MODEL

GROWTH IN CAPITAL REQUIREMENTS* (MILLION POUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
EGYPT - LOW NUCLEAR/IMPORTS

Table 32 Continued

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
NON-MANUAL TECHNICAL MANPOWER	10.	80.	36.	80.	(2000)	18.4	11.6	5.6	8.9
NON-MANUAL NON-TECHNICAL MANPOWER	0.	9.	2.	9.	(2000)	26.5	21.3	7.9	13.5
MANUAL MANPOWER	9.	60.	28.	60.	(2000)	14.2	10.7	6.0	8.3
MANPOWER TOTAL	20.	149.	66.	149.	(2000)	16.8	11.6	5.9	8.8
WOOD PRODUCTS (20)	1.	5.	2.	5.	(2000)	11.9	12.1	7.6	9.2
CHEMICALS & ALLIED PROD. (27,28,30,32)	3.	4.	3.	4.	(2000)	4.6	9.3	1.5	2.0
PETROLEUM PRODUCTS (31)	2.	4.	2.	4.	(2000)	2.6	2.0	3.7	3.2
GLASS, CLAY & STONE PRODUCTS (35,36)	2.	16.	7.	16.	(2000)	7.3	16.2	5.6	8.0
PRIMARY IRON & STEEL PRODUCTS (37)	15.	20.	17.	21.	(1999)	3.6	2.5	1.9	1.3
PRIMARY NON-FERROUS METALS (38)	2.	13.	11.	29.	(1993)	18.7	25.7	0.8	8.4
FABRICATED STRUCTURAL PRODUCTS (40) *	4.	39.	21.	39.	(2000)	15.3	30.3	2.4	9.8
OTHER FABRICATED PRODUCTS (42)	31.	131.	64.	131.	(2000)	9.4	4.9	5.7	6.1
MATERIALS TOTAL	33.	122.	74.	122.	(2000)	6.9	12.3	3.1	5.6
HVAC HEATING & COOLING UNITS (52) ++	0.	5.	2.	5.	(2000)	51.4	21.4	7.7	16.9
HVAC DUCTWORK & ACCESSORIES (40) *	0.	2.	1.	2.	(2000)	50.8	27.1	8.5	18.4
TURBINES (43)	22.	82.	43.	84.	(1999)	-6.4	9.1	7.8	5.5
GAS WELDING SETS (47) ++	0.	0.	0.	0.	(1980)	4.7	-7.4	1.0	-0.2
ELECTRIC WELDING SETS (53) **	0.	1.	1.	1.	(1999)	17.3	7.5	7.5	9.1
CONSTRUCTION, MINING & OIL FIELD EQP (45)	31.	35.	31.	35.	(2000)	-0.0	1.4	0.5	0.6
MATERIALS HANDLING EQUIPMENT (46)	0.	3.	1.	3.	(1999)	11.0	18.1	7.0	9.9
GENERAL INDUSTRY EQUIPMENT (49)	2.	15.	11.	17.	(1997)	39.0	-2.4	4.3	7.9
INSTRUMENTATION & CONTROLS (62)	1.	11.	7.	12.	(1999)	34.7	3.2	4.3	8.6
ELECTRICAL EQUIPMENT (53) **	4.	28.	15.	28.	(2000)	19.9	10.4	5.4	8.8
FABRICATED PLATE PRODUCTS (40) *	12.	114.	56.	118.	(1999)	23.4	5.0	8.2	9.9
EQUIPMENT TOTAL	73.	296.	168.	303.	(1999)	7.7	4.8	6.0	6.0
MISCELLANEOUS MATERIALS & EQUIPMENT	8.	12.	10.	13.	(1999)	6.6	-2.3	2.0	1.8
MOBILE FACILITY	13.	11.	14.	19.	(1990)	0.1	2.4	-1.8	-0.6
OTHER CONSTRUCTOR COSTS	19.	153.	69.	153.	(2000)	10.9	12.3	7.6	9.1
CONSTRUCTOR COST TOTAL **	165.	742.	401.	742.	(2000)	8.6	8.1	5.4	6.5

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

#BEA (BUREAU OF ECONOMIC ANALYSIS). TWO-DIGIT CATEGORIES ARE IN PARENTHESIS.

* PARTIAL BEA CATEGORY 40. TOTAL IS SUM OF 3 SEPARATE ENTRIES FOR CATEGORY 40.

++ PARTIAL BEA CATEGORY 52. REMAINDER IS PART OF MISCELLANEOUS ENTRY.

** PARTIAL BEA CATEGORY 53. TOTAL IS SUM OF 2 SEPARATE ENTRIES FOR CATEGORY 53.

** CONSTRUCTION CAPITAL COST TOTAL INCLUDES MANPOWER, MATERIALS AND EQUIPMENT SUBTOTALS ABOVE PLUS OTHER (OVERHEAD, PROFIT, ETC.) COSTS. IT EXCLUDES OWNER'S COSTS. (LAND COSTS, INTEREST DURING CONSTRUCTION, ETC.)

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 32 Continued

GROWTH IN MANPOWER REQUIREMENTS (MAN-YEARS)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
EGYPT - LOW NUCLEAR/IMPORTS

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
CHEMICAL ENGINEERS	0.	6.	12.	16.	(1996)	9999.0	11.8	-3.7	9999.0
CIVIL ENGINEERS	41.	647.	235.	647.	(2000)	23.1	13.4	9.0	12.1
ELECTRICAL ENGINEERS	36.	516.	213.	516.	(2000)	24.4	12.5	8.2	11.7
MECHANICAL ENGINEERS	30.	401.	161.	401.	(2000)	24.7	10.0	8.5	11.4
MINING ENGINEERS	0.	1.	0.	1.	(1994)	0.0	0.0	9999.0	9999.0
NUCLEAR ENGINEERS	0.	58.	14.	58.	(2000)	9999.0	11.1	12.0	9999.0
GEOLOGICAL ENGINEERS	29.	29.	27.	32.	(1978)	0.6	-2.9	0.7	-0.1
PETROLEUM ENGINEERS	29.	25.	26.	32.	(1978)	0.6	-4.7	0.4	-0.7
OTHER ENGINEERS	0.	5.	7.	10.	(1994)	64.7	14.9	-1.5	10.8
ENGINEERS TOTAL	167.	1687.	695.	1687.	(2000)	18.7	9.9	8.0	10.1
DESIGNERS & DRAFTSMEN	59.	631.	287.	631.	(2000)	22.3	11.0	7.2	10.4
SUPERVISORS & MANAGERS	54.	340.	136.	340.	(2000)	6.5	10.8	7.5	8.0
NON-MANUAL, TECHNICAL TOTAL	280.	2658.	1118.	2658.	(2000)	17.5	10.3	7.7	9.8
NON-MANUAL, NON-TECHNICAL	11.	456.	115.	456.	(2000)	53.3	8.9	11.4	16.9
NON-MANUAL TOTAL	290.	3114.	1233.	3114.	(2000)	19.5	10.1	8.2	10.4
PIPEFITTERS	119.	1059.	482.	1059.	(2000)	26.5	0.9	8.3	9.5
PIPEFITTER/WELDERS	68.	477.	213.	477.	(2000)	16.9	3.3	8.0	8.5
ELECTRICIANS	54.	1008.	359.	1008.	(2000)	25.3	18.9	8.1	13.0
BOILERMAKERS	44.	224.	142.	314.	(1996)	2.1	-5.5	12.9	7.0
BOILERMAKER/WELDERS	15.	107.	53.	107.	(2000)	-6.8	26.7	7.5	8.6
IRON WORKERS	21.	529.	239.	529.	(2000)	23.9	44.0	3.7	14.4
CARPENTERS	23.	676.	215.	676.	(2000)	34.9	24.1	7.8	15.2
EQUIPMENT OPERATORS	115.	486.	247.	486.	(2000)	8.5	8.5	4.8	6.2
LINEMEN	24.	143.	160.	445.	(1993)	26.4	27.7	-2.4	7.8
TEAMSTERS & LABORERS	159.	1093.	471.	1093.	(2000)	11.8	12.9	6.0	8.4
OTHER	260.	497.	336.	497.	(2000)	2.9	-0.5	3.8	2.7
MANUAL TOTAL	902.	6300.	2916.	6300.	(2000)	13.8	11.2	6.2	8.4
CONSTRUCTION MANPOWER TOTAL	1192.	9414.	4149.	9414.	(2000)	15.2	10.9	6.8	9.0

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A GROWTH RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

BECHTEL ENERGY SUPPLY PLANNING MODEL

GROWTH IN ANNUAL COSTS (MILLION POUNDS JANUARY 1978)
FOR THE OPERATION AND MAINTENANCE OF ENERGY-RELATED FACILITIES
EGYPT - LOW NUCLEAR/IMPORTS

Table 32 Continued

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
NON-MANUAL TECHNICAL MANPOWER	0.	0.	0.	0.	(1989)	0.0	0.0	9999.0	9999.0
NON-MANUAL NON-TECHNICAL MANPOWER	0.	0.	0.	0.		0.0	0.0	0.0	0.0
MANUAL MANPOWER	0.	0.	0.	0.	(1989)	0.0	0.0	9999.0	9999.0
MANPOWER TOTAL	0.	1.	0.	1.	(1989)	0.0	0.0	9999.0	9999.0
WOOD PRODUCTS (26)	0.	0.	0.	0.	(1989)	0.0	0.0	9999.0	9999.0
CHEMICALS & ALLIED PROD. (27,28,30,32)	4.	19.	10.	19.	(2000)	0.8	6.5	7.9	6.4
PETROLEUM PRODUCTS (31)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
GLASS, CLAY & STONE PRODUCTS (35,36)	0.	0.	0.	0.	(2000)	12.4	14.0	8.0	10.0
PRIMARY IRON & STEEL PRODUCTS (37)	0.	2.	1.	2.	(2000)	19.1	3.4	7.7	8.6
PRIMARY NON-FERROUS METALS (38)	0.	1.	0.	1.	(2000)	6.1	5.8	6.9	6.5
FABRICATED STRUCTURAL PRODUCTS (40) *	0.	0.	0.	0.	(1989)	0.0	0.0	9999.0	9999.0
OTHER FABRICATED PRODUCTS (42)	1.	5.	2.	5.	(2000)	5.4	8.3	9.4	8.5
MATERIALS TOTAL	6.	28.	15.	28.	(2000)	2.8	6.6	8.2	6.9
HVAC HEATING & COOLING UNITS (52) ++	0.	0.	0.	0.	(1981)	20.2	3.1	-0.3	3.6
HVAC DUCTWORK & ACCESSORIES (40) *	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TURBINES (43)	0.	4.	2.	4.	(2000)	14.5	8.0	10.1	10.4
GAS WELDING SETS (47) ++	0.	0.	0.	0.		0.0	0.0	0.0	0.0
ELECTRIC WELDING SETS (53) **	0.	0.	0.	0.		0.0	0.0	0.0	0.0
CONSTRUCTION, MINING & OIL FIELD EUP (45)	0.	1.	0.	1.	(2000)	15.7	8.4	9.2	10.1
MATERIALS HANDLING EQUIPMENT (46)	0.	0.	0.	0.	(2000)	21.4	12.2	8.8	11.5
GENERAL INDUSTRY EQUIPMENT (49)	1.	3.	2.	3.	(2000)	-0.7	2.5	5.7	3.9
INSTRUMENTATION & CONTROLS (62)	1.	4.	2.	4.	(2000)	6.5	4.3	6.1	5.8
ELECTRICAL EQUIPMENT (53) **	1.	7.	4.	7.	(2000)	4.9	7.7	7.9	7.4
FABRICATED PLATE PRODUCTS (40) *	0.	0.	0.	0.		0.0	0.0	0.0	0.0
EQUIPMENT TOTAL	4.	20.	10.	20.	(2000)	5.1	5.7	7.5	6.7
ELECTRICITY	0.	0.	0.	0.		0.0	0.0	0.0	0.0
NATURAL GAS	0.	0.	0.	0.		0.0	0.0	0.0	0.0
WATER	0.	0.	0.	0.		0.0	0.0	0.0	0.0
UTILITY TOTAL	0.	0.	0.	0.		0.0	0.0	0.0	0.0
RENTS, ROYALTIES, ETC.	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TAXES	0.	0.	0.	0.		0.0	0.0	0.0	0.0
SERVICES & MISCELLANEOUS	1.	6.	3.	6.	(2000)	10.5	6.1	5.0	6.1
ANNUAL OPERATING COST (EX FUEL)	11.	54.	29.	54.	(2000)	4.7	6.1	7.6	6.8

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A GROWTH RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

#BEA (BUREAU OF ECONOMIC ANALYSIS) TWO-DIGIT CATEGORIES ARE IN PARENTHESIS.

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++ PARTIAL BEA CATEGORY 52. REMAINDER IS PART OF MISCELLANEOUS ENTRY.

** PARTIAL BEA CATEGORY 53. TOTAL IS SUM OF 2 SEPARATE ENTRIES FOR CATEGORY 53.

7.0 SENSITIVITY OF RESOURCE REQUIREMENTS TO OTHER ALTERNATIVE ENERGY FUTURES

This section presents an analysis of the effects of various alternative Egyptian energy futures on the resource requirements results. The Comparison Case energy development program has been used as a point of comparison. Four alternative cases defined by DOE have been analyzed:

- o Maximum Gas Use Case
- o Improved Efficiency Case
- o Accelerated Renewable Resources Case
- o Nuclear Capacity Variations Case

7.1 Maximum Gas Use Case

In this scenario, the natural gas which is assumed to be flared in the Comparison Case is instead put to productive use. Some existing thermal power plants are converted from oil to gas use and additional steam and combined cycle power plants with the ability to burn gas are built. Increased use of thermal power plants lowers nuclear plant requirements somewhat. This substitution of lower capital cost fossil plants lowers the computed capital requirements relative to the Comparison Case. This effect is reinforced, in the years immediately prior to 2000, by an assumption of lower generating capacity growth (again, relative to the Comparison Case) after 2000. Detailed results are available in Table 33.

7.2 Improved Efficiency Case

The improved efficiency in end use assumed for this case frees some of the fixed oil production for export and lowers generating capacity requirements. These assumptions result in lower computed resource requirements for the electric utility sector. The ESPM tracks costs in the energy supply system only - possible increased capital costs in the end use sector are therefore not reflected in the detailed results presented in Table 34.

7.3 Accelerated Renewable Resource Case

This case postulates increased use of renewable resources to substitute for the correspondingly reduced, more traditional sources of the Comparison Case. Relative to the Comparison Case, direct solar power projected to be installed by 2000 is increased from 902 MWe to 2625 MWe; wind power capacity is increased from 364 MWe and electric power from biomass increases from 180 MWe to 500 MWe. In addition, the Qattara project, representing 670 MWe installed capacity, is expected to be completed. The use of solar energy for water heating is also projected to increase, from 10×10^{15} joules by 2000 in the Comparison Case to 62.45×10^{15} joules in this case. Table 35 presents the A.D. Little, Inc. estimates of some resource requirements for the renewable energy sources projected for this case. Table 36 shows the lower (relative to the Comparison Case) resource requirements of the remaining more traditional energy sources, as computed by the ESPM.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 33

ELECTRIC GENERATING CAPACITY (MWE)

Egypt - Maximum Gas Use

	1975	1982	1985	2000	AVERAGE ANNUAL GROWTH
COAL AND COAL/WASTE PLANTS	0,0	0,0	0,0	0,0	-----
OIL-STEAM PLANTS	1420,0	2904,0	2868,0	1617,0	0,52%
GAS-STEAM PLANTS	0,0	0,0	0,0	0,0	-----
LOW-BTU GAS-STEAM PLANTS	0,0	0,0	0,0	0,0	-----
GAS TURBINE PLANTS	137,0	107,0	107,0	0,0	-----
COMBINED CYCLE PLANTS	0,0	330,0	1230,0	1868,0	-----
FUEL CELLS	0,0	0,0	0,0	0,0	-----
NUCLEAR POWER PLANTS	0,0	0,0	0,0	12000,0	-----
CONVENTIONAL HYDRO PLANTS	2445,0	2445,0	2445,0	2403,0	0,25%
PUMPED STORAGE PLANTS	0,0	0,0	0,0	2550,0	-----
GEOTHERMAL PLANTS	0,0	0,0	0,0	20,0	-----
TOTAL CAPACITY	4002,0	5786,0	6650,0	20658,0	6,79%

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 33 (Continued)

Schedule of Annual Energy Facilities Additions to Supply Fuel Mix: Egypt - Maximum Gas Use 1976-2010

FACILITY NAME	1975 TOTALS	1976	1977	1978	1979	1980	1981	1982	TOTAL ADDED (1978- 1982)
1 ONSHORE PRIMARY OIL RECOVERY-(1,000 MBPD)	66.0	17*	17*	17*	18*	17	18	17	87
2 ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	0.0	0	0	0	0	0	0	0	0
3 ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	0.0	0	0	0	0	0	0	0	0
4 OFFSHORE OIL RECOVERY (12.5 MBPD)	11.8	3*	3*	3*	3*	4*	3	3	16
6 HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	0.0	0	0	0	0	0	0	0	0
7 LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	2.0	0	0	0	0	0	0	1	1
19 ONSHORE CONVENTIONAL GAS RECOVERY (100 MMCF/D)	0.4	1*	0	0	1*	0	0	0	1
20 ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	0.0	0	0	0	0	0	0	0	0
21 OFFSHORE GAS RECOVERY (25 MMCF/D)	-0.0	0	0	0	0	0	0	0	0
24 LNG EXPORT (3030 MMCF/D)	0.0	0	0	0	0	0	0	0	0
27 UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	0.0	0	0	0	0	0	0	0	0
37 SURFACE URANIUM MINE (275.4 M TONNES/Y)	0.0	0	0	0	0	0	0	0	0
38 UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	0.0	0	0	0	0	0	0	0	0
39 URANIUM MILL (275.4 M TONNES/Y)	0.0	0	0	0	0	0	0	0	0
42 LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	0.0	0	0	0	0	0	0	0	0
43 LWR FUEL FABRICATION - PU RECYCLE (150 MTH/Y)	0.0	0	0	0	0	0	0	0	0
49 HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	0.0	0	0	0	0	0	0	0	0
50 OIL-FIRED POWER PLANT (800 MWE)	0.0	0	0	0	0	0	0	0	0
51 OIL-FIRED POWER PLANT (600 MWE)	0.0	0	0	0	0	1*	1*	0	2
52 OIL-FIRED POWER PLANT (450 MWE)	3.2	0	0	0	1*	0	0	0	1
53 COAL FIRED POWER PLANT-LOW BTU (800 MWE)	0.0	0	0	0	0	0	0	0	0
54 COAL FIRED POWER PLANT-HIGH BTU (800 MWE)	0.0	0	0	0	0	0	0	0	0
55 COAL FIRED POWER PLANT-LOW BTU (600 MWE)	0.0	0	0	0	0	0	0	0	0
56 COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	0.0	0	0	0	0	0	0	0	0
59 HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	0.0	0	0	0	0	0	0	0	0
60 HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	0.0	0	0	0	0	0	0	0	0
61 COMBINED CYCLE POWER PLANT (400 MWE)	0.0	0	0	0	1*	0	0	0	1
62 GAS TURBINE POWER PLANT (133 MWE)	1.0	0	0	0	0	0	0	0	0
63 FUEL CELLS (26 MWE)	0.0	0	0	0	0	0	0	0	0
64 LIGHT WATER REACTOR (LWR) (1200 MWE)	0.0	0	0	0	0	0	0	0	0
65 LIGHT WATER REACTOR (LWR) (900 MWE)	0.0	0	0	0	0	0	0	0	0
66 LIGHT WATER REACTOR (LWR) (600 MWE)	0.0	0	0	0	0	0	0	0	0
67 DAM & HYDROELECTRIC POWER PLANT (200 MWE)	12.2	0	0	0	0	0	0	0	0
68 PUMPED STORAGE (500 MWE)	0.0	0	0	0	0	0	0	0	0
69 GEOTHERMAL POWER COMPLEX (200 MWE)	0.0	0	0	0	0	0	0	0	0

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 33 (Continued)

Schedule of Annual Energy Facilities Additions to Supply Fuel Mix: Egypt - Maximum Gas Use 1976-2010

FACILITY NAME	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	TOTAL ADDED (1978- 1993)
1 ONSHORE PRIMARY OIL RECOVERY-(1,000 MBPD)	17	16	16	14	13	14	13	13	14	13	14	244
2 ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	0	0	0	0	0	0	0	0	0	0	0	0
3 ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	0	0	0	0	0	0	0	0	0	0	0	0
4 OFFSHORE OIL RECOVERY (12.5 MBPD)	3	3	3	3	2	3	2	3	2	3	2	45
6 HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	0	0	0	0	0	0	0	0	0	0	0	0
7 LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	0	0	0	1	0	0	0	1	0	0	0	3
19 ONSHORE CONVENTIONAL GAS RECOVERY (100 MMCF/D)	1	0	0	0	0	1	0	0	0	0	1	4
20 ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0	0
21 OFFSHORE GAS RECOVERY (25 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0	0
24 LNG EXPORT (3030 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0	0
27 UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0	0
37 SURFACE URANIUM MINE (275.4 M TONNES/Y)	0	0	0	0	0	1	0	0	0	1	0	2
38 UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0	0
39 URANIUM MILL (275.4 M TONNES/Y)	0	0	0	0	0	1	0	0	0	1	0	2
42 LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	0	0	0	0	0	0	0	0	0	0	0	0
43 LWR FUEL FABRICATION - PU RECYCLE (150 MTH/Y)	0	0	0	0	0	0	0	0	0	0	0	0
49 HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	0	0	0	0	0	0	0	0	0	0	0	0
50 OIL-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
51 OIL-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	0	0	0	0	2
52 OIL-FIRED POWER PLANT (450 MWE)	0	0	0	0	0	0	0	0	0	0	0	1
53 COAL FIRED POWER PLANT-LOW BTU (800 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
54 COAL FIRED POWER PLANT-HIGH BTU (800 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
55 COAL FIRED POWER PLANT-LOW BTU (600 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
56 COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
59 HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
60 HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
61 COMBINED CYCLE POWER PLANT (400 MWE)	0	1	1	0	0	0	1	0	0	0	0	4
62 GAS TURBINE POWER PLANT (133 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
63 FUEL CELLS (26 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
64 LIGHT WATER REACTOR (LWR) (1200 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
65 LIGHT WATER REACTOR (LWR) (900 MWE)	0	0	0	0	0	0	0	0	1	1	0	0
66 LIGHT WATER REACTOR (LWR) (600 MWE)	0	0	0	1*	0	1	0	1	0	0	0	0
67 DAM & HYDROELECTRIC POWER PLANT (200 MWE)	0	0	0	0	0	1	0	0	0	0	0	0
68 PUMPED STORAGE (500 MWE)	0	0	0	0	0	0	0	1	0	0	1	0
69 GEOTHERMAL POWER COMPLEX (200 MWE)	0	0	0	0	0	0	0	0	0	0	0	0

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 33 (Continued)

Schedule of Annual Energy Facilities Additions to Supply Fuel Mix: Egypt - Maximum Gas Use 1976-2010

FACILITY NAME	1994	1995	1996	1997	1998	1999	2000	TOTAL ADDED (1976- 2000)
1 ONSHORE PRIMARY OIL RECOVERY-(1,000 MBPD)	13	14	14	14	14	15	14	342
2 ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	0	0	0	0	0	0	0	0
3 ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	0	0	0	0	0	0	0	0
4 OFFSHORE OIL RECOVERY (12.5 MBPD)	3	2	3	3	2	3	3	64
6 HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	0	0	0	0	0	0	0	0
7 LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	1	0	0	0	1	0	0	5
19 ONSHORE CONVENTIONAL GAS RECOVERY (100 MMCF/D)	0	0	0	0	1	0	0	5
20 ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	0	0	0	0	0	0	0	0
21 OFFSHORE GAS RECOVERY (25 MMCF/D)	0	0	0	0	0	0	0	0
24 LNG EXPORT (3030 MMCF/D)	0	0	0	0	0	0	0	0
27 UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	0	0	0	0	0	0	0	0
37 SURFACE URANIUM MINE (275.4 M TONNES/Y)	0	1	0	0	1	0	0	4
38 UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	0	0	0	0	0	0	0	0
39 URANIUM MILL (275.4 M TONNES/Y)	0	1	0	0	1	0	0	4
42 LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	0	0	0	0	0	0	0	0
43 LWR FUEL FABRICATION - PU RECYCLE (150 MTH/Y)	0	0	0	0	0	0	0	0
49 HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	0	0	0	0	0	0	0	0
50 OIL-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0
51 OIL-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	2
52 OIL-FIRED POWER PLANT (450 MWE)	0	0	0	0	0	0	0	1
53 COAL FIRED POWER PLANT-LOW BTU (800 MWE)	0	0	0	0	0	0	0	0
54 COAL FIRED POWER PLANT-HIGH BTU (800 MWE)	0	0	0	0	0	0	0	0
55 COAL FIRED POWER PLANT-LOW BTU (600 MWE)	0	0	0	0	0	0	0	0
56 COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	0	0	0	0	0	0	0	0
59 HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0
60 HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	0
61 COMBINED CYCLE POWER PLANT (400 MWE)	0	0	0	0	0	0	0	4
62 GAS TURBINE POWER PLANT (133 MWE)	0	0	0	0	0	0	0	0
63 FUEL CELLS (26 MWE)	0	0	0	0	0	0	0	0
64 LIGHT WATER REACTOR (LWR) (1200 MWE)	1	1	1	1	1	1	1	7
65 LIGHT WATER REACTOR (LWR) (900 MWE)	0	0	0	0	0	0	0	2
66 LIGHT WATER REACTOR (LWR) (600 MWE)	0	0	0	0	0	0	0	1
67 DAM & HYDROELECTRIC POWER PLANT (200 MWE)	0	0	0	0	0	0	0	5
68 PUMPED STORAGE (500 MWE)	0	1	0	1	0	1	0	5
69 GEOTHERMAL POWER COMPLEX (200 MWE)	0	0	0	0	0	0	0	0

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 33 (Continued)

Schedule of Annual Energy Facilities Additions to Supply Fuel Mix: Egypt - Maximum Gas Use 1976-2010

FACILITY NAME	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL ADDED (1978- 2010)
1 ONSHORE PRIMARY OIL RECOVERY-(1,000 MBPD)	14	14	14	14	14	14	14	14	14	14	482
2 ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	0	0	0	0	0	0	0	0	0	0	0
3 ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	0	0	0	0	0	0	0	0	0	0	0
4 OFFSHORE OIL RECOVERY (12.5 MBPD)	3	3	3	3	3	3	3	3	3	3	94
6 HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	0	0	0	0	0	0	0	0	0	0	0
7 LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	0	1	0	0	0	1	0	0	0	0	7
19 ONSHORE CONVENTIONAL GAS RECOVERY (100 MMCF/D)	0	0	0	0	0	1	0	0	0	0	6
20 ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0
21 OFFSHORE GAS RECOVERY (25 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0
24 LNG EXPORT (3030 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0
27 UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0
37 SURFACE URANIUM MINE (275.4 M TONNES/Y)	1	0	0	1	0	0	1	0	0	1	8
38 UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0
39 URANIUM MILL (275.4 M TONNES/Y)	1	0	0	1	0	0	1	0	0	1	8
42 LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	0	0	0	0	0	0	0	0	0	0	0
43 LWR FUEL FABRICATION - PU RECYCLE (150 MTH/Y)	0	0	0	0	0	0	0	0	0	0	0
49 HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	0	0	0	0	0	0	0	0	0	0	0
50 OIL-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0	0	0	0
51 OIL-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	0	0	0	2
52 OIL-FIRED POWER PLANT (450 MWE)	0	0	0	0	0	0	0	0	0	0	1
53 COAL FIRED POWER PLANT-LOW BTU (800 MWE)	0	0	0	0	0	0	0	0	0	0	0
54 COAL FIRED POWER PLANT-HIGH BTU (800 MWE)	0	0	0	0	0	0	0	0	0	0	0
55 COAL FIRED POWER PLANT-LOW BTU (600 MWE)	0	0	0	0	0	0	0	0	0	0	0
56 COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	0	0	0	0	0	0	0	0	0	0	0
59 HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0	0	0	0
60 HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	0	0	0	0
61 COMBINED CYCLE POWER PLANT (400 MWE)	0	0	0	0	0	0	0	0	0	0	4
62 GAS TURBINE POWER PLANT (133 MWE)	0	0	0	0	0	0	0	0	0	0	0
63 FUEL CELLS (26 MWE)	0	0	0	0	0	0	0	0	0	0	0
64 LIGHT WATER REACTOR (LWR) (1200 MWE)	1	1	1	1	1	1	2	2	2	2	21
65 LIGHT WATER REACTOR (LWR) (900 MWE)	0	0	0	0	0	0	0	0	0	0	2
66 LIGHT WATER REACTOR (LWR) (600 MWE)	0	0	0	0	0	0	0	0	0	0	3
67 DAM & HYDROELECTRIC POWER PLANT (200 MWE)	0	0	0	0	0	0	0	0	0	0	1
68 PUMPED STORAGE (500 MWE)	1	0	1	0	1	1	1	1	1	1	13
69 GEOTHERMAL POWER COMPLEX (200 MWE)	0	0	0	0	0	0	0	0	0	0	0

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 33 (Continued)

Schedule of Annual Energy Facilities Additions to Supply Fuel Mix: Egypt - Maximum Gas Use 1976-2010

FACILITY NAME	1975 TOTALS	1976	1977	1978	1979	1980	1981	1982	TOTAL ADDED (1976- 1982)
1 CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	0.1	0	0	0	0	0	0	0	0
3 OIL TANKER (90,000 DWT, 620,000 B)	0.0	0	0	0	0	0	0	0	0
4 OIL BARGES (90,000 BBL)	3.0	1*	2*	1*	1	0	1	1	4
5 OIL TANK TRUCK (226 BBL)	290.3	128*	130*	131*	130	129	136	149	675
6 PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	0.5	0	0	0	0	0	0	0	0
7 HOT OIL PIPELINE (40 MB/D, 80.5 KM)	2.4	0	0	1*	0	0	0	0	1
8 REFINED PRODUCTS BULK STATION (69 MB/D)	1.6	0	0	0	1*	0	0	0	1
9 RAIL LINE (64.4 KM, SINGLE TRACK)	0.0	0	0	0	0	0	0	0	0
10 MIXED TRAIN (6556 TONNES)	2.3	0	0	1*	0	0	0	1	2
11 COAL UNIT TRAIN (9,528 TONNES)	0.0	0	0	0	0	0	0	0	0
12 COAL SLURRY PIPELINE (22.69 MM TONNES/Y, 241.4 KM)	0.0	0	0	0	0	0	0	0	0
13 COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	0.0	0	0	0	0	0	0	0	0
14 COAL SLURRY DEWATERING (22.69 MM TONNES/Y)	0.0	0	0	0	0	0	0	0	0
15 COAL BARGES (19,048 TONNES)	0.2	0	0	0	0	0	0	0	0
16 COAL TRUCK (22.7 TONNES)	4.8	1*	1*	1*	1	1	1	1	5
17 GAS PIPELINE (.87 BSCF/D, 241.4 KM)	0.1	0	0	0	0	0	0	0	0
18 GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	0.7	1*	1*	0	0	0	0	0	0
20 LNG TANKER (2.6 BCF)	0.0	0	0	0	0	0	0	0	0
21 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	0.5	0	0	0	0	1	0	0	1
22 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	0.0	0	0	0	0	0	0	0	0
23 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	0.2	0	0	0	0	0	0	0	0
24 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	0.0	0	0	0	0	0	0	0	0
25 +-400 KVDC TRANSMISSION LINE (1500 MWE, 1287 KM)	0.0	0	0	0	0	0	0	0	0
26 ELECTRICITY DISTRIBUTION-AERIAL LINES (131.6 MWE)	9.0	1*	1*	1*	2*	2*	3	2	10

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 33 (Continued)

Schedule of Annual Transportation Additions to Supply Fuel Mix: Egypt - Maximum Gas Use 1976-2010

FACILITY NAME	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	TOTAL ADDED (1976- 1993)
1 CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0	0
3 OIL TANKER (90,000 DWT, 620,000 B)	0	0	0	0	0	0	0	0	0	0	0	0
4 OIL BARGES (90,000 BBL)	0	1	0	1	0	0	1	0	0	0	0	7
5 OIL TANK TRUCK (226 BBL)	168	179	179	176	182	186	188	189	187	184	181	2674
6 PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	1	0	0	0	0	0	0	0	0	0	0	1
7 HOT OIL PIPELINE (40 MB/D, 80.5 KM)	1	0	0	1	0	0	1	0	0	0	1	5
8 REFINED PRODUCTS BULK STATION (69 MB/D)	0	0	1	0	0	0	0	1	0	0	0	3
9 RAIL LINE (64.4 KM, SINGLE TRACK)	0	0	0	0	0	0	0	0	0	0	0	0
10 MIXED TRAIN (6556 TONNES)	0	0	1	0	1	0	1	1	1	0	1	8
11 COAL UNIT TRAIN (9,528 TONNES)	0	0	0	0	0	0	0	0	0	0	0	0
12 COAL SLURRY PIPELINE (22.69 MM TONNES/Y, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0	0
13 COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0	0
14 COAL SLURRY DEWATERING (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0	0
15 COAL BARGES (19,048 TONNES)	0	0	0	0	0	0	0	1	0	0	0	1
16 COAL TRUCK (22.7 TONNES)	2	1	2	2	2	3	3	3	3	3	4	33
17 GAS PIPELINE (.87 BSCF/D, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0	0
18 GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	0	0	0	0	0	0	0	0	0	0	0	0
20 LNG TANKER (2.6 BCF)	0	0	0	0	0	0	0	0	0	0	0	0
21 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	0	0	0	1	0	0	0	1	0	0	0	3
22 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	0	0	0	0	0	0	0	0	0	0	0	0
23 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	1	0	0	0	0	0	0	0	0	0	0	1
24 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	0	0	0	0	0	0	0	0	0	0	0	0
25 +-400 KVDC TRANSMISSION LINE (1500 MWE, 1287 KM)	0	0	0	0	0	0	0	0	0	0	0	0
26 ELECTRICITY DISTRIBUTION-AERIAL LINES(131.6MWE)	3	4	3	4	3	4	4	4	5	4	5	53

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 33 (Continued)

Schedule of Annual Transportation Additions to Supply Fuel Mix: Egypt - Maximum Gas Use 1976-2010

FACILITY NAME	1994	1995	1996	1997	1998	1999	2000	TOTAL ADDED (1978- 2000)
1 CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	0	0	0	0	0	0	0	0
3 OIL TANKER (90,000 DWT, 620,000 B)	0	0	0	0	0	0	0	0
4 OIL BARGES (90,000 BBL)	0	0	0	0	0	0	0	7
5 OIL TANK TRUCK (226 BBL)	174	166	157	146	134	119	104	3674
6 PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	0	0	0	0	0	0	0	1
7 HOT OIL PIPELINE (40 MB/D, 80.5 KM)	0	0	0	0	0	1	0	6
8 REFINED PRODUCTS BULK STATION (69 MB/D)	0	0	1	0	0	0	0	4
9 RAIL LINE (64.4 KM, SINGLE TRACK)	0	0	0	0	0	0	0	0
10 MIXED TRAIN (6556 TONNES)	1	1	2	1	1	1	2	17
11 COAL UNIT TRAIN (9,528 TONNES)	0	0	0	0	0	0	0	0
12 COAL SLURRY PIPELINE (22.69 MM TONNES/Y, 241.4 KM)	0	0	0	0	0	0	0	0
13 COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0
14 COAL SLURRY DEWATERING (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0
15 COAL BARGES (19,048 TONNES)	0	0	0	0	0	0	0	1
16 COAL TRUCK (22.7 TONNES)	4	4	5	5	5	5	6	67
17 GAS PIPELINE (.87 BSCF/D, 241.4 KM)	0	0	0	0	0	0	0	0
18 GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	0	0	0	0	0	0	0	0
20 LNG TANKER (2.6 BCF)	0	0	0	0	0	0	0	0
21 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	1	0	0	0	1	0	0	5
22 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	0	0	0	0	0	0	0	0
23 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	1	0	0	0	0	0	0	2
24 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	0	0	0	0	0	0	0	0
25 +/-400 KVDC TRANSMISSION LINE (1500 MWE, 1287 KM)	0	0	0	0	0	0	0	0
26 ELECTRICITY DISTRIBUTION-AERIAL LINES (131.6 MWE)	4	5	5	5	6	5	6	69

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

HECHTEL ENERGY SUPPLY PLANNING MODEL

Table 33 (Continued)

Schedule of Annual Transportation Additions to Supply Fuel Mix: Egypt - Maximum Gas Use 1976-2010

FACILITY NAME	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL ADDED (1978- 2010)
1 CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0
3 OIL TANKER (90,000 DWT; 620,000 B)	0	0	0	0	0	0	0	0	0	0	0
4 OIL BARGES (90,000 BBL)	0	0	0	0	0	0	0	0	0	0	7
5 OIL TANK TRUCK (226 BBL)	104	104	104	104	104	104	104	104	104	104	4714
6 PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	0	0	0	0	0	0	0	0	0	0	1
7 HOT OIL PIPELINE (40 MB/D, 80.5 KM)	0	0	0	0	0	1	0	0	0	0	7
8 REFINED PRODUCTS BULK STATION (69 MB/D)	0	0	0	0	0	1	0	0	0	0	5
9 RAIL LINE (64.4 KM, SINGLE TRACK)	0	0	0	0	0	0	0	0	0	0	0
10 MIXED TRAIN (6556 TONNES)	2	2	2	2	2	2	2	2	2	2	37
11 COAL UNIT TRAIN (9,528 TONNES)	0	0	0	0	0	0	0	0	0	0	0
12 COAL SLURRY PIPELINE (22.69 MM TONNES/Y, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0
13 COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0
14 COAL SLURRY DEWATERING (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0
15 COAL BARGES (19,048 TONNES)	0	0	0	0	0	0	0	0	0	0	1
16 COAL TRUCK (22.7 TONNES)	6	6	6	6	6	6	6	6	6	6	127
17 GAS PIPELINE (.87 BSCF/D, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0
18 GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	0	0	0	0	0	0	0	0	0	0	0
20 LNG TANKER (2.6 BCF)	0	0	0	0	0	0	0	0	0	0	0
21 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	0	0	0	0	0	1	0	0	0	0	6
22 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	0	0	0	0	0	0	0	0	0	0	0
23 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	0	0	0	0	0	0	0	0	0	0	2
24 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	0	0	0	0	0	0	0	0	0	0	0
25 +-400 KVDC TRANSMISSION LINE (1500 MWE, 1287 KM)	0	0	0	0	0	0	0	0	0	0	0
26 ELECTRICITY DISTRIBUTION-AERIAL LINES(131.6MWE)	6	6	6	6	6	6	6	6	6	6	149

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 33 (Continued)

CUMULATIVE CAPITAL REQUIREMENTS (MILLION POUNDS, JAN 1978) OF THE ENERGY INDUSTRY BY FACILITY GROUPING

(1978-1985)

Egypt - Maximum Gas Use

FACILITY	CONSTRUCTION COSTS	OWNER'S COSTS PRIOR TO STARTUP	TOTAL
OIL			
EXPLORATION, DEVELOPMENT, & PRODUCTION	643.2	98.9	742.1
REFINING AND PROCESSING	436.4	70.0	506.4
PIPELINES	35.4	6.0	41.4
TANKERS, BARGES, TRUCKS	117.1	20.5	137.6
BULK STATIONS	9.7	1.6	11.3
OTHER	0.0	0.0	0.0
TOTAL OIL	1241.7	197.1	1438.7
OIL SHALE	0.0	0.0	0.0
GAS			
EXPLORATION, DEVELOPMENT, & PRODUCTION	7.3	1.1	8.4
GEOPRESSURED METHANE	0.0	0.0	0.0
PIPELINES	0.0	0.0	0.0
LNG TANKERS	0.0	0.0	0.0
DISTRIBUTION	0.0	0.0	0.0
OTHER	0.0	0.0	0.0
TOTAL GAS	7.3	1.1	8.4
COAL			
UNDERGROUND MINING	0.0	0.0	0.0
SURFACE MINING	0.0	0.0	0.0
RAIL	11.1	1.9	12.9
PIPELINES	0.0	0.0	0.0
BARGES, TRUCKS	0.6	0.1	0.7
TOTAL COAL	11.6	2.0	13.6
COAL SYNTHETICS			
LIQUEFACTION	0.0	0.0	0.0
METHANOL	0.0	0.0	0.0
SOLVENT REFINING	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.0	0.0	0.0
TOTAL SYNTHETICS	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	8.0	1.2	9.2
SOLAR	0.0	0.0	0.0
ELECTRIC UTILITIES			
COAL-FIRED	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.0	0.0	0.0
NUCLEAR	679.5	76.5	756.0
HYDRO & PUMPED STORAGE	46.5	4.9	51.4
OIL & GAS	310.2	35.1	345.3
GEOTHERMAL	0.0	0.0	0.0
TOTAL GENERATION	1036.2	116.4	1152.7
TRANSMISSION	270.8	31.4	302.2
DISTRIBUTION	233.5	26.6	260.1
TOTAL UTILITIES	1540.5	174.5	1715.0
TOTAL ENERGY INDUSTRY	2809.1	375.8	3185.0

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 33 (Continued)

CUMULATIVE CAPITAL REQUIREMENTS (MILLION POUNDS, JAN 1978) OF THE ENERGY INDUSTRY

BY FACILITY GROUPING

Egypt - Maximum Gas Use

(1978-2000)

FACILITY	CONSTRUCTION COSTS	OWNER'S COSTS PRIOR TO STARTUP	TOTAL
OIL			
EXPLORATION, DEVELOPMENT, & PRODUCTION	1665.8	256.2	1922.0
REFINING AND PROCESSING	1265.5	203.0	1468.4
PIPELINES	68.6	11.7	80.3
TANKERS, BARGES, TRUCKS	327.9	57.4	385.3
BULK STATIONS	21.3	3.6	24.9
OTHER	0.0	0.0	0.0
TOTAL OIL	3349.1	531.9	3881.0
OIL SHALE	0.0	0.0	0.0
GAS			
EXPLORATION, DEVELOPMENT, & PRODUCTION	20.2	3.1	23.3
GEOPRESSURED METHANE	0.0	0.0	0.0
PIPELINES	0.0	0.0	0.0
LNG TANKERS	0.0	0.0	0.0
DISTRIBUTION	0.0	0.0	0.0
OTHER	0.0	0.0	0.0
TOTAL GAS	20.2	3.1	23.3
COAL			
UNDERGROUND MINING	0.0	0.0	0.0
SURFACE MINING	0.0	0.0	0.0
RAIL	62.7	10.7	73.3
PIPELINES	0.0	0.0	0.0
BARGES, TRUCKS	8.1	1.4	9.5
TOTAL COAL	70.8	12.0	82.9
COAL SYNTHETICS			
LIQUEFACTION	0.0	0.0	0.0
METHANOL	0.0	0.0	0.0
SOLVENT REFINING	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.0	0.0	0.0
TOTAL SYNTHETICS	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	93.5	14.0	107.5
SOLAR	0.0	0.0	0.0
ELECTRIC UTILITIES			
COAL-FIRED	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.0	0.0	0.0
NUCLEAR	6707.3	755.2	7462.6
HYDRO & PUMPED STORAGE	926.0	97.2	1023.2
OIL & GAS	364.6	41.2	405.8
GEOTHERMAL	0.0	0.0	0.0
TOTAL GENERATION	7998.0	893.7	8891.7
TRANSMISSION	599.9	69.6	669.5
DISTRIBUTION	943.5	107.6	1051.1
TOTAL UTILITIES	9541.4	1070.8	10612.3
TOTAL ENERGY INDUSTRY	13075.1	1631.9	14706.9

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 33 (Continued)

GROWTH IN REQUIREMENTS FOR CONSTRUCTOR COST TOTAL \$M (MILLION EPOUNDS, JANUARY 1978)
 FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
 For The Egypt - Maximum Gas Use CASE

CATEGORY	ANNUAL REQUIREMENTS				AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
OIL								
EXPLORATION, DEVELOPMENT, & PRODUCTION	82.	73.	72.	88. (1979)	0.6	-3.9	0.4	-0.5
REFINING AND PROCESSING	0.	87.	55.	87. (1980)	9999.0	-12.9	4.7	9999.0
PIPELINES	2.	0.	3.	21. (1982)	-100.0	9999.0	-100.0	-100.0
TANKERS, BARGES, TRUCKS	14.	9.	14.	19. (1989)	-7.0	6.8	-3.6	-2.1
BULK STATIONS	0.	0.	1.	4. (1978)	0.0	0.0	0.0	0.0
OTHER	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TOTAL OIL	98.	168.	146.	186. (1984)	16.8	-5.6	1.4	2.3
OIL SHALE	0.	0.	0.	0.	0.0	0.0	0.0	0.0
GAS								
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	0.	1.	3. (1978)	0.0	0.0	0.0	0.0
GEOPRESSURED METHANE	0.	0.	0.	0.	0.0	0.0	0.0	0.0
PIPELINES	0.	0.	0.	0.	0.0	0.0	0.0	0.0
LNG TANKERS	0.	0.	0.	0.	0.0	0.0	0.0	0.0
DISTRIBUTION	6.	0.	0.	6. (1976)	-100.0	0.0	0.0	-100.0
OTHER	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TOTAL GAS	6.	0.	1.	6. (1976)	-100.0	0.0	0.0	-100.0
COAL								
UNDERGROUND MINING	0.	0.	0.	0.	0.0	0.0	0.0	0.0
SURFACE MINING	0.	0.	0.	0.	0.0	0.0	0.0	0.0
RAIL	0.	7.	3.	7. (1996)	0.0	9999.0	4.7	9999.0
PIPELINES	0.	0.	0.	0.	0.0	0.0	0.0	0.0
BARGES, TRUCKS	0.	0.	0.	4. (1990)	0.0	14.9	7.6	7.8
TOTAL COAL	0.	8.	3.	8. (1990)	0.0	130.7	4.8	22.6
COAL SYNTHETICS								
LIQUEFACTION	0.	0.	0.	0.	0.0	0.0	0.0	0.0
METHANOL	0.	0.	0.	0.	0.0	0.0	0.0	0.0
SOLVENT REFINING	0.	0.	0.	0.	0.0	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.0	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TOTAL SYNTHETICS	0.	0.	0.	0.	0.0	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	0.	11.	4.	11. (1991)	0.0	9999.0	8.0	9999.0
SOLAR	0.	0.	0.	0.	0.0	0.0	0.0	0.0
ELECTRIC UTILITIES								
COAL-FIRED	0.	0.	0.	0.	0.0	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.0	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.0	0.0	0.0	0.0
NUCLEAR	0.	491.	292.	491. (2000)	9999.0	38.3	7.0	9999.0
HYDRO & PUMPED STORAGE	0.	69.	40.	69. (2000)	0.0	9999.0	4.0	9999.0
OIL & GAS	77.	0.	16.	107. (1977)	-21.0	-27.3	-100.0	-100.0
GEOTHERMAL	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TOTAL GENERATION	77.	560.	348.	560. (2000)	-4.1	27.9	6.3	8.6
TRANSMISSION	0.	0.	26.	127. (1993)	0.0	9999.0	-100.0	0.0
DISTRIBUTION	12.	58.	41.	58. (1999)	20.1	6.7	3.5	6.8
TOTAL UTILITIES	89.	618.	415.	695. (1993)	0.3	26.5	5.1	8.4
TOTAL ENERGY INDUSTRY	193.	805.	568.	829. (1993)	9.0	9.9	4.2	6.1

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BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 33 (Continue

GROWTH IN REQUIREMENTS FOR CONSTRUCTOR COST TOTAL ## (MILLION EPOUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
For The Egypt - Maximum Gas Use CASE

RESOURCES	1976	1977	1978	1979	1980	1981	1982
OIL							
EXPLORATION, DEVELOPMENT, & PRODUCTION	82.	85.	87.	88.	84.	82.	81.
REFINING AND PROCESSING	0.	0.	22.	65.	87.	44.	22.
PIPELINES	2.	9.	0.	0.	0.	4.	21.
TANKERS, BARGES, TRUCKS	14.	18.	14.	14.	11.	15.	16.
BULK STATIONS	0.	2.	4.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL OIL	98.	114.	127.	167.	182.	144.	130.
OIL SHALE	0.	0.	0.	0.	0.	0.	0.
GAS							
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	1.	3.	0.	0.	1.	3.
GEOPRESSURED METHANE	0.	0.	0.	0.	0.	0.	0.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
LNG TANKERS	0.	0.	0.	0.	0.	0.	0.
DISTRIBUTION	6.	0.	0.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL GAS	6.	1.	3.	0.	0.	1.	3.
COAL							
UNDERGROUND MINING	0.	0.	0.	0.	0.	0.	0.
SURFACE MINING	0.	0.	0.	0.	0.	0.	0.
RAIL	0.	0.	4.	0.	0.	0.	4.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
BARGES, TRUCKS	0.	0.	0.	0.	0.	0.	0.
TOTAL COAL	0.	0.	4.	0.	0.	0.	4.
COAL SYNTHETICS							
LIQUEFACTION	0.	0.	0.	0.	0.	0.	0.
METHANOL	0.	0.	0.	0.	0.	0.	0.
SOLVENT REFINING	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.	0.	0.
TOTAL SYNTHETICS	0.	0.	0.	0.	0.	0.	0.
NUCLEAR FUEL CYCLE	0.	0.	0.	0.	0.	0.	0.
SOLAR	0.	0.	0.	0.	0.	0.	0.
ELECTRIC UTILITIES							
COAL-FIRED	0.	0.	0.	0.	0.	0.	0.
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.	0.	0.
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.	0.	0.
NUCLEAR	0.	3.	5.	11.	35.	60.	112.
HYDRO & PUMPED STORAGE	0.	0.	0.	0.	0.	0.	0.
OIL & GAS	77.	107.	105.	55.	30.	24.	39.
GEOTHERMAL	0.	0.	0.	0.	0.	0.	0.
TOTAL GENERATION	77.	110.	110.	66.	65.	84.	151.
TRANSMISSION	0.	0.	23.	35.	0.	62.	92.
DISTRIBUTION	12.	16.	22.	23.	25.	28.	33.
TOTAL UTILITIES	89.	126.	155.	124.	90.	173.	277.
TOTAL ENERGY INDUSTRY	193.	241.	289.	291.	272.	319.	423.

CONSTRUCTOR COST TOTAL DOES NOT INCLUDE OWNER'S COSTS.

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BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 33 (Continued)

GROWTH IN REQUIREMENTS FOR CONSTRUCTOR COST TOTAL ## (MILLION POUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
For The Egypt - Maximum Gas Use CASE

RESOURCES	1983	1984	1985	1986	1987	1988	1989
OIL							
EXPLORATION, DEVELOPMENT, & PRODUCTION	79.	75.	69.	63.	69.	63.	67.
REFINING AND PROCESSING	65.	87.	44.	22.	65.	87.	44.
PIPELINES	0.	2.	9.	0.	2.	9.	0.
TANKERS, BARGES, TRUCKS	14.	18.	15.	18.	15.	15.	19.
BULK STATIONS	2.	4.	0.	0.	0.	2.	4.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL OIL	160.	186.	136.	103.	151.	177.	134.
OIL SHALE	0.	0.	0.	0.	0.	0.	0.
GAS							
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	0.	0.	1.	3.	0.	0.
GEOPRESSURED METHANE	0.	0.	0.	0.	0.	0.	0.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
LNG TANKERS	0.	0.	0.	0.	0.	0.	0.
DISTRIBUTION	0.	0.	0.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL GAS	0.	0.	0.	1.	3.	0.	0.
COAL							
UNDERGROUND MINING	0.	0.	0.	0.	0.	0.	0.
SURFACE MINING	0.	0.	0.	0.	0.	0.	0.
RAIL	0.	0.	4.	0.	4.	0.	4.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
BARGES, TRUCKS	0.	0.	0.	0.	0.	0.	0.
TOTAL COAL	0.	0.	4.	0.	4.	0.	4.
COAL SYNTHETICS							
LIQUEFACTION	0.	0.	0.	0.	0.	0.	0.
METHANOL	0.	0.	0.	0.	0.	0.	0.
SOLVENT REFINING	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.	0.	0.
TOTAL SYNTHETICS	0.	0.	0.	0.	0.	0.	0.
NUCLEAR FUEL CYCLE	0.	5.	3.	4.	6.	5.	3.
SOLAR	0.	0.	0.	0.	0.	0.	0.
ELECTRIC UTILITIES							
COAL-FIRED	0.	0.	0.	0.	0.	0.	0.
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.	0.	0.
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.	0.	0.
NUCLEAR	127.	151.	178.	224.	268.	290.	298.
HYDRO & PUMPED STORAGE	0.	8.	38.	56.	54.	41.	50.
OIL & GAS	36.	15.	6.	18.	21.	15.	0.
GEOTHERMAL	0.	0.	0.	0.	0.	0.	0.
TOTAL GENERATION	164.	175.	222.	299.	343.	346.	348.
TRANSMISSION	0.	23.	35.	0.	0.	23.	35.
DISTRIBUTION	35.	33.	35.	35.	39.	41.	43.
TOTAL UTILITIES	199.	231.	292.	334.	381.	410.	425.
TOTAL ENERGY INDUSTRY	359.	421.	436.	442.	545.	591.	567.

CONSTRUCTOR COST TOTAL DOES NOT INCLUDE OWNER'S COSTS.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 33 (Continued)

GROWTH IN REQUIREMENTS FOR
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
For The Egypt - Maximum Gas Use

(MILLION POUNDS, JANUARY 1978)
CASE

RESOURCES	1990	1991	1992	1993	1994	1995	1996
OIL							
EXPLORATION, DEVELOPMENT, & PRODUCTION	65.	67.	65.	67.	68.	71.	70.
REFINING AND PROCESSING	22.	65.	87.	44.	22.	65.	87.
PIPELINES	0.	2.	9.	0.	0.	0.	0.
TANKERS, BARGES, TRUCKS	16.	15.	15.	15.	14.	14.	13.
BULK STATIONS	0.	0.	0.	0.	2.	4.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL OIL	102.	150.	177.	126.	106.	154.	170.
OIL SHALE	0.	0.	0.	0.	0.	0.	0.
GAS							
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	1.	3.	0.	0.	0.	1.
GEOPRESSURED METHANE	0.	0.	0.	0.	0.	0.	0.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
LNG TANKERS	0.	0.	0.	0.	0.	0.	0.
DISTRIBUTION	0.	0.	0.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL GAS	0.	1.	3.	0.	0.	0.	1.
COAL							
UNDERGROUND MINING	0.	0.	0.	0.	0.	0.	0.
SURFACE MINING	0.	0.	0.	0.	0.	0.	0.
RAIL	4.	4.	0.	4.	4.	4.	7.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
BARGES, TRUCKS	4.	0.	0.	0.	0.	0.	0.
TOTAL COAL	8.	4.	0.	4.	4.	4.	8.
COAL SYNTHETICS							
LIQUEFACTION	0.	0.	0.	0.	0.	0.	0.
METHANOL	0.	0.	0.	0.	0.	0.	0.
SOLVENT REFINING	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.	0.	0.
TOTAL SYNTHETICS	0.	0.	0.	0.	0.	0.	0.
NUCLEAR FUEL CYCLE	4.	11.	3.	4.	11.	3.	4.
SOLAR	0.	0.	0.	0.	0.	0.	0.
ELECTRIC UTILITIES							
COAL-FIRED	0.	0.	0.	0.	0.	0.	0.
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.	0.	0.
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.	0.	0.
NUCLEAR	347.	408.	440.	463.	463.	463.	463.
HYDRO & PUMPED STORAGE	50.	59.	66.	59.	66.	59.	66.
OIL & GAS	0.	0.	0.	0.	0.	0.	0.
GEOTHERMAL	0.	0.	0.	0.	0.	0.	0.
TOTAL GENERATION	397.	467.	506.	523.	529.	523.	529.
TRANSMISSION	0.	0.	85.	127.	0.	0.	23.
DISTRIBUTION	44.	43.	44.	45.	48.	51.	52.
TOTAL UTILITIES	441.	510.	635.	695.	577.	574.	605.
TOTAL ENERGY INDUSTRY	555.	676.	818.	829.	698.	734.	787.

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CONSTRUCTOR COST TOTAL DOES NOT INCLUDE OWNER'S COSTS.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 33 (Continued)

GROWTH IN REQUIREMENTS FOR CONSTRUCTOR COST TOTAL ## (MILLION POUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
For The Egypt - Maximum Gas Use CASE

RESOURCES	1997	1998	1999	2000	TOTAL 1978-2000
OIL					
EXPLORATION, DEVELOPMENT, & PRODUCTION	69.	75.	73.	73.	1666.
REFINING AND PROCESSING	44.	22.	65.	87.	1265.
PIPELINES	2.	9.	0.	0.	69.
TANKERS, BARGES, TRUCKS	12.	11.	10.	9.	328.
BULK STATIONS	0.	0.	0.	0.	21.
OTHER	0.	0.	0.	0.	0.
TOTAL OIL	126.	117.	148.	168.	3349.
OIL SHALE	0.	0.	0.	0.	0.
GAS					
EXPLORATION, DEVELOPMENT, & PRODUCTION	3.	0.	0.	0.	20.
GEOPRESSURED METHANE	0.	0.	0.	0.	0.
PIPELINES	0.	0.	0.	0.	0.
LNG TANKERS	0.	0.	0.	0.	0.
DISTRIBUTION	0.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.
TOTAL GAS	3.	0.	0.	0.	20.
COAL					
UNDERGROUND MINING	0.	0.	0.	0.	0.
SURFACE MINING	0.	0.	0.	0.	0.
RAIL	4.	4.	4.	7.	63.
PIPELINES	0.	0.	0.	0.	0.
BARGES, TRUCKS	0.	0.	0.	0.	8.
TOTAL COAL	4.	4.	4.	8.	71.
COAL SYNTHETICS					
LIQUEFACTION	0.	0.	0.	0.	0.
METHANOL	0.	0.	0.	0.	0.
SOLVENT REFINING	0.	0.	0.	0.	0.
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.
TOTAL SYNTHETICS	0.	0.	0.	0.	0.
NUCLEAR FUEL CYCLE	11.	3.	4.	11.	94.
SOLAR	0.	0.	0.	0.	0.
ELECTRIC UTILITIES					
COAL-FIRED	0.	0.	0.	0.	0.
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.
NUCLEAR	463.	468.	477.	491.	6707.
HYDRO & PUMPED STORAGE	59.	66.	59.	69.	926.
OIL & GAS	0.	0.	0.	0.	365.
GEOTHERMAL	0.	0.	0.	0.	0.
TOTAL GENERATION	523.	534.	537.	560.	7998.
TRANSMISSION	35.	0.	0.	0.	600.
DISTRIBUTION	54.	55.	58.	58.	944.
TOTAL UTILITIES	612.	588.	595.	618.	9541.
TOTAL ENERGY INDUSTRY	756.	713.	750.	805.	13075.

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CONSTRUCTOR COST TOTAL DOES NOT INCLUDE OWNER'S COSTS.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 33 (Continued)

GROWTH IN CAPITAL REQUIREMENTS* (MILLION POUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
Egypt - Maximum Gas Use

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
NON-MANUAL TECHNICAL MANPOWER	11.	80.	53.	80.	(2000)	18.1	12.3	4.8	8.5
NON-MANUAL NON-TECHNICAL MANPOWER	1.	16.	10.	16.	(2000)	18.4	20.0	6.0	10.8
MANUAL MANPOWER	16.	88.	60.	90.	(1993)	14.7	11.1	4.4	7.5
MANPOWER TOTAL	28.	184.	124.	184.	(2000)	16.3	12.2	4.7	8.1
WOOD PRODUCTS (20)	2.	11.	8.	11.	(2000)	16.6	9.0	4.5	7.4
CHEMICALS & ALLIED PROD. (27,28,30,32)	3.	3.	3.	4.	(1998)	-3.3	10.9	-2.0	0.4
PETROLEUM PRODUCTS (31)	4.	8.	5.	8.	(2000)	-4.9	7.3	3.1	2.6
GLASS, CLAY & STONE PRODUCTS (35,36)	3.	19.	14.	24.	(1993)	12.3	13.4	4.3	7.5
PRIMARY IRON & STEEL PRODUCTS (37)	16.	21.	18.	21.	(1992)	5.2	-3.2	1.4	1.0
PRIMARY NON-FERROUS METALS (38)	2.	13.	13.	36.	(1993)	17.7	26.8	0.1	8.0
FABRICATED STRUCTURAL PRODUCTS (40) *	5.	43.	34.	67.	(1993)	12.7	29.5	2.2	9.1
OTHER FABRICATED PRODUCTS (42)	4.	20.	13.	20.	(2000)	16.3	3.2	5.1	6.4
MATERIALS TOTAL	40.	137.	108.	179.	(1993)	8.3	11.4	2.5	5.3
HVAC HEATING & COOLING UNITS (52) ++	0.	6.	3.	6.	(2000)	51.8	25.9	6.6	17.0
HVAC DUCTWORK & ACCESSORIES (40) *	0.	2.	1.	2.	(2000)	36.9	31.3	6.8	16.2
TURBINES (43)	19.	65.	44.	65.	(2000)	-1.7	11.9	5.0	5.3
GAS WELDING SETS (47) ++	0.	0.	0.	0.	(1980)	9.8	-7.6	1.9	1.1
ELECTRIC WELDING SETS (53) **	0.	1.	1.	1.	(2000)	14.9	9.0	5.3	7.6
CONSTRUCTION, MINING & OIL FIELD EOP (45)	34.	56.	47.	60.	(1993)	0.8	5.6	1.2	2.1
MATERIALS HANDLING EQUIPMENT (46)	0.	3.	2.	3.	(2000)	4.9	20.6	5.4	8.3
GENERAL INDUSTRY EQUIPMENT (49)	3.	14.	10.	14.	(2000)	40.4	-7.3	4.3	6.9
INSTRUMENTATION & CONTROLS (62)	2.	10.	7.	10.	(2000)	32.5	1.1	3.7	7.5
ELECTRICAL EQUIPMENT (53) **	4.	29.	20.	31.	(1993)	21.5	10.2	4.8	8.6
FABRICATED PLATE PRODUCTS (40) *	14.	96.	60.	96.	(2000)	18.9	6.1	6.3	8.2
EQUIPMENT TOTAL	77.	282.	196.	282.	(2000)	9.0	6.4	4.4	5.6
MISCELLANEOUS MATERIALS & EQUIPMENT	8.	12.	10.	12.	(2000)	6.8	-3.5	1.9	1.6
MOBILE FACILITY	14.	16.	17.	23.	(1990)	-7.0	11.7	-0.9	0.6
OTHER CONSTRUCTOR COSTS	26.	175.	114.	180.	(1993)	8.3	16.1	5.9	8.3
CONSTRUCTOR COST TOTAL **	193.	805.	568.	829.	(1993)	9.0	9.9	4.2	6.1

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

#BEA (BUREAU OF ECONOMIC ANALYSIS) TWO-DIGIT CATEGORIES ARE IN PARENTHESIS.

* PARTIAL BEA CATEGORY 40. TOTAL IS SUM OF 3 SEPARATE ENTRIES FOR CATEGORY 40.

++ PARTIAL BEA CATEGORY 52. REMAINDER IS PART OF MISCELLANEOUS ENTRY.

** PARTIAL BEA CATEGORY 53. TOTAL IS SUM OF 2 SEPARATE ENTRIES FOR CATEGORY 53.

** CONSTRUCTION CAPITAL COST TOTAL INCLUDES MANPOWER, MATERIALS AND EQUIPMENT SUBTOTALS ABOVE PLUS OTHER (OVERHEAD, PROFIT, ETC.) COSTS. IT EXCLUDES OWNER'S COSTS. (LAND COSTS, INTEREST DURING CONSTRUCTION, ETC.)

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 33 (Continued)

GROWTH IN MANPOWER REQUIREMENTS (MAN-YEARS)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
Egypt - Maximum Gas Use

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
CHEMICAL ENGINEERS	0.	18.	22.	39.	(1987)	9999.0	-24.2	10.1	9999.0
CIVIL ENGINEERS	110.	770.	490.	770.	(2000)	4.2	22.2	5.3	8.4
ELECTRICAL ENGINEERS	101.	605.	432.	717.	(1992)	7.4	18.4	4.5	7.7
MECHANICAL ENGINEERS	66.	453.	306.	470.	(1999)	13.4	11.0	6.2	8.4
MINING ENGINEERS	0.	4.	2.	4.	(1991)	0.0	9999.0	1.9	9999.0
NUCLEAR ENGINEERS	0.	50.	31.	50.	(2000)	9999.0	31.0	7.4	9999.0
GEOLOGICAL ENGINEERS	29.	41.	34.	41.	(2000)	0.6	2.6	1.2	1.4
PETROLEUM ENGINEERS	29.	25.	26.	32.	(1978)	0.6	-4.7	0.4	-0.7
OTHER ENGINEERS	1.	12.	14.	24.	(1991)	71.2	-4.5	4.0	11.0
ENGINEERS TOTAL	336.	1985.	1358.	1985.	(2000)	8.3	15.2	5.1	7.7
DESIGNERS & DRAFTSMEN	131.	778.	561.	813.	(1999)	12.7	11.7	5.2	7.7
SUPERVISORS & MANAGERS	75.	435.	278.	435.	(2000)	3.3	19.4	5.1	7.6
NON-MANUAL, TECHNICAL TOTAL	542.	3197.	2197.	3197.	(2000)	8.8	14.8	5.1	7.7
NON-MANUAL, NON-TECHNICAL	383.	2907.	1823.	2907.	(2000)	8.3	18.1	6.0	8.8
NON-MANUAL TOTAL	925.	6104.	4020.	6104.	(2000)	8.6	16.2	5.5	8.2
PIPEFITTERS	586.	3877.	2305.	3877.	(2000)	33.8	-4.9	6.7	8.2
PIPEFITTER/WELDERS	311.	1646.	1014.	1646.	(2000)	23.3	-2.2	6.5	7.2
ELECTRICIANS	354.	3587.	2209.	3587.	(2000)	22.3	10.9	6.8	10.1
BOILERMAKERS	311.	481.	334.	593.	(1977)	1.1	-11.8	7.0	1.8
BOILERMAKER/WELDERS	104.	379.	242.	379.	(1996)	-8.7	18.0	5.7	5.6
IRON WORKERS	147.	1846.	1601.	4405.	(1993)	18.1	41.8	0.8	11.1
CARPENTERS	151.	2499.	1485.	2499.	(2000)	31.0	15.3	7.0	12.4
EQUIPMENT OPERATORS	481.	2395.	1548.	2395.	(2000)	13.2	9.2	4.6	6.9
LINEMEN	167.	1004.	1121.	3123.	(1993)	26.4	27.7	-2.4	7.8
TEAMSTERS & LABORERS	672.	4594.	2964.	4594.	(2000)	19.6	10.6	4.8	8.3
OTHER	971.	1737.	1390.	1737.	(2000)	4.1	-0.8	3.1	2.5
MANUAL TOTAL	4254.	24046.	16214.	25855.	(1993)	18.0	8.4	4.5	7.5
CONSTRUCTION MANPOWER TOTAL	5179.	30150.	20234.	31268.	(1993)	16.5	9.6	4.7	7.6

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A GROWTH RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 33 (Continued)

SCHEDULE OF MANPOWER RESOURCES (MAN-YEARS) FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES Egypt - Maximum Gas Use

RESOURCES	1976	1977	1978	1979	1980	1981	1982
CHEMICAL ENGINEERS	0.	0.	26.	38.	17.	4.	26.
CIVIL ENGINEERS	110.	139.	213.	194.	129.	241.	296.
ELECTRICAL ENGINEERS	101.	129.	246.	213.	135.	332.	342.
MECHANICAL ENGINEERS	66.	83.	166.	183.	109.	131.	212.
MINING ENGINEERS	0.	0.	0.	0.	0.	0.	0.
NUCLEAR ENGINEERS	0.	1.	2.	4.	5.	8.	11.
GEOLOGICAL ENGINEERS	29.	32.	32.	30.	30.	30.	30.
PETROLEUM ENGINEERS	29.	32.	32.	30.	30.	30.	30.
OTHER ENGINEERS	1.	2.	13.	19.	9.	4.	16.
ENGINEERS TOTAL	336.	418.	730.	712.	463.	780.	962.
DESIGNERS & DRAFTSMEN	131.	162.	341.	359.	211.	312.	431.
SUPERVISORS & MANAGERS	75.	89.	119.	121.	85.	118.	170.
NON-MANUAL, TECHNICAL TOTAL	542.	669.	1190.	1192.	759.	1210.	1563.
NON-MANUAL, NON-TECHNICAL	383.	489.	717.	739.	526.	818.	1159.
NON-MANUAL TOTAL	925.	1157.	1907.	1931.	1286.	2028.	2723.
PIPEFITTERS	586.	925.	902.	1473.	1879.	1000.	705.
PIPEFITTER/WELDERS	311.	466.	459.	606.	717.	430.	373.
ELECTRICIANS	354.	643.	654.	705.	792.	663.	955.
BOILERMAKERS	311.	593.	582.	452.	325.	150.	178.
BOILERMAKER/WELDERS	104.	198.	194.	128.	72.	39.	67.
IRON WORKERS	147.	295.	619.	1237.	285.	806.	2051.
CARPENTERS	151.	290.	278.	346.	445.	324.	391.
EQUIPMENT OPERATORS	481.	634.	655.	732.	789.	677.	815.
LINEMEN	167.	243.	620.	1265.	427.	918.	2101.
TEAMSTERS & LABORERS	672.	907.	969.	1402.	1374.	1170.	1615.
OTHER	971.	1159.	1218.	1144.	1140.	1069.	1191.
MANUAL TOTAL	4254.	6353.	7149.	9488.	8243.	7244.	10443.
CONSTRUCTION MANPOWER TOTAL	5179.	7510.	9056.	11420.	9529.	9272.	13166.

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 33 (Continued)

SCHEDULE OF MANPOWER RESOURCES (MAN-YEARS) FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES Egypt - Maximum Gas Use

RESOURCES	1983	1984	1985	1986	1987	1988	1989
CHEMICAL ENGINEERS	38.	17.	4.	26.	39.	17.	4.
CIVIL ENGINEERS	309.	361.	353.	407.	488.	511.	503.
ELECTRICAL ENGINEERS	275.	340.	313.	324.	382.	467.	437.
MECHANICAL ENGINEERS	250.	216.	184.	264.	339.	303.	273.
MINING ENGINEERS	0.	2.	3.	3.	2.	2.	3.
NUCLEAR ENGINEERS	16.	18.	20.	23.	28.	32.	35.
GEOLOGICAL ENGINEERS	29.	34.	34.	34.	35.	31.	34.
PETROLEUM ENGINEERS	28.	26.	23.	24.	25.	22.	23.
OTHER ENGINEERS	19.	11.	7.	15.	22.	12.	5.
ENGINEERS TOTAL	964.	1024.	941.	1120.	1360.	1399.	1318.
DESIGNERS & DRAFTSMEN	453.	430.	366.	483.	606.	568.	501.
SUPERVISORS & MANAGERS	188.	209.	207.	247.	305.	283.	273.
NON-MANUAL, TECHNICAL TOTAL	1606.	1663.	1513.	1849.	2271.	2250.	2092.
NON-MANUAL, NON-TECHNICAL	1192.	1206.	1209.	1433.	1736.	1852.	1878.
NON-MANUAL TOTAL	2798.	2869.	2723.	3282.	4007.	4101.	3970.
PIPEFITTERS	1789.	2402.	1462.	1122.	2254.	3041.	2166.
PIPEFITTER/WELDERS	756.	964.	641.	556.	962.	1257.	975.
ELECTRICIANS	1238.	1493.	1329.	1532.	2039.	2381.	2258.
BOILERMAKERS	349.	353.	173.	154.	356.	429.	258.
BOILERMAKER/WELDERS	105.	114.	165.	244.	302.	258.	255.
IRON WORKERS	549.	1008.	1637.	831.	1053.	1527.	2168.
CARPENTERS	722.	939.	906.	1095.	1436.	1635.	1566.
EQUIPMENT OPERATORS	911.	1153.	1223.	1368.	1685.	1640.	1593.
LINEMEN	594.	862.	1449.	577.	669.	954.	1599.
TEAMSTERS & LABORERS	1708.	2230.	2273.	2132.	2891.	3298.	3173.
OTHER	1225.	1260.	1093.	1100.	1330.	1360.	1326.
MANUAL TOTAL	9946.	12778.	12351.	10712.	14979.	17782.	17336.
CONSTRUCTION MANPOWER TOTAL	12744.	15647.	15074.	13994.	18986.	21883.	21306.

• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 33 (Continued)

SCHEDULE OF MANPOWER RESOURCES (MAN-YEARS) FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES Egypt - Maximum Gas Use

RESOURCES	1990	1991	1992	1993	1994	1995	1996
CHEMICAL ENGINEERS	26.	39.	17.	5.	27.	38.	17.
CIVIL ENGINEERS	521.	583.	726.	677.	644.	654.	673.
ELECTRICAL ENGINEERS	419.	457.	717.	641.	510.	526.	590.
MECHANICAL ENGINEERS	332.	396.	403.	365.	406.	431.	392.
MINING ENGINEERS	3.	4.	3.	3.	4.	3.	3.
NUCLEAR ENGINEERS	37.	40.	45.	47.	47.	47.	47.
GEOLOGICAL ENGINEERS	33.	37.	37.	34.	38.	36.	37.
PETROLEUM ENGINEERS	23.	25.	24.	23.	24.	24.	25.
OTHER ENGINEERS	15.	24.	13.	5.	17.	22.	11.
ENGINEERS TOTAL	1410.	1606.	1985.	1799.	1715.	1781.	1796.
DESIGNERS & DRAFTSMEN	583.	688.	789.	684.	698.	750.	712.
SUPERVISORS & MANAGERS	302.	351.	377.	345.	372.	375.	365.
NON-MANUAL, TECHNICAL TOTAL	2295.	2645.	3150.	2829.	2785.	2905.	2873.
NON-MANUAL, NON-TECHNICAL	1974.	2193.	2566.	2584.	2447.	2519.	2497.
NON-MANUAL TOTAL	4269.	4838.	5716.	5413.	5231.	5425.	5369.
PIPEFITTERS	1581.	2729.	3760.	2927.	2325.	3241.	3863.
PIPEFITTER/WELDERS	773.	1186.	1597.	1325.	1121.	1441.	1643.
ELECTRICIANS	2106.	2672.	3441.	3397.	3077.	3290.	3544.
BOILERMAKERS	176.	331.	465.	348.	263.	390.	479.
BOILERMAKER/WELDERS	224.	295.	373.	319.	345.	326.	379.
IRON WORKERS	1106.	1392.	2666.	4405.	1678.	1738.	2161.
CARPENTERS	1442.	1876.	2388.	2227.	2176.	2286.	2482.
EQUIPMENT OPERATORS	1503.	1918.	2137.	1906.	2056.	1974.	2254.
LINEMEN	761.	745.	1554.	3123.	837.	837.	1197.
TEAMSTERS & LABORERS	2643.	3478.	4485.	4338.	3723.	3983.	4545.
OTHER	1276.	1447.	1660.	1538.	1543.	1636.	1716.
MANUAL TOTAL	13591.	18068.	24525.	25855.	19144.	21142.	24265.
CONSTRUCTION MANPOWER TOTAL	17860.	22906.	30241.	31268.	24375.	26567.	29634.

• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 33 (Continued)

SCHEDULE OF MANPOWER RESOURCES (MAN-YEARS)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES

Egypt - Maximum Gas Use

RESOURCES	1997	1998	1999	2000	TOTAL 1978-2000
CHEMICAL ENGINEERS	5.	26.	39.	18.	515.
CIVIL ENGINEERS	636.	667.	721.	770.	11277.
ELECTRICAL ENGINEERS	554.	537.	582.	605.	9946.
MECHANICAL ENGINEERS	356.	410.	470.	453.	7042.
MINING ENGINEERS	4.	3.	3.	4.	47.
NUCLEAR ENGINEERS	47.	49.	53.	58.	716.
GEOLOGICAL ENGINEERS	39.	38.	37.	41.	789.
PETROLEUM ENGINEERS	26.	25.	25.	25.	594.
OTHER ENGINEERS	7.	17.	22.	12.	318.
ENGINEERS TOTAL	1674.	1772.	1951.	1985.	31245.
DESIGNERS & DRAFTSMEN	635.	717.	813.	778.	12904.
SUPERVISORS & MANAGERS	345.	383.	410.	435.	6386.
NON-MANUAL, TECHNICAL TOTAL	2655.	2872.	3174.	3197.	50533.
NON-MANUAL, NON-TECHNICAL	2430.	2550.	2787.	2907.	41918.
NON-MANUAL TOTAL	5085.	5422.	5961.	6104.	92451.
PIPEFITTERS	2953.	2325.	3244.	3877.	53020.
PIPEFITTER/WELDERS	1334.	1133.	1436.	1646.	23330.
ELECTRICIANS	3249.	3066.	3340.	3587.	50805.
BOILERMAKERS	350.	260.	392.	481.	7693.
BOILERMAKER/WELDERS	319.	345.	326.	379.	5576.
IRON WORKERS	2676.	1649.	1723.	1846.	36812.
CARPENTERS	2248.	2152.	2292.	2499.	34151.
EQUIPMENT OPERATORS	2132.	1999.	2100.	2395.	35615.
LINEMEN	1783.	912.	1004.	1004.	25793.
TEAMSTERS & LABORERS	4232.	3795.	4127.	4594.	68177.
OTHER	1680.	1600.	1670.	1737.	31959.
MANUAL TOTAL	22958.	19236.	21655.	24046.	372931.
CONSTRUCTION MANPOWER TOTAL	28042.	24659.	27616.	30150.	465382.

• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 33 (Continued)

GROWTH IN REQUIREMENTS FOR CONSTRUCTION MANPOWER TOTAL (MAN-YEARS/YEAR)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
For The Egypt - Maximum Gas Use Case

CATEGORY	ANNUAL REQUIREMENTS				AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
OIL								
EXPLORATION, DEVELOPMENT, & PRODUCTION	1602.	1375.	1403.	1686. (1978)	0.8	-4.4	0.3	-0.6
REFINING AND PROCESSING	0.	4770.	2663.	4770. (1980)	9999.0	-17.2	6.5	9999.0
PIPELINES	76.	0.	83.	547. (1982)	-100.0	9999.0	-100.0	-100.0
TANKERS, BARGES, TRUCKS	0.	0.	0.	0.	0.0	0.0	0.0	0.0
BULK STATIONS	0.	0.	26.	96. (1978)	0.0	0.0	0.0	0.0
OTHER	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TOTAL OIL	1677.	6145.	4175.	6423. (1980)	39.9	-12.0	4.0	5.6
OIL SHALE	0.	0.	0.	0.	0.0	0.0	0.0	0.0
GAS								
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	0.	26.	88. (1978)	0.0	0.0	0.0	0.0
GEOPRESSURED METHANE	0.	0.	0.	0.	0.0	0.0	0.0	0.0
PIPELINES	0.	0.	0.	0.	0.0	0.0	0.0	0.0
LNG TANKERS	0.	0.	0.	0.	0.0	0.0	0.0	0.0
DISTRIBUTION	256.	0.	0.	256. (1976)	-100.0	0.0	0.0	-100.0
OTHER	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TOTAL GAS	256.	0.	26.	256. (1976)	-100.0	0.0	0.0	-100.0
COAL								
UNDERGROUND MINING	0.	0.	0.	0.	0.0	0.0	0.0	0.0
SURFACE MINING	0.	0.	0.	0.	0.0	0.0	0.0	0.0
RAIL	0.	0.	0.	0.	0.0	0.0	0.0	0.0
PIPELINES	0.	0.	0.	0.	0.0	0.0	0.0	0.0
BARGES, TRUCKS	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TOTAL COAL	0.	0.	0.	0.	0.0	0.0	0.0	0.0
COAL SYNTHETICS								
LIQUEFACTION	0.	0.	0.	0.	0.0	0.0	0.0	0.0
METHANOL	0.	0.	0.	0.	0.0	0.0	0.0	0.0
SOLVENT REFINING	0.	0.	0.	0.	0.0	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.0	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TOTAL SYNTHETICS	0.	0.	0.	0.	0.0	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	0.	560.	229.	560. (1991)	0.0	9999.0	8.8	9999.0
SOLAR	0.	0.	0.	0.	0.0	0.0	0.0	0.0
ELECTRIC UTILITIES								
COAL-FIRED	0.	0.	0.	0.	0.0	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.0	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.0	0.0	0.0	0.0
NUCLEAR	0.	17448.	10162.	17448. (2000)	9999.0	44.7	7.6	9999.0
HYDRO & PUMPED STORAGE	0.	2672.	1516.	2672. (2000)	0.0	9999.0	4.5	9999.0
OIL & GAS	2654.	0.	558.	4628. (1977)	-26.6	-42.3	-100.0	-100.0
GEOTHERMAL	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TOTAL GENERATION	2654.	20120.	12235.	20120. (2000)	-10.7	33.8	7.0	8.8
TRANSMISSION	0.	0.	1250.	6575. (1993)	0.0	9999.0	-100.0	0.0
DISTRIBUTION	591.	3324.	2320.	3324. (1999)	24.4	6.8	3.5	7.5
TOTAL UTILITIES	3245.	23444.	15805.	27816. (1993)	-1.1	30.0	4.8	8.6
TOTAL ENERGY INDUSTRY	5179.	30150.	20234.	31268. (1993)	16.5	9.6	4.7	7.4

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 33 (Continued)

GROWTH IN SELECTED MATERIALS AND EQUIPMENT ITEMS REQUIRED
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
Egypt - Maximum Gas Use

CATEGORY		ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
		1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
CEMENT	(TONNES)	17386.	91956.	61142.	91956.	(2000)	7.2	13.8	5.1	7.2
CONCRETE (INCLUDES CEMENT)	(TONNES)	91408.	817205.	519223.	817205.	(2000)	11.7	20.5	5.6	9.6
BENTONITE (IN DRILLING MUD)	(TONNES)	2719.	2300.	2399.	2971.	(1978)	0.9	-4.7	0.3	-0.7
BARITE (IN DRILLING MUD)	(TONNES)	2636.	2277.	2339.	2893.	(1978)	0.8	-4.5	0.3	-0.6
CARBON STEEL	(TONNES)	34569.	99604.	78199.	121204.	(1993)	4.4	11.1	2.4	4.5
ALLOY STEEL	(TONNES)	2622.	9008.	6398.	9008.	(2000)	9.7	4.2	4.5	5.3
STAINLESS STEEL	(TONNES)	190.	2788.	1729.	2788.	(2000)	45.3	2.7	7.3	11.8
STEEL TOTAL	(TONNES)	37380.	111399.	86325.	132120.	(1993)	5.1	10.5	2.7	4.7
COPPER	(TONNES)	447.	3634.	2696.	5327.	(1993)	23.6	15.2	3.7	9.1
ALUMINUM	(TONNES)	627.	1548.	3005.	11914.	(1993)	6.4	37.3	-6.0	3.8
MANGANESE	(TONNES)	284.	843.	651.	955.	(1993)	5.9	9.8	2.7	4.6
CHROMIUM	(TONNES)	134.	748.	504.	748.	(2000)	21.0	3.1	5.5	7.4
NICKEL	(TONNES)	8.	111.	69.	111.	(2000)	41.3	5.1	6.7	11.5
CAST IRON	(TONNES)	459.	2644.	1731.	2644.	(2000)	26.2	2.4	4.8	7.6
STEEL CASTINGS	(TONNES)	348.	1598.	983.	1598.	(2000)	12.8	10.5	3.7	6.6
ALUMINUM CASTINGS	(TONNES)	29.	134.	89.	134.	(2000)	13.2	8.5	4.4	6.6
BRASS & BRONZE CASTINGS	(TONNES)	31.	205.	133.	205.	(2000)	30.5	-0.6	5.8	8.2
IRON & STEEL FORGINGS	(TONNES)	294.	1374.	877.	1374.	(2000)	9.5	13.8	3.6	6.6
STRUCTURAL STEEL SHAPES	(TONNES)	2325.	12587.	10886.	24683.	(1993)	13.2	24.7	0.6	7.3
STEEL PLATE < 3.8 CM THICK	(TONNES)	3313.	16926.	12333.	18660.	(1993)	15.6	11.2	3.5	7.0
STEEL PLATE > 3.8 CM THICK	(TONNES)	2.	2846.	1654.	2846.	(2000)	177.8	47.8	7.4	34.5
PIPE, CARBON STEEL	(TONNES)	6974.	9812.	8839.	16043.	(1982)	0.7	4.1	0.8	1.4
PIPE, ALLOY & STAINLESS STEEL	(TONNES)	107.	3974.	2409.	3974.	(2000)	44.2	26.3	6.8	16.3
OIL COUNTRY TUBULAR GOODS	(TONNES)	16166.	13901.	14426.	18061.	(1978)	0.8	-4.5	0.3	-0.6
REINFORCING BAR (REBAR)	(TONNES)	907.	15951.	9854.	15951.	(2000)	20.9	30.2	5.4	12.7
VALVES, CARBON STEEL	(TONNES)	156.	928.	647.	970.	(1995)	44.1	-11.5	6.4	7.7
VALVES, ALLOY & STAINLESS STEEL	(TONNES)	8.	367.	224.	367.	(2000)	83.2	8.9	7.1	17.5
STEAM TURBOGENERATORS	(MEGAWATTS)	389.	1260.	824.	1260.	(2000)	-8.7	12.7	6.5	5.0
STEAM TURBINES (EXCL TRBGENS)	(MEGAWATTS)	10.	25.	17.	25.	(2000)	3.4	-3.0	6.7	4.1
GAS TURBOGENERATORS	(MEGAWATTS)	71.	3.	34.	161.	(1982)	-22.3	-0.4	-12.6	-11.9
DRAGLINES	(CUBIC METERS)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
DRILL RIGS, ONSHORE	(RIG YEARS)	16.	15.	15.	18.	(1978)	1.0	-3.7	0.4	-0.4
DRILL RIGS, OFFSHORE	(RIG YEARS)	5.	5.	4.	5.	(1979)	0.0	-2.8	1.0	0.0
DRILL BITS	(NUMBER)	1358.	1198.	1237.	1494.	(1978)	0.7	-1.6	-0.5	-0.5
PUMPS & DRIVERS > 745 MW	(MEGAWATTS)	9.	102.	64.	102.	(2000)	22.6	14.5	6.5	10.7
PUMPS & DRIVERS < 745 MW	(MEGAWATTS)	20.	29.	25.	29.	(1979)	9.4	-7.8	2.7	1.5
AXIAL COMPRESSORS > 3727 MW	(MW)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
CENTRIF COMP & DRV > 7455 MW	(MW)	0.	19.	12.	19.	(1979)	9999.0	-24.2	9.7	9999.0
CENTRIF COMP & DRV < 7455 MW	(MW)	1.	4.	3.	4.	(1980)	48.1	-18.5	6.8	6.6
HEAT EXCHANGERS	(SQUARE METERS)	7704.	84631.	54552.	84631.	(2000)	63.2	-12.7	7.7	10.5
NON-NUC PRESS VESS < 3.8 CM WALL	(TONNES)	54.	2062.	1349.	2095.	(1984)	148.4	-23.3	9.2	16.3
NON-NUC PRESS VESS 3.8-10 CM W	(TONNES)	4.	4.	4.	4.	(1979)	0.0	-2.8	1.0	0.0
NON-NUC PRESS VESS > 10 CM WALL	(TONNES)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
BOILERS	(TONNES STEAM PER HOUR)	1130277.	313796.	387346.	1589417.	(1977)	-9.6	-29.8	6.1	-5.2
NUCLEAR STEAM SUPPLY SYSTEMS	(MEGAWATTS)	0.	1233.	741.	1233.	(2000)	9999.0	38.7	6.7	9999.0

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• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A GROWTH RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 33 (Continued)

GROWTH IN ANNUAL COSTS (MILLION POUNDS JANUARY 1978)
FOR THE OPERATION AND MAINTENANCE OF ENERGY-RELATED FACILITIES
Egypt - Maximum Gas Use

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1976-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
NON-MANUAL TECHNICAL MANPOWER	3.	18.	10.	18.	(2000)	9.9	7.0	7.3	7.6
NON-MANUAL NON-TECHNICAL MANPOWER	1.	4.	2.	4.	(2000)	12.6	5.7	7.3	7.8
MANUAL MANPOWER	9.	41.	25.	41.	(2000)	11.9	6.9	5.4	6.7
MANPOWER TOTAL	12.	63.	37.	63.	(2000)	11.4	6.8	6.0	7.0
WOOD PRODUCTS (20)	1.	5.	2.	5.	(2000)	5.2	10.9	7.8	8.0
CHEMICALS & ALLIED PROD. (27,28,30,32)	8.	33.	18.	33.	(2000)	-0.9	6.6	7.7	6.0
PETROLEUM PRODUCTS (31)	4.	15.	12.	15.	(1998)	16.9	6.1	2.2	5.3
GLASS, CLAY & STONE PRODUCTS (35,36)	1.	2.	1.	2.	(2000)	0.8	5.6	4.8	4.3
PRIMARY IRON & STEEL PRODUCTS (37)	1.	10.	4.	10.	(2000)	13.4	3.5	11.9	10.3
PRIMARY NON-FERROUS METALS (38)	0.	4.	2.	4.	(2000)	9.7	11.8	7.7	8.9
FABRICATED STRUCTURAL PRODUCTS (40) *	0.	3.	2.	3.	(2000)	15.4	5.8	6.6	7.9
OTHER FABRICATED PRODUCTS (42)	2.	9.	5.	9.	(2000)	7.8	8.2	6.4	7.0
MATERIALS TOTAL	17.	80.	46.	80.	(2000)	7.0	6.7	6.4	6.5
HVAC HEATING & COOLING UNITS (52) ++	0.	0.	0.	0.	(1977)	11.6	-0.7	-0.7	1.2
HVAC DUCTWORK & ACCESSORIES (40) *	0.	0.	0.	0.	(1977)	11.6	-0.7	-0.7	1.2
TURBINES (43)	0.	5.	2.	5.	(2000)	15.4	5.5	10.4	10.2
GAS WELDING SETS (47) ++	1.	9.	4.	9.	(2000)	1.1	3.9	13.2	9.1
ELECTRIC WELDING SETS (53) **	0.	0.	0.	0.		0.0	0.0	0.0	0.0
CONSTRUCTION, MINING & OIL FIELD EQP (45)	0.	2.	1.	2.	(2000)	17.0	7.4	12.5	12.1
MATERIALS HANDLING EQUIPMENT (46)	0.	1.	0.	1.	(2000)	28.1	15.1	9.2	13.3
GENERAL INDUSTRY EQUIPMENT (49)	4.	10.	6.	10.	(2000)	-2.3	4.7	6.3	4.5
INSTRUMENTATION & CONTROLS (62)	1.	4.	2.	4.	(2000)	3.8	3.9	6.7	5.6
ELECTRICAL EQUIPMENT (53) **	3.	15.	8.	15.	(2000)	8.1	8.4	7.1	7.6
FABRICATED PLATE PRODUCTS (40) *	0.	0.	0.	0.		0.0	0.0	0.0	0.0
EQUIPMENT TOTAL	8.	36.	19.	36.	(2000)	4.0	6.3	7.4	6.6
ELECTRICITY	5.	13.	9.	13.	(1998)	-3.4	6.4	5.6	4.2
NATURAL GAS	0.	1.	0.	1.	(1998)	22.4	10.6	22.8	20.1
WATER	2.	22.	9.	22.	(2000)	10.8	7.1	12.6	11.1
UTILITY TOTAL	7.	36.	18.	36.	(2000)	1.1	6.6	9.2	7.3
RENTS, ROYALTIES, ETC.	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TAXES	0.	0.	0.	0.		0.0	0.0	0.0	0.0
SERVICES & MISCELLANEOUS	10.	53.	29.	53.	(2000)	10.3	6.0	7.0	7.3
ANNUAL OPERATING COST (EX FUEL)	53.	259.	145.	259.	(2000)	7.7	6.6	6.7	6.8

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

#BEA (BUREAU OF ECONOMIC ANALYSIS) TWO-DIGIT CATEGORIES ARE IN PARENTHESIS.

* PARTIAL BEA CATEGORY 40. TOTAL IS SUM OF 3 SEPARATE ENTRIES FOR CATEGORY 40.

++ PARTIAL BEA CATEGORY 52. REMAINDER IS PART OF MISCELLANEOUS ENTRY.

** PARTIAL BEA CATEGORY 53. TOTAL IS SUM OF 2 SEPARATE ENTRIES FOR CATEGORY 53.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 33 (Continued)

GROWTH IN MANPOWER REQUIREMENTS (MAN-YEARS) FOR THE OPERATION AND MAINTENANCE OF ENERGY-RELATED FACILITIES Egypt - Maximum Gas Use

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
CHEMICAL ENGINEERS	30.	78.	51.	81.	(1998)	-4.5	6.7	5.7	4.1
CIVIL ENGINEERS	18.	92.	49.	92.	(2000)	5.2	7.4	7.5	7.1
ELECTRICAL ENGINEERS	34.	188.	110.	188.	(2000)	13.5	8.7	5.5	7.4
MECHANICAL ENGINEERS	33.	161.	90.	161.	(2000)	7.2	7.9	6.5	6.9
MINING ENGINEERS	0.	14.	5.	15.	(1998)	0.0	0.0	9999.0	9999.0
NUCLEAR ENGINEERS	0.	24.	7.	24.	(2000)	0.0	0.0	9999.0	9999.0
GEOLOGICAL ENGINEERS	0.	7.	2.	7.	(1998)	0.0	0.0	9999.0	9999.0
PETROLEUM ENGINEERS	0.	0.	0.	0.		0.0	0.0	0.0	0.0
OTHER ENGINEERS	31.	136.	85.	136.	(2000)	3.6	6.5	5.7	6.4
ENGINEERS TOTAL	144.	701.	399.	701.	(2000)	6.8	7.6	6.5	6.8
DESIGNERS & DRAFTSMEN	28.	139.	78.	139.	(2000)	6.0	8.2	6.7	6.9
SUPERVISORS & MANAGERS	383.	1470.	1017.	1470.	(2000)	12.3	6.6	3.8	5.8
OTHER TECHNICAL	75.	467.	234.	467.	(2000)	3.9	8.4	8.9	7.9
NON-MANUAL, TECHNICAL TOTAL	630.	2776.	1728.	2776.	(2000)	9.9	7.0	5.2	6.4
NON-MANUAL, NON-TECHNICAL	224.	1355.	736.	1355.	(2000)	12.6	5.7	7.3	7.8
NON-MANUAL TOTAL	854.	4131.	2464.	4131.	(2000)	10.6	6.7	5.8	6.8
PIPEFITTERS	182.	385.	308.	387.	(1999)	5.2	3.9	2.4	3.2
WELDERS	77.	274.	206.	274.	(1999)	14.5	6.5	2.8	5.4
ELECTRICIANS	222.	1080.	642.	1080.	(2000)	10.1	8.1	5.5	6.8
BOILERMAKERS	25.	66.	43.	68.	(1998)	-4.5	6.7	5.7	4.1
MECHANICS	767.	2946.	2111.	2946.	(2000)	13.9	6.3	3.5	5.8
MACHINISTS	195.	677.	511.	683.	(1998)	13.4	6.2	3.0	5.3
IRONWORKERS	14.	32.	21.	32.	(1999)	0.0	2.3	4.7	3.4
CARPENTERS	28.	58.	42.	60.	(1998)	-2.7	4.0	4.2	3.0
EQUIPMENT OPERATORS	88.	838.	411.	838.	(2000)	11.3	13.6	8.2	9.8
OTHER OPERATORS	858.	5068.	2557.	5068.	(2000)	4.2	7.5	8.7	7.7
METER READERS	281.	1733.	951.	1733.	(2000)	11.6	8.8	6.6	7.9
TEAMSTERS & LABORERS	1797.	6300.	4888.	6300.	(2000)	15.2	6.5	2.5	5.4
LINEMEN	61.	595.	295.	595.	(2000)	11.7	14.1	8.1	9.9
OTHER	482.	2772.	1534.	2772.	(2000)	11.7	6.8	6.7	7.6
MANUAL TOTAL	4990.	21986.	14108.	21986.	(2000)	11.9	6.9	4.8	6.4
MANPOWER TOTAL	5844.	26117.	16572.	26117.	(2000)	11.7	6.8	5.0	6.4

• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A GROWTH RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

CUMULATIVE CAPITAL REQUIREMENTS (MILLION EPCOUNDS, JAN 1978) OF THE ENERGY INDUSTRY
 BY FACILITY GROUPING
 Egypt - Maximum Gas Use/Imports

(1978-1985)

FACILITY	CONSTRUCTION COSTS	OWNER'S COSTS PRIOR TO STARTUP	TOTAL
OIL			
EXPLORATION, DEVELOPMENT, & PRODUCTION	581.0	89.4	670.3
REFINING AND PROCESSING	314.3	50.4	364.7
PIPELINES	29.2	5.0	34.2
TANKERS, BARGES, TRUCKS	107.3	18.8	126.0
BULK STATIONS	7.3	1.2	8.6
OTHER	0.0	0.0	0.0
TOTAL OIL	1039.1	164.7	1203.8
OIL SHALE	0.0	0.0	0.0
GAS			
EXPLORATION, DEVELOPMENT, & PRODUCTION	6.5	1.0	7.6
GEOPRESSURED METHANE	0.0	0.0	0.0
PIPELINES	0.0	0.0	0.0
LNG TANKERS	0.0	0.0	0.0
DISTRIBUTION	0.0	0.0	0.0
OTHER	0.0	0.0	0.0
TOTAL GAS	6.5	1.0	7.6
COAL			
UNDERGROUND MINING	0.0	0.0	0.0
SURFACE MINING	0.0	0.0	0.0
RAIL	3.8	0.6	4.4
PIPELINES	0.0	0.0	0.0
BARGES, TRUCKS	0.5	0.1	0.6
TOTAL COAL	4.3	0.7	5.0
COAL SYNTHETICS			
LIQUEFACTION	0.0	0.0	0.0
METHANOL	0.0	0.0	0.0
SOLVENT REFINING	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.0	0.0	0.0
TOTAL SYNTHETICS	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	5.4	0.8	6.2
SOLAR	0.0	0.0	0.0
ELECTRIC UTILITIES			
COAL-FIRED	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.0	0.0	0.0
NUCLEAR	575.6	64.8	640.4
HYDRO & PUMPED STORAGE	29.0	3.1	32.1
OIL & GAS	240.9	27.2	268.1
GEOTHERMAL	0.0	0.0	0.0
TOTAL GENERATION	845.6	95.1	940.6
TRANSMISSION	203.6	23.6	227.2
DISTRIBUTION	151.6	17.3	168.9
TOTAL UTILITIES	1200.8	136.0	1336.8
TOTAL ENERGY INDUSTRY	2256.1	303.3	2559.3

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 33 (Continued)

CUMULATIVE CAPITAL REQUIREMENTS (MILLION POUNDS, JAN 1978) OF THE ENERGY INDUSTRY

BY FACILITY GROUPING

(1978-2000)

Egypt - Maximum Gas Use/Imports

FACILITY	CONSTRUCTION COSTS	OWNER'S COSTS PRIOR TO STARTUP	TOTAL
OIL			
EXPLORATION, DEVELOPMENT, & PRODUCTION	1504.8	231.4	1736.3
REFINING AND PROCESSING	911.4	146.2	1057.6
PIPELINES	57.1	9.7	66.8
TANKERS, BARGES, TRUCKS	300.5	52.6	353.1
BULK STATIONS	16.1	2.7	18.9
OTHER	0.0	0.0	0.0
TOTAL OIL	2789.9	442.7	3232.6
OIL SHALE	0.0	0.0	0.0
GAS			
EXPLORATION, DEVELOPMENT, & PRODUCTION	18.1	2.8	20.9
GEOPRESSURED METHANE	0.0	0.0	0.0
PIPELINES	0.0	0.0	0.0
LNG TANKERS	0.0	0.0	0.0
DISTRIBUTION	0.0	0.0	0.0
OTHER	0.0	0.0	0.0
TOTAL GAS	18.1	2.8	20.9
COAL			
UNDERGROUND MINING	0.0	0.0	0.0
SURFACE MINING	0.0	0.0	0.0
RAIL	21.3	3.6	25.0
PIPELINES	0.0	0.0	0.0
BARGES, TRUCKS	7.4	1.3	8.7
TOTAL COAL	28.8	4.9	33.7
COAL SYNTHETICS			
LIQUEFACTION	0.0	0.0	0.0
METHANOL	0.0	0.0	0.0
SOLVENT REFINING	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.0	0.0	0.0
TOTAL SYNTHETICS	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	62.1	9.3	71.4
SOLAR	0.0	0.0	0.0
ELECTRIC UTILITIES			
COAL-FIRED	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.0	0.0	0.0
NUCLEAR	5687.8	640.4	6328.2
HYDRO & PUMPED STORAGE	456.6	47.9	504.5
OIL & GAS	286.2	32.3	318.5
GEOTHERMAL	0.0	0.0	0.0
TOTAL GENERATION	6430.5	720.7	7151.2
TRANSMISSION	449.9	52.2	502.1
DISTRIBUTION	612.8	69.9	682.7
TOTAL UTILITIES	7493.2	842.8	8335.9
TOTAL ENERGY INDUSTRY	10392.1	1302.4	11694.5

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 33 (Continued)

GROWTH IN CAPITAL REQUIREMENTS* (MILLION EPOUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
Egypt - Maximum Gas Use/Imports

CATEGORY	-----ANNUAL REQUIREMENTS-----					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
NON-MANUAL TECHNICAL MANPOWER	10.	75.	50.	75.	(2000)	17.5	13.3	4.9	8.7
NON-MANUAL NON-TECHNICAL MANPOWER	0.	9.	6.	9.	(2000)	25.1	26.9	6.6	13.5
MANUAL MANPOWER	8.	53.	35.	53.	(2000)	14.6	12.8	4.9	8.1
MANPOWER TOTAL	19.	137.	91.	137.	(2000)	16.5	13.6	5.0	8.6
WOOD PRODUCTS (20)	1.	5.	3.	5.	(2000)	10.0	15.2	6.1	8.6
CHEMICALS & ALLIED PROD. (27,28,30,32)	2.	3.	3.	4.	(1998)	-3.3	10.9	-2.0	0.4
PETROLEUM PRODUCTS (31)	2.	4.	3.	4.	(2000)	2.4	3.0	3.3	3.1
GLASS, CLAY & STONE PRODUCTS (35,36)	3.	15.	11.	19.	(1993)	6.1	19.6	4.4	7.7
PRIMARY IRON & STEEL PRODUCTS (37)	14.	17.	16.	19.	(1982)	4.7	-2.6	1.2	1.0
PRIMARY NON-FERROUS METALS (38)	2.	12.	12.	33.	(1993)	17.7	26.8	0.1	8.0
FABRICATED STRUCTURAL PRODUCTS (40) *	4.	38.	30.	61.	(1993)	13.4	30.5	2.2	9.4
OTHER FABRICATED PRODUCTS (42)	31.	119.	81.	119.	(2000)	8.7	5.6	5.0	5.7
MATERIALS TOTAL	31.	109.	88.	152.	(1993)	7.3	13.2	2.4	5.4
HVAC HEATING & COOLING UNITS (52) ++	0.	5.	3.	5.	(2000)	51.8	25.9	6.6	17.0
HVAC DUCTWORK & ACCESSORIES (40) *	0.	2.	1.	2.	(2000)	48.5	34.1	6.8	18.3
TURBINES (43)	17.	60.	41.	60.	(2000)	-1.7	11.9	5.0	5.3
GAS WELDING SETS (47) ++	0.	0.	0.	0.	(1980)	9.8	-7.6	1.9	1.1
ELECTRIC WELDING SETS (53) **	0.	1.	1.	1.	(2000)	14.9	9.0	5.3	7.6
CONSTRUCTION, MINING & OIL FIELD EQP (45)	29.	33.	31.	33.	(1982)	0.8	2.2	-0.1	0.6
MATERIALS HANDLING EQUIPMENT (46)	0.	2.	1.	2.	(2000)	4.9	20.6	5.4	8.3
GENERAL INDUSTRY EQUIPMENT (49)	3.	12.	8.	12.	(2000)	36.7	-6.6	4.3	6.6
INSTRUMENTATION & CONTROLS (62)	2.	9.	6.	9.	(2000)	32.5	1.1	3.7	7.5
ELECTRICAL EQUIPMENT (53) **	4.	25.	17.	27.	(1993)	18.8	11.0	4.7	8.3
FABRICATED PLATE PRODUCTS (40) *	13.	88.	55.	88.	(2000)	18.9	6.1	6.3	8.2
EQUIPMENT TOTAL	68.	237.	165.	237.	(2000)	8.7	5.7	4.3	5.3
MISCELLANEOUS MATERIALS & EQUIPMENT	8.	11.	9.	11.	(2000)	6.9	-3.6	1.9	1.6
MOBILE FACILITY	13.	10.	14.	19.	(1990)	-6.9	8.7	-2.2	-0.8
OTHER CONSTRUCTOR COSTS	19.	129.	85.	135.	(1993)	8.6	16.1	5.7	8.2
CONSTRUCTOR COST TOTAL **	157.	633.	452.	657.	(1993)	8.4	9.8	4.1	6.0

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

#BEA (BUREAU OF ECONOMIC ANALYSIS) TWO-DIGIT CATEGORIES ARE IN PARENTHESIS.

* PARTIAL BEA CATEGORY 40, TOTAL IS SUM OF 3 SEPARATE ENTRIES FOR CATEGORY 40.

++ PARTIAL BEA CATEGORY 52, REMAINDER IS PART OF MISCELLANEOUS ENTRY.

** PARTIAL BEA CATEGORY 53, TOTAL IS SUM OF 2 SEPARATE ENTRIES FOR CATEGORY 53.

** CONSTRUCTION CAPITAL COST TOTAL INCLUDES MANPOWER, MATERIALS AND EQUIPMENT SUBTOTALS ABOVE PLUS OTHER (OVERHEAD, PROFIT, ETC.) COSTS. IT EXCLUDES OWNER'S COSTS. (LAND COSTS, INTEREST DURING CONSTRUCTION, ETC.)

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 33 (Continued)

GROWTH IN MANPOWER REQUIREMENTS (MAN-YEARS)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
Egypt - Maximum Gas Use/Imports

CATEGORY	ANNUAL REQUIREMENTS				AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
CHEMICAL ENGINEERS	0.	7.	8.	15. (1987)	9999.0	-24.2	10.1	9999.0
CIVIL ENGINEERS	46.	615.	364.	615. (2000)	15.7	24.6	6.2	11.4
ELECTRICAL ENGINEERS	42.	487.	307.	487. (2000)	17.0	22.2	5.7	10.8
MECHANICAL ENGINEERS	31.	380.	232.	380. (2000)	20.4	17.2	6.6	11.0
MINING ENGINEERS	0.	1.	1.	1. (1991)	0.0	9999.0	1.9	9999.0
NUCLEAR ENGINEERS	0.	58.	31.	58. (2000)	9999.0	31.0	7.4	9999.0
GEOLOGICAL ENGINEERS	29.	31.	29.	32. (1978)	0.6	-1.8	0.8	0.2
PETROLEUM ENGINEERS	29.	25.	26.	32. (1978)	0.6	-4.7	0.4	-0.7
OTHER ENGINEERS	0.	4.	5.	9. (1991)	64.7	-3.6	3.7	10.3
ENGINEERS TOTAL	178.	1607.	1003.	1607. (2000)	14.1	17.8	5.9	9.6
DESIGNERS & DRAFTSMEN	65.	599.	385.	599. (2000)	17.1	15.8	5.9	9.7
SUPERVISORS & MANAGERS	44.	328.	200.	328. (2000)	8.7	18.3	5.7	8.7
NON-MANUAL, TECHNICAL TOTAL	286.	2533.	1588.	2533. (2000)	14.0	17.4	5.9	9.5
NON-MANUAL, NON-TECHNICAL	11.	456.	250.	456. (2000)	47.5	26.2	7.2	16.9
NON-MANUAL TOTAL	297.	2989.	1838.	2989. (2000)	15.8	18.3	6.0	10.1
PIPEFITTERS	100.	902.	543.	902. (2000)	31.4	2.3	6.9	9.6
PIPEFITTER/WELDERS	58.	405.	251.	405. (2000)	20.5	4.8	6.6	8.4
ELECTRICIANS	53.	908.	553.	908. (2000)	25.3	19.6	7.1	12.5
BOILERMAKERS	44.	108.	71.	108. (2000)	2.0	-4.6	7.3	3.8
BOILERMAKER/WELDERS	15.	74.	46.	74. (1996)	-7.0	22.1	6.2	6.9
IRON WORKERS	21.	480.	358.	845. (1993)	24.0	43.9	3.1	13.9
CARPENTERS	22.	632.	376.	632. (2000)	36.3	24.3	7.3	15.1
EQUIPMENT OPERATORS	107.	473.	314.	473. (2000)	9.9	8.8	4.7	6.4
LINEMEN	24.	143.	160.	445. (1993)	26.4	27.7	-2.4	7.8
TEAMSTERS & LABORERS	118.	1010.	642.	1010. (2000)	18.4	14.4	5.5	9.4
OTHER	259.	448.	364.	448. (2000)	3.0	-0.3	3.0	2.3
MANUAL TOTAL	821.	5583.	3679.	5829. (1993)	15.8	11.9	5.3	8.3
CONSTRUCTION MANPOWER TOTAL	1118.	8572.	5518.	8572. (2000)	15.8	13.8	5.5	8.9

• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A GROWTH RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 33 (Continued)

GROWTH IN ANNUAL COSTS (MILLION POUNDS JANUARY 1978)
FOR THE OPERATION AND MAINTENANCE OF ENERGY-RELATED FACILITIES
Egypt - Maximum Gas Use/Imports

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
NON-MANUAL TECHNICAL MANPOWER	0.	3.	1.	3.	(2000)	0.0	0.0	9999.0	9999.0
NON-MANUAL NON-TECHNICAL MANPOWER	0.	0.	0.	0.		0.0	0.0	0.0	0.0
MANUAL MANPOWER	0.	1.	0.	1.	(2000)	0.0	0.0	9999.0	9999.0
MANPOWER TOTAL	0.	4.	1.	4.	(2000)	0.0	0.0	9999.0	9999.0
WOOD PRODUCTS (20)	0.	0.	0.	0.	(2000)	0.0	0.0	9999.0	9999.0
CHEMICALS & ALLIED PROD. (27,28,30,32)	4.	19.	10.	19.	(2000)	0.7	6.5	7.8	6.3
PETROLEUM PRODUCTS (31)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
GLASS, CLAY & STONE PRODUCTS (35,36)	0.	0.	0.	0.	(2000)	12.4	14.0	8.0	10.0
PRIMARY IRON & STEEL PRODUCTS (37)	0.	8.	2.	8.	(2000)	10.9	0.9	25.1	17.3
PRIMARY NON-FERROUS METALS (38)	0.	1.	0.	1.	(2000)	7.0	6.2	6.0	6.2
FABRICATED STRUCTURAL PRODUCTS (40) *	0.	2.	1.	2.	(2000)	0.0	0.0	9999.0	9999.0
OTHER FABRICATED PRODUCTS (42)	1.	6.	3.	6.	(2000)	7.6	8.4	9.7	9.1
MATERIALS TOTAL	5.	36.	16.	36.	(2000)	2.3	6.6	10.4	8.2
HVAC HEATING & COOLING UNITS (52) ++	0.	0.	0.	0.	(1977)	11.6	-0.7	-0.7	1.2
HVAC DUCTWORK & ACCESSORIES (40) *	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TURBINES (43)	0.	4.	2.	4.	(2000)	15.4	5.5	10.4	10.2
GAS WELDING SETS (47) ++	0.	0.	0.	0.		0.0	0.0	0.0	0.0
ELECTRIC WELDING SETS (53) **	0.	0.	0.	0.		0.0	0.0	0.0	0.0
CONSTRUCTION, MINING & OIL FIELD EQP (45)	0.	0.	0.	0.	(2000)	17.0	7.3	6.4	8.3
MATERIALS HANDLING EQUIPMENT (46)	0.	0.	0.	0.	(2000)	28.1	15.1	9.2	13.3
GENERAL INDUSTRY EQUIPMENT (49)	1.	4.	2.	4.	(2000)	-0.8	2.5	6.7	4.6
INSTRUMENTATION & CONTROLS (62)	1.	4.	2.	4.	(2000)	3.8	3.9	6.7	5.6
ELECTRICAL EQUIPMENT (53) **	1.	8.	4.	8.	(2000)	6.1	7.6	8.3	7.7
FABRICATED PLATE PRODUCTS (40) *	0.	0.	0.	0.		0.0	0.0	0.0	0.0
EQUIPMENT TOTAL	4.	20.	10.	20.	(2000)	4.9	5.3	8.0	6.9
ELECTRICITY	0.	0.	0.	0.		0.0	0.0	0.0	0.0
NATURAL GAS	0.	0.	0.	0.		0.0	0.0	0.0	0.0
WATER	0.	0.	0.	0.		0.0	0.0	0.0	0.0
UTILITY TOTAL	0.	0.	0.	0.		0.0	0.0	0.0	0.0
RENTS, ROYALTIES, ETC.	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TAXES	0.	0.	0.	0.		0.0	0.0	0.0	0.0
SERVICES & MISCELLANEOUS	1.	7.	4.	7.	(2000)	10.3	6.0	7.2	7.5
ANNUAL OPERATING COST (EX FUEL)	11.	68.	32.	68.	(2000)	4.4	6.0	9.6	7.9

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A GROWTH RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

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* PARTIAL BEA CATEGORY 40. TOTAL IS SUM OF 3 SEPARATE ENTRIES FOR CATEGORY 40.

++ PARTIAL BEA CATEGORY 52. REMAINDER IS PART OF MISCELLANEOUS ENTRY.

* PARTIAL BEA CATEGORY 53. TOTAL IS SUM OF 2 SEPARATE ENTRIES FOR CATEGORY 53.

ELECTRIC GENERATING CAPACITY (MW)

Egypt - Improved

	1975	1982	1985	2000	AVERAGE ANNUAL GROWTH
COAL AND COAL/WASTE PLANTS	0.0	0.0	0.0	0.0	-----
OIL-STEAM PLANTS	1420.0	2904.0	2868.0	1617.0	0.52%
GAS-STEAM PLANTS	0.0	0.0	0.0	0.0	-----
LOW-BTU GAS-STEAM PLANTS	0.0	0.0	0.0	0.0	-----
GAS TURBINE PLANTS	137.0	437.0	437.0	0.0	-----
COMBINED CYCLE PLANTS	0.0	0.0	450.0	900.0	-----
FUEL CELLS	0.0	0.0	0.0	0.0	-----
NUCLEAR POWER PLANTS	0.0	0.0	0.0	11700.0	-----
CONVENTIONAL HYDRO PLANTS	2445.0	2445.0	2445.0	2603.0	0.25%
PUMPED STORAGE PLANTS	0.0	0.0	0.0	2550.0	-----
GEO THERMAL PLANTS	0.0	0.0	0.0	20.0	-----
TOTAL CAPACITY	4002.0	5786.0	6200.0	19390.0	6.52%

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 34 (Continued)

Schedule of Annual Energy Facilities Additions 10 Supply Fuel Mix: Egypt - Improved Efficiency 1976-2010

FACILITY NAME	1975	1976	1977	1978	1979	1980	1981	1982	TOTAL ADDED (1978- 1982)
	TOTALS								
1 ONSHORE PRIMARY OIL RECOVERY-(1,000 MBPD)	66.0	17*	17*	17*	18*	17	18	17	87
2 ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	0.0	0	0	0	0	0	0	0	0
3 ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	0.0	0	0	0	0	0	0	0	0
4 OFFSHORE OIL RECOVERY (12.5 MBPD)	11.2	3*	3*	3*	3*	4*	3	3	16
6 HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	0.0	0	0	0	0	0	0	0	0
7 LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	2.0	0	0	0	0	0	0	1	1
19 ONSHORE CONVENTIONAL GAS RECOVERY (100 MMCF/D)	0.4	1*	0	0	1*	0	0	0	1
20 ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	0.0	0	0	0	0	0	0	0	0
21 OFFSHORE GAS RECOVERY (25 MMCF/D)	-0.0	0	0	0	0	0	0	0	0
24 LNG EXPORT (3030 MMCF/D)	0.0	0	0	0	0	0	0	0	0
27 UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	0.0	0	0	0	0	0	0	0	0
37 SURFACE URANIUM MINE (275.4 M TONNES/Y)	0.0	0	0	0	0	0	0	0	0
38 UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	0.0	0	0	0	0	0	0	0	0
39 URANIUM MILL (275.4 M TONNES/Y)	0.0	0	0	0	0	0	0	0	0
42 LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	0.0	0	0	0	0	0	0	0	0
43 LWR FUEL FABRICATION - PU RECYCLE (150 MTH/Y)	0.0	0	0	0	0	0	0	0	0
49 HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	0.0	0	0	0	0	0	0	0	0
50 OIL-FIRED POWER PLANT (800 MWE)	0.0	0	0	0	0	0	0	0	0
51 OIL-FIRED POWER PLANT (600 MWE)	0.0	0	0	0	0	1*	1*	0	2
52 OIL-FIRED POWER PLANT (450 MWE)	3.2	0	0	0	1*	0	0	0	1
53 COAL FIRED POWER PLANT-LOW BTU (800 MWE)	0.0	0	0	0	0	0	0	0	0
54 COAL FIRED POWER PLANT-HIGH BTU (800 MWE)	0.0	0	0	0	0	0	0	0	0
55 COAL FIRED POWER PLANT-LOW BTU (600 MWE)	0.0	0	0	0	0	0	0	0	0
56 COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	0.0	0	0	0	0	0	0	0	0
59 HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	0.0	0	0	0	0	0	0	0	0
60 HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	0.0	0	0	0	0	0	0	0	0
61 COMBINED CYCLE POWER PLANT (400 MWE)	0.0	0	0	0	0	0	0	0	0
62 GAS TURBINE POWER PLANT (133 MWE)	1.0	0	1*	1*	0	0	0	0	1
63 FUEL CELLS (26 MWE)	0.0	0	0	0	0	0	0	0	0
64 LIGHT WATER REACTOR (LWR) (1200 MWE)	0.0	0	0	0	0	0	0	0	0
65 LIGHT WATER REACTOR (LWR) (900 MWE)	0.0	0	0	0	0	0	0	0	0
66 LIGHT WATER REACTOR (LWR) (600 MWE)	0.0	0	0	0	0	0	0	0	0
67 DAM & HYDROELECTRIC POWER PLANT (200 MWE)	12.2	0	0	0	0	0	0	0	0
68 PUMPED STORAGE (500 MWE)	0.0	0	0	0	0	0	0	0	0
69 GEOTHERMAL POWER COMPLEX (200 MWE)	0.0	0	0	0	0	0	0	0	0

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

Schedule of Annual Energy Facilities Addition 10 Supply Fuel Mix: Egypt - Improved Efficiency 1976-2010

FACILITY NAME	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	TOTAL ADDED (1978- 1993)
1 ONSHORE PRIMARY OIL RECOVERY-(1,000 MBPD)	17	16	16	14	13	14	13	13	14	13	14	244
2 ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	0	0	0	0	0	0	0	0	0	0	0	0
3 ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	0	0	0	0	0	0	0	0	0	0	0	0
4 OFFSHORE OIL RECOVERY (12.5 MBPD)	3	3	3	3	2	3	2	3	2	3	2	45
6 HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	0	0	0	0	0	0	0	0	0	0	0	0
7 LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	0	0	0	1	0	0	0	1	0	0	0	3
19 ONSHORE CONVENTIONAL GAS RECOVERY (100 MMCF/D)	1	0	0	0	0	1	0	0	0	0	1	4
20 ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0	0
21 OFFSHORE GAS RECOVERY (25 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0	0
24 LNG EXPORT (3030 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0	0
27 UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0	0
37 SURFACE URANIUM MINE (275.4 M TONNES/Y)	0	0	0	0	0	1	0	0	0	1	0	2
38 UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0	0
39 URANIUM MILL (275.4 M TONNES/Y)	0	0	0	0	0	1	0	0	0	1	0	2
42 LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	0	0	0	0	0	0	0	0	0	0	0	0
43 LWR FUEL FABRICATION - PU RECYCLE (150 MTU/Y)	0	0	0	0	0	0	0	0	0	0	0	0
49 HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	0	0	0	0	0	0	0	0	0	0	0	0
50 OIL-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
51 OIL-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	0	0	0	0	2
52 OIL-FIRED POWER PLANT (450 MWE)	0	0	0	0	0	0	0	0	0	0	0	1
53 COAL FIRED POWER PLANT-LOW BTU (800 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
54 COAL FIRED POWER PLANT-HIGH BTU (800 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
55 COAL FIRED POWER PLANT-LOW BTU (600 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
56 COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
59 HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
60 HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
61 COMBINED CYCLE POWER PLANT (400 MWE)	0	1	0	0	0	1	0	0	0	0	0	2
62 GAS TURBINE POWER PLANT (133 MWE)	0	0	0	0	0	0	0	0	0	0	0	1
63 FUEL CELLS (26 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
64 LIGHT WATER REACTOR (LWR) (1200 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
65 LIGHT WATER REACTOR (LWR) (900 MWE)	0	0	0	0	0	0	0	1	1	0	1	3
66 LIGHT WATER REACTOR (LWR) (600 MWE)	0	0	0	1	1	0	0	0	0	0	0	2
67 DAM & HYDROELECTRIC POWER PLANT (200 MWE)	0	0	0	0	0	1	0	0	0	0	0	1
68 PUMPED STORAGE (500 MWE)	0	0	0	0	0	0	0	1	0	1	0	2
69 GEOTHERMAL POWER COMPLEX (200 MWE)	0	0	0	0	0	0	0	0	0	0	0	0

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

Schedule of Annual Energy Facilities Additions 10 Supply Fuel Mix: Egypt - Improved Efficiency

FACILITY NAME	1994	1995	1996	1997	1998	1999	2000	TOTAL ADDED (1978- 2000)
1 ONSHORE PRIMARY OIL RECOVERY-(1,000 MBPD)	13	14	14	14	14	15	14	342
2 ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	0	0	0	0	0	0	0	0
3 ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	0	0	0	0	0	0	0	0
4 OFFSHORE OIL RECOVERY (12.5 MBPD)	3	2	3	3	2	3	3	64
6 HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	0	0	0	0	0	0	0	0
7 LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	1	0	0	0	1	0	0	5
19 ONSHORE CONVENTIONAL GAS RECOVERY (100 MMCF/D)	0	0	0	0	1	0	0	5
20 ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	0	0	0	0	0	0	0	0
21 OFFSHORE GAS RECOVERY (25 MMCF/D)	0	0	0	0	0	0	0	0
24 LNG EXPORT (3030 MMCF/D)	0	0	0	0	0	0	0	0
27 UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	0	0	0	0	0	0	0	0
37 SURFACE URANIUM MINE (275.4 M TONNES/Y)	0	1	0	0	1	0	0	4
38 UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	0	0	0	0	0	0	0	0
39 URANIUM MILL (275.4 M TONNES/Y)	0	1	0	0	1	0	0	4
42 LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	0	0	0	0	0	0	0	0
43 LWR FUEL FABRICATION - PU RECYCLE (150 MTU/Y)	0	0	0	0	0	0	0	0
49 HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	0	0	0	0	0	0	0	0
50 OIL-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0
51 OIL-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	2
52 OIL-FIRED POWER PLANT (450 MWE)	0	0	0	0	0	0	0	1
53 COAL FIRED POWER PLANT-LOW BTU (800 MWE)	0	0	0	0	0	0	0	0
54 COAL FIRED POWER PLANT-HIGH BTU (800 MWE)	0	0	0	0	0	0	0	0
55 COAL FIRED POWER PLANT-LOW BTU (600 MWE)	0	0	0	0	0	0	0	0
56 COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	0	0	0	0	0	0	0	0
59 HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0
60 HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	0
61 COMBINED CYCLE POWER PLANT (400 MWE)	0	0	0	0	0	0	0	2
62 GAS TURBINE POWER PLANT (133 MWE)	0	0	0	0	0	0	0	1
63 FUEL CELLS (26 MWE)	0	0	0	0	0	0	0	0
64 LIGHT WATER REACTOR (LWR) (1200 MWE)	0	0	1	1	1	1	1	5
65 LIGHT WATER REACTOR (LWR) (900 MWE)	1	1	0	0	0	0	0	5
66 LIGHT WATER REACTOR (LWR) (600 MWE)	0	0	0	0	0	0	0	2
67 DAM & HYDROELECTRIC POWER PLANT (200 MWE)	0	0	0	0	0	0	0	1
68 PUMPED STORAGE (500 MWE)	0	1	0	1	0	1	0	5
69 GEOTHERMAL POWER COMPLEX (200 MWE)	0	0	0	0	0	0	0	0

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 34 (Continued)

Schedule of Annual Transportat-on Additions to Supply Fuel Mix: Egypt - Improved Efficiency 1976-2010

FACILITY NAME	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL ADDED (1978- 2010)
1 ONSHORE PRIMARY OIL RECOVERY (1,000 MHPD)	14	14	14	14	14	14	14	14	14	14	482
2 ONSHORE SECONDARY OIL RECOVERY (.913 MHPD)	0	0	0	0	0	0	0	0	0	0	0
3 ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	0	0	0	0	0	0	0	0	0	0	0
4 OFFSHORE OIL RECOVERY (12.5 MBPD)	3	3	3	3	3	3	3	3	3	3	94
6 HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	0	0	0	0	0	0	0	0	0	0	0
7 LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	0	1	0	0	0	1	0	0	0	0	7
19 ONSHORE CONVENTIONAL GAS RECOVERY (100 MMCF/D)	0	0	0	0	0	1	0	0	0	0	6
20 ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0
21 OFFSHORE GAS RECOVERY (25 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0
24 LNG EXPORT (3030 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0
27 UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0
37 SURFACE URANIUM MINE (275.4 M TONNES/Y)	1	0	0	1	0	0	1	0	0	1	8
38 UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0
39 URANIUM MILL (275.4 M TONNES/Y)	1	0	0	1	0	0	1	0	0	1	8
42 LWR FUEL FABRICATION-NO PU RECYCLE (600MTU/Y)	0	0	0	0	0	0	0	0	0	0	0
43 LWR FUEL FABRICATION - PU RECYCLE (150 MTH/Y)	0	0	0	0	0	0	0	0	0	0	0
49 HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	0	0	0	0	0	0	0	0	0	0	0
50 OIL-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0	0	0	0
51 OIL-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	0	0	0	2
52 OIL-FIRED POWER PLANT (450 MWE)	0	0	0	0	0	0	0	0	0	0	1
53 COAL FIRED POWER PLANT-LOW BTU (800 MWE)	0	0	0	0	0	0	0	0	0	0	0
54 COAL FIRED POWER PLANT-HIGH BTU (800 MWE)	0	0	0	0	0	0	0	0	0	0	0
55 COAL FIRED POWER PLANT-LOW BTU (600 MWE)	0	0	0	0	0	0	0	0	0	0	0
56 COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	0	0	0	0	0	0	0	0	0	0	0
59 HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0	0	0	0
60 HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	0	0	0	0
61 COMBINED CYCLE POWER PLANT (400 MWE)	0	0	0	0	0	0	0	0	0	0	2
62 GAS TURBINE POWER PLANT (133 MWE)	0	0	0	0	0	0	0	0	0	0	1
63 FUEL CELLS (26 MWE)	0	0	0	0	0	0	0	0	0	0	0
64 LIGHT WATER REACTOR (LWR) (1200 MWE)	1	1	1	1	1	1	2	2	2	2	10
65 LIGHT WATER REACTOR (LWR) (900 MWE)	0	0	0	0	0	0	0	0	0	0	0
66 LIGHT WATER REACTOR (LWR) (600 MWE)	0	0	0	0	0	0	0	0	0	0	0
67 DAM & HYDROELECTRIC POWER PLANT (200 MWE)	0	0	0	0	0	0	0	0	0	0	0
68 PUMPED STORAGE (500 MWE)	1	0	1	0	1	0	1	1	1	1	1
69 GEOTHERMAL POWER COMPLEX (200 MWE)	0	0	0	0	0	0	0	0	0	0	0

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

Schedule of Annual Transportation Additions To Supply Fuel Mix: Egypt - Improved Efficiency 1976-2010

FACILITY NAME	1975 TOTALS	1976	1977	1978	1979	1980	1981	1982	TOTAL ADDED (1976- 1982)
1 CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	0.1	0	0	0	0	0	0	0	0
3 OIL TANKER (90,000 DWT; 620,000 B)	0.0	0	0	0	0	0	0	0	0
4 OIL BARGES (90,000 BBL)	3.0	1*	2*	1*	1	0	1	1	4
5 OIL TANK TRUCK (226 HBL)	290.3	128*	130*	131*	130	129	136	149	675
6 PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	0.5	0	0	0	0	0	0	0	0
7 HOT OIL PIPELINE (40 MB/D, 80.5 KM)	2.4	0	0	1*	0	0	0	0	1
8 REFINED PRODUCTS BULK STATION (69 MB/D)	1.6	0	0	0	1*	0	0	0	1
9 RAIL LINE (64.4 KM, SINGLE TRACK)	0.0	0	0	0	0	0	0	0	0
10 MIXED TRAIN (6556 TONNES)	2.3	0	0	1*	0	0	0	1	2
11 COAL UNIT TRAIN (9,528 TONNES)	0.0	0	0	0	0	0	0	0	0
12 COAL SLURRY PIPELINE (22.69 MM TONNES/Y, 241.4 KM)	0.0	0	0	0	0	0	0	0	0
13 COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	0.0	0	0	0	0	0	0	0	0
14 COAL SLURRY DEWATERING (22.69 MM TONNES/Y)	0.0	0	0	0	0	0	0	0	0
15 COAL BARGES (19,048 TONNES)	0.2	0	0	0	0	0	0	0	0
16 COAL TRUCK (22.7 TONNES)	4.8	1*	1*	1*	1	1	1	1	5
17 GAS PIPELINE (.87 BSCF/D, 241.4 KM)	0.1	0	0	0	0	0	0	0	0
18 GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	0.7	1*	2*	0	1*	1*	0	1*	3
20 LNG TANKER (2.6 BCF)	0.0	0	0	0	0	0	0	0	0
21 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	0.5	0	0	0	0	1	0	0	1
22 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	0.0	0	0	0	0	0	0	0	0
23 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	0.2	0	0	0	0	0	0	0	0
24 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	0.0	0	0	0	0	0	0	0	0
25 +-400 KVDC TRANSMISSION LINE (1500 MWE, 1287 KM)	0.0	0	0	0	0	0	0	0	0
26 ELECTRICITY DISTRIBUTION-AERIAL LINES (131.6 MWE)	9.0	1*	1*	2*	2*	2*	2	2	10

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

Schedule of Annual Transportation Additons To Supply Fuel Mix: Egypt - Improved Efficiency 1976-2010

FACILITY NAME	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	TOTAL ADDED (1978- 1993)
1 CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0	0
3 OIL TANKER (90,000 DWT, 620,000 B)	0	0	0	0	0	0	0	0	0	0	0	0
4 OIL BARGES (90,000 BBL)	0	1	0	1	0	0	1	0	0	0	0	7
5 OIL TANK TRUCK (226 BBL)	168	179	179	176	182	186	188	189	187	184	181	2674
6 PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	1	0	0	0	0	0	0	0	0	0	0	1
7 HOT OIL PIPELINE (40 MB/D, 80.5 KM)	1	0	0	1	0	0	1	0	0	0	1	5
8 REFINED PRODUCTS BULK STATION (69 MB/D)	0	0	1	0	0	0	0	1	0	0	0	3
9 RAIL LINE (64.4 KM, SINGLE TRACK)	0	0	0	0	0	0	0	0	0	0	0	0
10 MIXED TRAIN (6556 TONNES)	0	0	1	0	1	0	1	1	1	0	1	8
11 COAL UNIT TRAIN (9,528 TONNES)	0	0	0	0	0	0	0	0	0	0	0	0
12 COAL SLURRY PIPELINE (22.69 MM TONNES/Y, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0	0
13 COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0	0
14 COAL SLURRY DEWATERING (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0	0
15 COAL BARGES (19,048 TONNES)	0	0	0	0	0	0	0	1	0	0	0	1
16 COAL TRUCK (22.7 TONNES)	2	1	2	2	2	3	3	3	3	3	4	33
17 GAS PIPELINE (.87 BSCF/D, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0	0
18 GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	0	0	0	0	0	0	0	0	0	0	0	3
20 LNG TANKER (2.6 BCF)	0	0	0	0	0	0	0	0	0	0	0	0
21 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	0	0	0	1	0	0	0	0	1	0	0	3
22 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	0	0	0	0	0	0	0	0	0	0	0	0
23 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	1	0	0	0	0	0	0	0	0	0	0	1
24 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	0	0	0	0	0	0	0	0	0	0	0	0
25 +-400 KVDC TRANSMISSION LINE (1500 MWE, 1287 KM)	0	0	0	0	0	0	0	0	0	0	0	0
26 ELECTRICITY DISTRIBUTION-AERIAL LINES (131.6 MWE)	3	3	3	3	4	3	4	4	4	4	4	49

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 34 (Continued)

Schedule of Annual Transportation Additions to Supply Fuel Mix: Egypt - Improved Efficiency 1976-2010

FACILITY NAME	1994	1995	1996	1997	1998	1999	2000	TOTAL ADDED (1976- 2000)
1 CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	0	0	0	0	0	0	0	0
3 OIL TANKER (90,000 DWT, 620,000 B)	0	0	0	0	0	0	0	0
4 OIL BARGES (90,000 BBL)	0	0	0	0	0	0	0	7
5 OIL TANK TRUCK (226 BBL)	174	166	157	146	134	119	104	3674
6 PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	0	0	0	0	0	0	0	1
7 HOT OIL PIPELINE (40 MB/D, 80.5 KM)	0	0	0	0	0	1	0	6
8 REFINED PRODUCTS BULK STATION (69 MB/D)	0	0	1	0	0	0	0	4
9 RAIL LINE (64.4 KM, SINGLE TRACK)	0	0	0	0	0	0	0	0
10 MIXED TRAIN (6556 TONNES)	1	1	2	1	1	1	2	17
11 COAL UNIT TRAIN (9,528 TONNES)	0	0	0	0	0	0	0	0
12 COAL SLURRY PIPELINE (22.69 MM TONNES/Y, 241.4 KM)	0	0	0	0	0	0	0	0
13 COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0
14 COAL SLURRY DEWATERING (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0
15 COAL BARGES (19,048 TONNES)	0	0	0	0	0	0	0	1
16 COAL TRUCK (22.7 TONNES)	4	4	5	5	5	5	6	67
17 GAS PIPELINE (.87 BSCF/D, 241.4 KM)	0	0	0	0	0	0	0	0
18 GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	0	0	0	0	0	0	0	3
20 LNG TANKER (2.6 BCF)	0	0	0	0	0	0	0	0
21 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	0	1	0	0	0	1	0	5
22 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	0	0	0	0	0	0	0	0
23 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	0	1	0	0	0	0	0	2
24 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	0	0	0	0	0	0	0	0
25 +/-400 KVDC TRANSMISSION LINE (1500 MWE, 1287 KM)	0	0	0	0	0	0	0	0
26 ELECTRICITY DISTRIBUTION-AERIAL LINES (131.6MWE)	5	4	5	5	5	5	5	83

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

Schedule of Annual Energy Facilities Additions 10 Supply Fuel Mix: Egypt - Improved Efficiency 1976-2010

FACILITY NAME	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL ADDED (1978- 2010)
1 CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0
3 OIL TANKER (90,000 DWT; 620,000 B)	0	0	0	0	0	0	0	0	0	0	0
4 OIL BARGES (90,000 BBL)	0	0	0	0	0	0	0	0	0	0	7
5 OIL TANK TRUCK (226 BBL)	104	104	104	104	104	104	104	104	104	104	4714
6 PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	0	0	0	0	0	0	0	0	0	0	1
7 HOT OIL PIPELINE (40 MB/D, 80.5 KM)	0	0	0	0	0	1	0	0	0	0	7
8 REFINED PRODUCTS BULK STATION (69 MB/D)	0	0	0	0	0	1	0	0	0	0	5
9 RAIL LINE (64.4 KM, SINGLE TRACK)	0	0	0	0	0	0	0	0	0	0	0
10 MIXED TRAIN (6556 TONNES)	2	2	2	2	2	2	2	2	2	2	37
11 COAL UNIT TRAIN (9,528 TONNES)	0	0	0	0	0	0	0	0	0	0	0
12 COAL SLURRY PIPELINE (22.69 MM TONNES/Y, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0
13 COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0
14 COAL SLURRY DEWATERING (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0
15 COAL BARGES (14,048 TONNES)	0	0	0	0	0	0	0	0	0	0	1
16 COAL TRUCK (22.7 TONNES)	6	6	6	6	6	6	6	6	6	6	127
17 GAS PIPELINE (.87 BSCF/D, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0
18 GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	0	0	0	0	0	0	0	0	0	0	3
20 LNG TANKER (2.6 BCF)	0	0	0	0	0	0	0	0	0	0	0
21 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	0	0	1	0	0	1	0	0	1	0	8
22 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	0	0	0	0	0	0	0	0	0	0	0
23 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	0	0	0	0	0	1	0	0	0	0	3
24 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	0	0	0	0	0	0	0	0	0	0	0
25 +-400 KVDC TRANSMISSION LINE (1500 MWE, 1287 KM)	0	0	0	0	0	0	0	0	0	0	0
26 ELECTRICITY DISTRIBUTION-AERIAL LINES (131.6 MWE)	5	5	5	5	5	5	5	5	5	5	133

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

HECHTEL ENERGY SUPPLY PLANNING MODEL

Table 34 (Continued)

CUMULATIVE CAPITAL REQUIREMENTS (MILLION POUNDS, JAN 1978) OF THE ENERGY INDUSTRY
BY FACILITY GROUPING

(1978-1985)

Egypt - Improved Efficiency

FACILITY	CONSTRUCTION COSTS	OWNER'S COSTS PRIOR TO STARTUP	TOTAL
OIL			
EXPLORATION, DEVELOPMENT, & PRODUCTION	643.2	98.9	742.1
REFINING AND PROCESSING	436.4	70.0	506.4
PIPELINES	35.4	6.0	41.4
TANKERS, BARGES, TRUCKS	117.1	20.5	137.6
BULK STATIONS	9.7	1.6	11.3
OTHER	0.0	0.0	0.0
TOTAL OIL	1241.7	197.1	1438.7
OIL SHALE	0.0	0.0	0.0
GAS			
EXPLORATION, DEVELOPMENT, & PRODUCTION	7.3	1.1	8.4
GEOPRESSURED METHANE	0.0	0.0	0.0
PIPELINES	0.0	0.0	0.0
LNG TANKERS	0.0	0.0	0.0
DISTRIBUTION	39.5	6.7	46.2
OTHER	0.0	0.0	0.0
TOTAL GAS	46.8	7.8	54.7
COAL			
UNDERGROUND MINING	0.0	0.0	0.0
SURFACE MINING	0.0	0.0	0.0
RAIL	11.1	1.9	12.9
PIPELINES	0.0	0.0	0.0
BARGES, TRUCKS	0.6	0.1	0.7
TOTAL COAL	11.6	2.0	13.6
COAL SYNTHETICS			
LIQUEFACTION	0.0	0.0	0.0
METHANOL	0.0	0.0	0.0
SOLVENT REFINING	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.0	0.0	0.0
TOTAL SYNTHETICS	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	8.0	1.2	9.2
SOLAR	0.0	0.0	0.0
ELECTRIC UTILITIES			
COAL-FIRED	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.0	0.0	0.0
NUCLEAR	732.2	82.4	814.6
HYDRO & PUMPED STORAGE	46.5	4.9	51.4
OIL & GAS	252.7	28.6	281.3
GEOTHERMAL	0.0	0.0	0.0
TOTAL GENERATION	1031.4	115.9	1147.3
TRANSMISSION	270.8	31.4	302.2
DISTRIBUTION	208.3	23.7	232.1
TOTAL UTILITIES	1510.6	171.1	1681.6
TOTAL ENERGY INDUSTRY	2818.7	379.1	3197.8

CUMULATIVE CAPITAL REQUIREMENTS (MILLION POUNDS, JAN 1978) OF THE ENERGY INDUSTRY
BY FACILITY GROUPING

(1978-2000)

Egypt - Improved Efficiency

FACILITY	CONSTRUCTION COSTS	OWNER'S COSTS PRIOR TO STARTUP	TOTAL
OIL			
EXPLORATION, DEVELOPMENT, & PRODUCTION	1665.8	256.2	1922.0
REFINING AND PROCESSING	1265.5	203.0	1468.4
PIPELINES	68.6	11.7	80.3
TANKERS, BARGES, TRUCKS	327.9	57.4	385.3
BULK STATIONS	21.3	3.6	24.9
OTHER	0.0	0.0	0.0
TOTAL OIL	3349.1	531.9	3881.0
OIL SHALE	0.0	0.0	0.0
GAS			
EXPLORATION, DEVELOPMENT, & PRODUCTION	20.2	3.1	23.3
GEOPRESSURED METHANE	0.0	0.0	0.0
PIPELINES	0.0	0.0	0.0
LNG TANKERS	0.0	0.0	0.0
DISTRIBUTION	39.5	6.7	46.2
OTHER	0.0	0.0	0.0
TOTAL GAS	59.7	9.8	69.5
COAL			
UNDERGROUND MINING	0.0	0.0	0.0
SURFACE MINING	0.0	0.0	0.0
RAIL	62.7	10.7	73.3
PIPELINES	0.0	0.0	0.0
BARGES, TRUCKS	8.1	1.4	9.5
TOTAL COAL	70.8	12.0	82.9
COAL SYNTHETICS			
LIQUEFACTION	0.0	0.0	0.0
METHANOL	0.0	0.0	0.0
SOLVENT REFINING	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.0	0.0	0.0
TOTAL SYNTHETICS	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	93.5	14.0	107.5
SOLAR	0.0	0.0	0.0
ELECTRIC UTILITIES			
COAL-FIRED	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.0	0.0	0.0
NUCLEAR	6621.2	745.5	7366.8
HYDRO & PUMPED STORAGE	922.9	96.9	1019.8
OIL & GAS	289.0	32.7	321.7
GEOTHERMAL	0.0	0.0	0.0
TOTAL GENERATION	7833.1	875.1	8708.2
TRANSMISSION	599.9	69.6	669.5
DISTRIBUTION	857.5	97.8	955.2
TOTAL UTILITIES	9290.5	1042.5	10333.0
TOTAL ENERGY INDUSTRY	12863.7	1610.2	14473.9

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 34 (Continued)

GROWTH IN REQUIREMENTS FOR CONSTRUCTION COST TOTAL ## (MILLION POUNDS, JANUARY 1978)
 FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
 For The Egypt - Improved Efficiency CASE

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK YEAR		1976- 1980	1980- 1985	1985- 2000	1976- 2000
OIL									
EXPLORATION, DEVELOPMENT, & PRODUCTION	82.	73.	72.	88. (1979)		0.6	-3.9	0.4	-0.5
REFINING AND PROCESSING	0.	87.	55.	87. (1980)		9999.0	-12.9	4.7	9999.0
PIPELINES	2.	0.	3.	21. (1982)		-100.0	9999.0	-100.0	-100.0
TANKERS, BARGES, TRUCKS	14.	9.	14.	19. (1989)		-7.0	6.8	-3.6	-2.1
BULK STATIONS	0.	0.	1.	4. (1978)		0.0	0.0	0.0	0.0
OTHER	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TOTAL OIL	98.	168.	146.	186. (1984)		16.8	-5.6	1.4	2.3
OIL SHALE	0.	0.	0.	0.		0.0	0.0	0.0	0.0
GAS									
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	0.	1.	3. (1978)		0.0	0.0	0.0	0.0
GEOPRESSURED METHANE	0.	0.	0.	0.		0.0	0.0	0.0	0.0
PIPELINES	0.	0.	0.	0.		0.0	0.0	0.0	0.0
LNG TANKERS	0.	0.	0.	0.		0.0	0.0	0.0	0.0
DISTRIBUTION	20.	0.	2.	20. (1976)		-25.0	-100.0	0.0	-100.0
OTHER	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TOTAL GAS	20.	0.	3.	20. (1976)		-25.0	-100.0	0.0	-100.0
COAL									
UNDERGROUND MINING	0.	0.	0.	0.		0.0	0.0	0.0	0.0
SURFACE MINING	0.	0.	0.	0.		0.0	0.0	0.0	0.0
RAIL	0.	7.	3.	7. (1996)		0.0	9999.0	4.7	9999.0
PIPELINES	0.	0.	0.	0.		0.0	0.0	0.0	0.0
BARGES, TRUCKS	0.	0.	0.	4. (1990)		0.0	14.9	7.6	7.8
TOTAL COAL	0.	8.	3.	8. (1990)		0.0	130.7	4.8	22.6
COAL SYNTHETICS									
LIQUEFACTION	0.	0.	0.	0.		0.0	0.0	0.0	0.0
METHANOL	0.	0.	0.	0.		0.0	0.0	0.0	0.0
SOLVENT REFINING	0.	0.	0.	0.		0.0	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TOTAL SYNTHETICS	0.	0.	0.	0.		0.0	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	0.	11.	4.	11. (1991)		0.0	9999.0	8.0	9999.0
SOLAR	0.	0.	0.	0.		0.0	0.0	0.0	0.0
ELECTRIC UTILITIES									
COAL-FIRED	0.	0.	0.	0.		0.0	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.		0.0	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
NUCLEAR	0.	491.	288.	491. (2000)		9999.0	33.7	7.7	9999.0
HYDRO & PUMPED STORAGE	0.	66.	40.	66. (1987)		0.0	9999.0	3.7	9999.0
OIL & GAS	78.	0.	13.	104. (1977)		-21.4	-9.5	-100.0	-100.0
GEOTHERMAL	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TOTAL GENERATION	78.	557.	341.	557. (2000)		-3.6	26.3	6.4	8.5
TRANSMISSION	0.	0.	26.	127. (1994)		0.0	9999.0	-100.0	0.0
DISTRIBUTION	16.	48.	37.	48. (1995)		8.1	8.6	2.6	4.7
TOTAL UTILITIES	94.	605.	404.	697. (1994)		-1.3	26.2	5.1	8.0
TOTAL ENERGY INDUSTRY	212.	792.	559.	817. (1994)		6.9	9.1	4.2	5.6

CONSTRUCTION COST TOTAL DOES NOT INCLUDE OWNER'S COSTS.

GROWTH IN REQUIREMENTS FOR CONSTRUCTOR COST TOTAL ## (MILLION EPDUNDS, JANUARY 1978)
 FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
 For The Egypt - Improved Efficiency CASE

RESOURCES	1976	1977	1978	1979	1980	1981	1982
OIL							
EXPLORATION, DEVELOPMENT, & PRODUCTION	82.	85.	87.	88.	84.	82.	81.
REFINING AND PROCESSING	0.	0.	22.	65.	87.	44.	22.
PIPELINES	2.	9.	0.	0.	0.	4.	21.
TANKERS, BARGES, TRUCKS	14.	18.	14.	14.	11.	15.	16.
BULK STATIONS	0.	2.	4.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL OIL	98.	114.	127.	167.	182.	144.	139.
OIL SHALE	0.	0.	0.	0.	0.	0.	0.
GAS							
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	1.	3.	0.	0.	1.	3.
GEOPRESSURED METHANE	0.	0.	0.	0.	0.	0.	0.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
LNG TANKERS	0.	0.	0.	0.	0.	0.	0.
DISTRIBUTION	20.	13.	15.	12.	6.	6.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL GAS	20.	14.	18.	12.	6.	8.	3.
COAL							
UNDERGROUND MINING	0.	0.	0.	0.	0.	0.	0.
SURFACE MINING	0.	0.	0.	0.	0.	0.	0.
RAIL	0.	0.	4.	0.	0.	0.	4.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
BARGES, TRUCKS	0.	0.	0.	0.	0.	0.	0.
TOTAL COAL	0.	0.	4.	0.	0.	0.	4.
COAL SYNTHETICS							
LIQUEFACTION	0.	0.	0.	0.	0.	0.	0.
METHANOL	0.	0.	0.	0.	0.	0.	0.
SOLVENT REFINING	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.	0.	0.
TOTAL SYNTHETICS	0.	0.	0.	0.	0.	0.	0.
NUCLEAR FUEL CYCLE	0.	0.	0.	0.	0.	0.	0.
SOLAR	0.	0.	0.	0.	0.	0.	0.
ELECTRIC UTILITIES							
COAL-FIRED	0.	0.	0.	0.	0.	0.	0.
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.	0.	0.
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.	0.	0.
NUCLEAR	0.	3.	8.	14.	38.	82.	133.
HYDRO & PUMPED STORAGE	0.	0.	0.	0.	0.	0.	0.
OIL & GAS	78.	104.	89.	55.	30.	18.	21.
GEOTHERMAL	0.	0.	0.	0.	0.	0.	0.
TOTAL GENERATION	78.	106.	98.	68.	68.	100.	154.
TRANSMISSION	0.	0.	23.	35.	0.	62.	92.
DISTRIBUTION	16.	19.	19.	19.	22.	26.	29.
TOTAL UTILITIES	94.	126.	140.	123.	90.	188.	276.
TOTAL ENERGY INDUSTRY	212.	254.	284.	302.	278.	339.	421.

CONSTRUCTOR COST TOTAL DOES NOT INCLUDE OWNER'S COSTS.

DECHIFL ENERGY SUPPLY PLANNING MODEL

Table 34 (Continued)

GROWTH IN REQUIREMENTS FOR CONSTRUCTOR COST TOTAL ## (MILLION POUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
For The Egypt - Improved Efficiency CASE

RESOURCES	1983	1984	1985	1986	1987	1988	1989
OIL							
EXPLORATION, DEVELOPMENT, & PRODUCTION	79.	75.	69.	63.	69.	63.	67.
REFINING AND PROCESSING	65.	87.	44.	22.	65.	87.	44.
PIPELINES	0.	2.	9.	0.	2.	9.	0.
TANKERS, BARGES, TRUCKS	14.	18.	15.	18.	15.	15.	19.
BULK STATIONS	2.	4.	0.	0.	0.	2.	4.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL OIL	160.	186.	136.	103.	151.	177.	134.
OIL SHALE	0.	0.	0.	0.	0.	0.	0.
GAS							
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	0.	0.	1.	3.	0.	0.
GEOPRESSURED METHANE	0.	0.	0.	0.	0.	0.	0.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
LNG TANKERS	0.	0.	0.	0.	0.	0.	0.
DISTRIBUTION	0.	0.	0.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL GAS	0.	0.	0.	1.	3.	0.	0.
COAL							
UNDERGROUND MINING	0.	0.	0.	0.	0.	0.	0.
SURFACE MINING	0.	0.	0.	0.	0.	0.	0.
RAIL	0.	0.	4.	0.	4.	0.	4.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
BARGES, TRUCKS	0.	0.	0.	0.	0.	0.	0.
TOTAL COAL	0.	0.	4.	0.	4.	0.	4.
COAL SYNTHETICS							
LIQUEFACTION	0.	0.	0.	0.	0.	0.	0.
METHANOL	0.	0.	0.	0.	0.	0.	0.
SOLVENT REFINING	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.	0.	0.
TOTAL SYNTHETICS	0.	0.	0.	0.	0.	0.	0.
NUCLEAR FUEL CYCLE	0.	5.	3.	4.	6.	5.	3.
SOLAR	0.	0.	0.	0.	0.	0.	0.
ELECTRIC UTILITIES							
COAL-FIRED	0.	0.	0.	0.	0.	0.	0.
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.	0.	0.
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.	0.	0.
NUCLEAR	151.	145.	162.	202.	245.	255.	294.
HYDRO & PUMPED STORAGE	0.	8.	38.	60.	66.	56.	53.
OIL & GAS	15.	6.	18.	21.	15.	0.	0.
GEOTHERMAL	0.	0.	0.	0.	0.	0.	0.
TOTAL GENERATION	166.	159.	218.	283.	327.	311.	348.
TRANSMISSION	0.	23.	35.	0.	0.	0.	23.
DISTRIBUTION	29.	31.	33.	35.	35.	39.	39.
TOTAL UTILITIES	195.	214.	286.	318.	362.	350.	410.
TOTAL ENERGY INDUSTRY	355.	405.	430.	426.	526.	531.	551.

CONSTRUCTOR COST TOTAL DOES NOT INCLUDE OWNER'S COSTS.

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BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 34 (Continued)

GROWTH IN REQUIREMENTS FOR CONSTRUCTOR COST TOTAL ** (MILLION POUNDS, JANUARY 1978)
 FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
 For The Egypt - Improved Efficiency CASE

RESOURCES	1990	1991	1992	1993	1994	1995	1996
OIL							
EXPLORATION, DEVELOPMENT, & PRODUCTION	65.	67.	65.	67.	68.	71.	70.
REFINING AND PROCESSING	22.	65.	87.	44.	22.	65.	87.
PIPELINES	0.	2.	9.	0.	0.	0.	0.
TANKERS, BARGES, TRUCKS	16.	15.	15.	15.	14.	14.	13.
BULK STATIONS	0.	0.	0.	0.	2.	4.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL OIL	102.	150.	177.	126.	106.	154.	170.
OIL SHALE	0.	0.	0.	0.	0.	0.	0.
GAS							
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	1.	3.	0.	0.	0.	1.
GEOPRESSURED METHANE	0.	0.	0.	0.	0.	0.	0.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
LNG TANKERS	0.	0.	0.	0.	0.	0.	0.
DISTRIBUTION	0.	0.	0.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL GAS	0.	1.	3.	0.	0.	0.	1.
COAL							
UNDERGROUND MINING	0.	0.	0.	0.	0.	0.	0.
SURFACE MINING	0.	0.	0.	0.	0.	0.	0.
RAIL	4.	4.	0.	4.	4.	4.	7.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
BARGES, TRUCKS	4.	0.	0.	0.	0.	0.	0.
TOTAL COAL	8.	4.	0.	4.	4.	4.	8.
COAL SYNTHETICS							
LIQUEFACTION	0.	0.	0.	0.	0.	0.	0.
METHANOL	0.	0.	0.	0.	0.	0.	0.
SOLVENT REFINING	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.	0.	0.
TOTAL SYNTHETICS	0.	0.	0.	0.	0.	0.	0.
NUCLEAR FUEL CYCLE	4.	11.	3.	4.	11.	3.	4.
SOLAR	0.	0.	0.	0.	0.	0.	0.
ELECTRIC UTILITIES							
COAL-FIRED	0.	0.	0.	0.	0.	0.	0.
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.	0.	0.
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.	0.	0.
NUCLEAR	345.	384.	428.	449.	459.	463.	463.
HYDRO & PUMPED STORAGE	41.	50.	50.	59.	66.	59.	66.
OIL & GAS	0.	0.	0.	0.	0.	0.	0.
GEOTHERMAL	0.	0.	0.	0.	0.	0.	0.
TOTAL GENERATION	386.	434.	478.	508.	524.	523.	529.
TRANSMISSION	35.	0.	0.	85.	127.	0.	0.
DISTRIBUTION	39.	41.	43.	44.	45.	48.	48.
TOTAL UTILITIES	460.	476.	521.	637.	697.	571.	577.
TOTAL ENERGY INDUSTRY	574.	641.	704.	771.	817.	732.	760.

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** CONSTRUCTOR COST TOTAL DOES NOT INCLUDE OWNER'S COSTS.

HECHTEL ENERGY SUPPLY PLANNING MODEL

Table 34 (Continued)

GROWTH IN REQUIREMENTS FOR CONSTRUCTOR COST TOTAL ** (MILLION POUNDS, JANUARY 1978)
 FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
 For The Egypt - Improved Efficiency CASE

RESOURCES	1997	1998	1999	2000	TOTAL 1978-2000
OIL					
EXPLORATION, DEVELOPMENT, & PRODUCTION	69.	75.	73.	73.	1666.
REFINING AND PROCESSING	44.	22.	65.	87.	1265.
PIPELINES	2.	9.	0.	0.	69.
TANKERS, BARGES, TRUCKS	12.	11.	10.	9.	328.
BULK STATIONS	0.	0.	0.	0.	21.
OTHER	0.	0.	0.	0.	0.
TOTAL OIL	126.	117.	148.	168.	3349.
OIL SHALE	0.	0.	0.	0.	0.
GAS					
EXPLORATION, DEVELOPMENT, & PRODUCTION	3.	0.	0.	0.	20.
GEOPRESSURED METHANE	0.	0.	0.	0.	0.
PIPELINES	0.	0.	0.	0.	0.
LNG TANKERS	0.	0.	0.	0.	0.
DISTRIBUTION	0.	0.	0.	0.	40.
OTHER	0.	0.	0.	0.	0.
TOTAL GAS	3.	0.	0.	0.	60.
COAL					
UNDERGROUND MINING	0.	0.	0.	0.	0.
SURFACE MINING	0.	0.	0.	0.	0.
RAIL	4.	4.	4.	7.	63.
PIPELINES	0.	0.	0.	0.	0.
BARGES, TRUCKS	0.	0.	0.	0.	8.
TOTAL COAL	4.	4.	4.	8.	71.
COAL SYNTHETICS					
LIQUEFACTION	0.	0.	0.	0.	0.
METHANOL	0.	0.	0.	0.	0.
SOLVENT REFINING	0.	0.	0.	0.	0.
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.
TOTAL SYNTHETICS	0.	0.	0.	0.	0.
NUCLEAR FUEL CYCLE	11.	3.	4.	11.	94.
SOLAR	0.	0.	0.	0.	0.
ELECTRIC UTILITIES					
COAL-FIRED	0.	0.	0.	0.	0.
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.
NUCLEAR	463.	468.	477.	491.	6621.
HYDRO & PUMPED STORAGE	59.	66.	59.	66.	923.
OIL & GAS	0.	0.	0.	0.	289.
GEOTHERMAL	0.	0.	0.	0.	0.
TOTAL GENERATION	523.	534.	537.	557.	7833.
TRANSMISSION	23.	35.	0.	0.	600.
DISTRIBUTION	48.	48.	48.	48.	857.
TOTAL UTILITIES	594.	617.	585.	605.	9291.
TOTAL ENERGY INDUSTRY	738.	741.	740.	792.	12864.

** CONSTRUCTOR COST TOTAL DOES NOT INCLUDE OWNER'S COSTS.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 34 (Continued)

GROWTH IN CAPITAL REQUIREMENTS* (MILLION POUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
For The Egypt - Improved Efficiency •

CATEGORY	ANNUAL REQUIREMENTS				AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
NON-MANUAL TECHNICAL MANPOWER	12.	79.	52.	79. (2000)	17.1	11.3	4.9	8.2
NON-MANUAL NON-TECHNICAL MANPOWER	1.	16.	10.	16. (2000)	19.1	18.3	6.3	10.8
MANUAL MANPOWER	18.	87.	59.	88. (1994)	12.0	9.9	4.5	6.8
MANPOWER TOTAL	31.	181.	122.	181. (1994)	14.4	11.0	4.8	7.6
WOOD PRODUCTS (20)	2.	10.	7.	10. (2000)	9.1	10.1	4.1	6.2
CHEMICALS & ALLIED PROD. (27,28,30,32)	3.	3.	3.	4. (1998)	-4.9	9.0	-2.0	-0.3
PETROLEUM PRODUCTS (31)	6.	7.	6.	7. (2000)	-7.8	2.9	3.0	1.1
GLASS, CLAY & STONE PRODUCTS (35,36)	4.	19.	14.	23. (1994)	12.1	12.4	4.5	7.3
PRIMARY IRON & STEEL PRODUCTS (37)	19.	21.	18.	21. (1992)	2.8	-4.5	1.4	0.4
PRIMARY NON-FERROUS METALS (38)	2.	12.	13.	36. (1994)	10.3	28.4	-0.3	6.9
FABRICATED STRUCTURAL PRODUCTS (40) *	5.	42.	33.	67. (1994)	14.0	28.4	2.3	9.2
OTHER FABRICATED PRODUCTS (42)	6.	20.	13.	20. (2000)	11.5	0.7	5.3	5.3
MATERIALS TOTAL	47.	134.	107.	177. (1994)	5.4	9.9	2.5	4.5
HVAC HEATING & COOLING UNITS (52) ++	0.	6.	3.	6. (2000)	50.7	22.4	7.2	16.6
HVAC DUCTWORK & ACCESSORIES (40) *	0.	2.	1.	2. (2000)	37.3	27.0	7.5	15.9
TURBINES (43)	26.	65.	43.	65. (2000)	-8.4	14.0	4.2	3.9
GAS WELDING SETS (47) ++	0.	0.	0.	0. (1980)	4.1	-9.8	1.9	-0.3
ELECTRIC WELDING SETS (53) **	0.	1.	1.	1. (2000)	16.5	7.8	5.6	7.8
CONSTRUCTION, MINING & OIL FIELD EDP (45)	37.	55.	48.	61. (1994)	-0.1	4.7	1.2	1.7
MATERIALS HANDLING EQUIPMENT (46)	0.	3.	2.	3. (2000)	9.7	19.5	5.5	9.0
GENERAL INDUSTRY EQUIPMENT (49)	3.	14.	10.	14. (2000)	42.6	-7.4	4.3	7.2
INSTRUMENTATION & CONTROLS (62)	2.	9.	6.	9. (2000)	29.2	1.3	3.5	6.9
ELECTRICAL EQUIPMENT (53) **	5.	28.	19.	31. (1994)	15.9	10.5	4.7	7.7
FABRICATED PLATE PRODUCTS (40) *	13.	96.	60.	96. (2000)	22.5	4.8	6.6	8.7
EQUIPMENT TOTAL	85.	278.	192.	278. (2000)	6.7	6.2	4.3	5.1
MISCELLANEOUS MATERIALS & EQUIPMENT	9.	12.	10.	12. (2000)	6.1	-3.8	1.9	1.4
MOBILE FACILITY	14.	16.	17.	23. (1990)	-7.0	11.7	-0.9	0.6
OTHER CONSTRUCTOR COSTS	27.	171.	111.	181. (1994)	7.1	15.3	5.9	8.0
CONSTRUCTOR COST TOTAL **	212.	792.	559.	817. (1994)	6.9	9.1	4.2	5.6

• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

*BEA (BUREAU OF ECONOMIC ANALYSIS) TWO-DIGIT CATEGORIES ARE IN PARENTHESIS.

* PARTIAL BEA CATEGORY 40. TOTAL IS SUM OF 3 SEPARATE ENTRIES FOR CATEGORY 40.

++ PARTIAL BEA CATEGORY 52. REMAINDER IS PART OF MISCELLANEOUS ENTRY.

** PARTIAL BEA CATEGORY 53. TOTAL IS SUM OF 2 SEPARATE ENTRIES FOR CATEGORY 53.

** CONSTRUCTION CAPITAL COST TOTAL INCLUDES MANPOWER, MATERIALS AND EQUIPMENT SUBTOTALS ABOVE PLUS OTHER (OVERHEAD, PROFIT, ETC.) COSTS. IT EXCLUDES OWNER'S COSTS. (LAND COSTS, INTEREST DURING CONSTRUCTION, ETC.)

HECHIEL ENERGY SUPPLY PLANNING MODEL

Table 34 (Continued)

GROWTH IN MANPOWER REQUIREMENTS (MAN-YEARS)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
Egypt - Improved Efficiency *

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
CHEMICAL ENGINEERS	0.	18.	22.	39.	(1987)	9999.0	-24.2	10.1	9999.0
CIVIL ENGINEERS	101.	726.	477.	726.	(2000)	7.8	22.2	4.6	8.6
ELECTRICAL ENGINEERS	97.	574.	417.	705.	(1993)	9.1	18.4	4.0	7.7
MECHANICAL ENGINEERS	64.	441.	300.	463.	(1999)	15.8	10.6	5.8	8.4
MINING ENGINEERS	0.	4.	2.	4.	(1991)	0.0	9999.0	1.9	9999.0
NUCLEAR ENGINEERS	0.	58.	31.	58.	(2000)	9999.0	25.6	7.9	9999.0
GEOLOGICAL ENGINEERS	29.	38.	34.	39.	(1997)	0.6	3.1	0.6	1.1
PETROLEUM ENGINEERS	29.	25.	26.	32.	(1978)	0.6	-4.7	0.4	-0.7
OTHER ENGINEERS	1.	12.	14.	24.	(1991)	71.2	-4.5	4.0	11.0
ENGINEERS TOTAL	321.	1896.	1323.	1979.	(1994)	10.6	15.2	4.6	7.7
DESIGNERS & DRAFTSMEN	121.	740.	547.	805.	(1994)	15.7	12.0	4.5	7.8
SUPERVISORS & MANAGERS	97.	404.	274.	404.	(2000)	0.1	17.7	4.1	6.1
NON-MANUAL, TECHNICAL TOTAL	539.	3040.	2144.	3172.	(1994)	10.2	14.6	4.5	7.5
NON-MANUAL, NON-TECHNICAL	360.	2856.	1782.	2856.	(2000)	11.5	17.0	5.8	9.0
NON-MANUAL TOTAL	899.	5896.	3927.	5896.	(2000)	10.7	15.6	5.1	8.2
PIPEFITTERS	748.	3877.	2291.	3877.	(2000)	27.0	-4.6	6.3	7.1
PIPEFITTER/WELDERS	391.	1646.	1008.	1646.	(2000)	17.8	-2.1	6.1	6.2
ELECTRICIANS	375.	3545.	2162.	3545.	(2000)	19.7	12.6	6.4	9.8
BOILERMAKERS	309.	481.	321.	533.	(1977)	1.3	-7.9	5.5	1.9
BOILERMAKER/WELDERS	103.	379.	238.	379.	(1996)	-8.5	20.0	5.1	5.6
IRON WORKERS	148.	1846.	1584.	4382.	(1994)	18.0	42.3	0.7	11.1
CARPENTERS	160.	2499.	1466.	2499.	(2000)	29.4	16.1	6.7	12.1
EQUIPMENT OPERATORS	583.	2312.	1516.	2312.	(2000)	7.2	9.9	4.3	5.9
LINEMEN	243.	837.	1060.	3123.	(1994)	8.4	33.7	-3.5	5.3
TEAMSTERS & LABORERS	1071.	4468.	2929.	4468.	(2000)	7.9	9.8	4.5	6.1
OTHER	997.	1695.	1365.	1698.	(1996)	3.0	-0.1	2.8	2.2
MANUAL TOTAL	5126.	23585.	15940.	24635.	(1994)	12.7	9.0	4.2	6.6
CONSTRUCTION MANPOWER TOTAL	6025.	29482.	19867.	30507.	(1994)	12.4	10.0	4.4	6.8

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A GROWTH RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

TECHNICAL ENERGY SUPPLY PLANNING MODEL

Table 34 (Continued)

SCHEDULE OF MANPOWER RESOURCES (MAN-YEARS) FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES Egypt - Improved Efficiency *

RESOURCES	1976	1977	1978	1979	1980	1981	1982
CHEMICAL ENGINEERS	0.	0.	26.	38.	17.	4.	26.
CIVIL ENGINEERS	101.	127.	211.	202.	136.	233.	275.
ELECTRICAL ENGINEERS	97.	119.	235.	212.	137.	319.	320.
MECHANICAL ENGINEERS	64.	80.	170.	191.	115.	128.	202.
MINING ENGINEERS	0.	0.	0.	0.	0.	0.	0.
NUCLEAR ENGINEERS	0.	1.	3.	5.	6.	8.	12.
GEOLOGICAL ENGINEERS	29.	32.	32.	30.	30.	30.	30.
PETROLEUM ENGINEERS	29.	32.	32.	30.	30.	30.	30.
OTHER ENGINEERS	1.	2.	13.	19.	9.	4.	16.
ENGINEERS TOTAL	321.	392.	721.	728.	479.	757.	910.
DESIGNERS & DRAFTSMEN	121.	150.	337.	365.	217.	301.	406.
SUPERVISORS & MANAGERS	97.	110.	143.	143.	97.	120.	162.
NON-MANUAL, TECHNICAL TOTAL	539.	652.	1202.	1238.	794.	1178.	1478.
NON-MANUAL, NON-TECHNICAL	360.	456.	734.	782.	555.	810.	1116.
NON-MANUAL TOTAL	899.	1108.	1935.	2018.	1349.	1987.	2594.
PIPEFITTERS	748.	987.	990.	1603.	1949.	1147.	768.
PIPEFITTER/WELDERS	391.	499.	506.	670.	752.	501.	404.
ELECTRICIANS	375.	614.	604.	689.	770.	769.	1035.
BOILERMAKERS	309.	533.	524.	452.	325.	160.	153.
BOILERMAKER/WELDERS	103.	178.	175.	128.	72.	44.	61.
IRON WORKERS	148.	268.	595.	1239.	286.	864.	2107.
CARPENTERS	160.	270.	259.	352.	448.	400.	466.
EQUIPMENT OPERATORS	583.	716.	701.	746.	771.	726.	798.
LINEMEN	243.	335.	620.	1189.	335.	918.	2026.
TEAMSTERS & LABORERS	1071.	1223.	1266.	1615.	1453.	1382.	1642.
OTHER	997.	1164.	1202.	1132.	1120.	1098.	1189.
MANUAL TOTAL	5126.	6787.	7442.	9815.	8282.	8009.	10649.
CONSTRUCTION MANPOWER TOTAL	6025.	7894.	9377.	11833.	9631.	9996.	13244.

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 34 (Continued)

SCHEDULE OF MANPOWER RESOURCES (MAN-YEARS) FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES Egypt - Improved Efficiency *

RESOURCES	1983	1984	1985	1986	1987	1988	1989
CHEMICAL ENGINEERS	38.	17.	4.	26.	39.	17.	4.
CIVIL ENGINEERS	280.	359.	372.	404.	459.	437.	495.
ELECTRICAL ENGINEERS	245.	340.	318.	306.	354.	351.	439.
MECHANICAL ENGINEERS	236.	215.	190.	255.	320.	268.	264.
MINING ENGINEERS	0.	2.	3.	3.	2.	2.	3.
NUCLEAR ENGINEERS	16.	18.	19.	21.	26.	31.	33.
GEOLOGICAL ENGINEERS	29.	34.	35.	36.	35.	31.	34.
PETROLEUM ENGINEERS	28.	26.	23.	24.	25.	22.	23.
OTHER ENGINEERS	19.	11.	7.	15.	22.	12.	5.
ENGINEERS TOTAL	892.	1022.	971.	1091.	1282.	1171.	1301.
DESIGNERS & DRAFTSMEN	422.	428.	382.	473.	575.	475.	497.
SUPERVISORS & MANAGERS	177.	209.	220.	255.	294.	261.	269.
NON-MANUAL, TECHNICAL TOTAL	1491.	1659.	1572.	1819.	2152.	1907.	2067.
NON-MANUAL, NON-TECHNICAL	1114.	1200.	1219.	1350.	1604.	1642.	1756.
NON-MANUAL TOTAL	2605.	2858.	2791.	3168.	3756.	3550.	3823.
PIPEFITTERS	1737.	2423.	1540.	955.	2113.	2939.	1998.
PIPEFITTER/WELDERS	734.	976.	676.	476.	896.	1211.	896.
ELECTRICIANS	1215.	1535.	1393.	1302.	1904.	2347.	2071.
BOILERMAKERS	262.	307.	215.	183.	307.	369.	238.
BOILERMAKER/WELDERS	77.	100.	179.	249.	313.	286.	275.
IRON WORKERS	553.	1044.	1673.	700.	1006.	1207.	1437.
CARPENTERS	739.	992.	947.	922.	1388.	1660.	1471.
EQUIPMENT OPERATORS	854.	1124.	1236.	1324.	1673.	1735.	1579.
LINEMEN	502.	787.	1432.	594.	577.	669.	954.
TEAMSTERS & LABORERS	1638.	2225.	2319.	1947.	2789.	3294.	2881.
OTHER	1184.	1246.	1113.	1057.	1264.	1329.	1257.
MANUAL TOTAL	9495.	12757.	12722.	9709.	14231.	17046.	15057.
CONSTRUCTION MANPOWER TOTAL	12100.	15615.	15513.	12877.	17987.	20595.	18881.

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

TECHNICAL ENERGY SUPPLY PLANNING MODEL

Table 34 (Continued)

SCHEDULE OF MANPOWER RESOURCES (MAN-YEARS)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
Egypt - Improved Efficiency *

RESOURCES	1990	1991	1992	1993	1994	1995	1996
CHEMICAL ENGINEERS	26.	39.	17.	5.	27.	38.	17.
CIVIL ENGINEERS	520.	574.	566.	699.	721.	648.	626.
ELECTRICAL ENGINEERS	450.	457.	450.	705.	669.	516.	496.
MECHANICAL ENGINEERS	331.	395.	344.	369.	434.	429.	373.
MINING ENGINEERS	3.	4.	3.	3.	4.	3.	3.
NUCLEAR ENGINEERS	35.	40.	43.	45.	46.	47.	47.
GEOLOGICAL ENGINEERS	33.	37.	35.	34.	38.	36.	37.
PETROLEUM ENGINEERS	23.	25.	24.	23.	24.	24.	25.
OTHER ENGINEERS	15.	24.	13.	5.	17.	22.	11.
ENGINEERS TOTAL	1436.	1593.	1495.	1889.	1979.	1763.	1635.
DESIGNERS & DRAFTSMEN	595.	682.	592.	722.	805.	742.	646.
SUPERVISORS & MANAGERS	291.	342.	325.	346.	388.	373.	355.
NON-MANUAL, TECHNICAL TOTAL	2323.	2618.	2412.	2957.	3172.	2879.	2636.
NON-MANUAL, NON-TECHNICAL	1981.	2186.	2208.	2502.	2701.	2509.	2393.
NON-MANUAL TOTAL	4304.	4804.	4620.	5459.	5873.	5388.	5029.
PIPEFITTERS	1479.	2822.	3620.	2800.	2302.	3241.	3863.
PIPEFITTER/WELDERS	725.	1230.	1532.	1266.	1111.	1441.	1643.
ELECTRICIANS	1952.	2743.	3122.	3107.	3245.	3290.	3525.
BOILERMAKERS	164.	342.	448.	333.	260.	390.	479.
BOILERMAKER/WELDERS	208.	281.	287.	312.	343.	326.	379.
IRON WORKERS	2008.	1433.	1592.	2511.	4382.	1738.	1835.
CARPENTERS	1343.	1924.	2156.	2122.	2158.	2286.	2482.
EQUIPMENT OPERATORS	1402.	1859.	1892.	1877.	2004.	1974.	2217.
LINEMEN	1524.	669.	745.	1554.	3123.	837.	837.
TEAMSTERS & LABORERS	2676.	3456.	3911.	3848.	4194.	3983.	4411.
OTHER	1223.	1455.	1615.	1505.	1513.	1636.	1698.
MANUAL TOTAL	14704.	18214.	20920.	21235.	24635.	21142.	23369.
CONSTRUCTION MANPOWER TOTAL	19008.	23019.	25541.	26695.	30507.	26530.	28398.

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 34 (Continued)

SCHEDULE OF MANPOWER RESOURCES (MAN-YEARS) FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES Egypt - Improved Efficiency

RESOURCES	1997	1998	1999	2000	TOTAL 1978-2000
CHEMICAL ENGINEERS	5.	26.	39.	18.	515.
CIVIL ENGINEERS	643.	685.	699.	726.	10969.
ELECTRICAL ENGINEERS	568.	574.	556.	574.	9590.
MECHANICAL ENGINEERS	360.	418.	463.	441.	6911.
MINING ENGINEERS	4.	3.	3.	4.	47.
NUCLEAR ENGINEERS	47.	49.	53.	58.	707.
GEOLOGICAL ENGINEERS	39.	38.	36.	38.	786.
PETROLEUM ENGINEERS	26.	25.	25.	25.	594.
OTHER ENGINEERS	7.	17.	22.	12.	318.
ENGINEERS TOTAL	1698.	1834.	1894.	1896.	30438.
DESIGNERS & DRAFTSMEN	645.	743.	790.	740.	12582.
SUPERVISORS & MANAGERS	347.	386.	398.	404.	6305.
NON-MANUAL, TECHNICAL TOTAL	2690.	2964.	3082.	3040.	49323.
NON-MANUAL, NON-TECHNICAL	2410.	2616.	2749.	2856.	40991.
NON-MANUAL TOTAL	5100.	5580.	5831.	5896.	90314.
PIPEFITTERS	2953.	2325.	3244.	3877.	52688.
PIPEFITTER/WELDERS	1334.	1133.	1436.	1646.	23192.
ELECTRICIANS	3226.	3047.	3298.	3545.	49732.
BOILERMAKERS	350.	260.	392.	481.	7393.
BOILERMAKER/WELDERS	319.	345.	326.	379.	5466.
IRON WORKERS	2024.	2626.	1723.	1846.	36428.
CARPENTERS	2248.	2152.	2292.	2499.	33707.
EQUIPMENT OPERATORS	2086.	1962.	2016.	2312.	34870.
LINEMEN	1122.	1691.	837.	837.	24379.
TEAMSTERS & LABORERS	4008.	3972.	4002.	4468.	67378.
OTHER	1657.	1581.	1628.	1695.	31397.
MANUAL TOTAL	21327.	21094.	21194.	23585.	366630.
CONSTRUCTION MANPOWER TOTAL	26427.	26674.	27026.	29482.	456944.

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 34 (Continued)

GROWTH IN REQUIREMENTS FOR CONSTRUCTION MANPOWER TOTAL (MAN-YEARS/YEAR)
 FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
 For The Egypt - Improved Efficiency CASE

CATEGORY	ANNUAL REQUIREMENTS				AVERAGE GROWTH RATES (%/YEAR)			
	1976- (CALC'D)	2000	1978-2000 AVERAGE	PEAK YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
OIL								
EXPLORATION, DEVELOPMENT, & PRODUCTION	1602.	1375.	1403.	1686. (1978)	0.8	-4.4	0.3	-0.6
REFINING AND PROCESSING	0.	4770.	2663.	4770. (1980)	9999.0	-17.2	6.5	9999.0
PIPELINES	76.	0.	83.	547. (1982)	-100.0	9999.0	-100.0	-100.0
TANKERS, BARGES, TRUCKS	0.	0.	0.	0.	0.0	0.0	0.0	0.0
BULK STATIONS	0.	0.	26.	96. (1978)	0.0	0.0	0.0	0.0
OTHER	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TOTAL OIL	1677.	6145.	4175.	6423. (1980)	39.9	-12.0	4.0	5.6
OIL SHALE	0.	0.	0.	0.	0.0	0.0	0.0	0.0
GAS								
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	0.	26.	88. (1978)	0.0	0.0	0.0	0.0
GEOPRESSURED METHANE	0.	0.	0.	0.	0.0	0.0	0.0	0.0
PIPELINES	0.	0.	0.	0.	0.0	0.0	0.0	0.0
LNG TANKERS	0.	0.	0.	0.	0.0	0.0	0.0	0.0
DISTRIBUTION	999.	0.	82.	999. (1976)	-25.3	-100.0	0.0	-100.0
OTHER	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TOTAL GAS	999.	0.	108.	999. (1976)	-25.3	-100.0	0.0	-100.0
COAL								
UNDERGROUND MINING	0.	0.	0.	0.	0.0	0.0	0.0	0.0
SURFACE MINING	0.	0.	0.	0.	0.0	0.0	0.0	0.0
RAIL	0.	0.	0.	0.	0.0	0.0	0.0	0.0
PIPELINES	0.	0.	0.	0.	0.0	0.0	0.0	0.0
BARGES, TRUCKS	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TOTAL COAL	0.	0.	0.	0.	0.0	0.0	0.0	0.0
COAL SYNTHETICS								
LIQUEFACTION	0.	0.	0.	0.	0.0	0.0	0.0	0.0
METHANOL	0.	0.	0.	0.	0.0	0.0	0.0	0.0
SOLVENT REFINING	0.	0.	0.	0.	0.0	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.0	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TOTAL SYNTHETICS	0.	0.	0.	0.	0.0	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	0.	560.	229.	560. (1991)	0.0	9999.0	8.8	9999.0
SOLAR	0.	0.	0.	0.	0.0	0.0	0.0	0.0
ELECTRIC UTILITIES								
COAL-FIRED	0.	0.	0.	0.	0.0	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.0	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.0	0.0	0.0	0.0
NUCLEAR	0.	17448.	10024.	17448. (2000)	9999.0	43.2	7.5	9999.0
HYDRO & PUMPED STORAGE	0.	2558.	1510.	2558. (1994)	0.0	9999.0	4.1	9999.0
OIL & GAS	2513.	0.	460.	4096. (1977)	-25.6	-10.0	-100.0	-100.0
GEOTHERMAL	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TOTAL GENERATION	2513.	20006.	11993.	20006. (2000)	-8.6	34.7	6.5	9.0
TRANSMISSION	0.	0.	1250.	6575. (1994)	0.0	9999.0	-100.0	0.0
DISTRIBUTION	836.	2770.	2113.	2770. (1995)	8.2	10.7	2.5	5.1
TOTAL UTILITIES	3348.	22776.	15356.	28074. (1994)	-3.6	32.8	4.4	8.3
TOTAL ENERGY INDUSTRY	6025.	29482.	19867.	30507. (1994)	12.4	10.0	4.4	6.8

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BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 34 (Continued)

GROWTH IN SELECTED MATERIALS AND EQUIPMENT ITEMS REQUIRED
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
Egypt - Improved Efficiency

CATEGORY		ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
		1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
CEMENT	(TONNES)	17598.	91253.	60496.	91253.	(2000)	8.3	11.6	5.3	7.1
CONCRETE (INCLUDES CEMENT)	(TONNES)	93569.	810167.	513085.	810167.	(2000)	13.3	17.3	5.9	9.4
BENTONITE (IN DRILLING MUD)	(TONNES)	2719.	2300.	2399.	2971.	(1978)	0.9	-4.7	0.3	-0.7
BARITE (IN DRILLING MUD)	(TONNES)	2636.	2277.	2339.	2893.	(1978)	0.8	-4.5	0.3	-0.6
CARBON STEEL	(TONNES)	41185.	98804.	78106.	123669.	(1994)	2.1	8.8	2.5	3.7
ALLOY STEEL	(TONNES)	2652.	8953.	6284.	8853.	(2000)	9.6	3.1	4.7	5.2
STAINLESS STEEL	(TONNES)	179.	2784.	1705.	2784.	(2000)	48.9	0.4	7.8	12.1
STEEL TOTAL	(TONNES)	44016.	110441.	86094.	134626.	(1994)	2.9	8.2	2.8	3.9
COPPER	(TONNES)	458.	3551.	2641.	5344.	(1994)	23.4	13.5	3.9	8.9
ALUMINUM	(TONNES)	637.	1510.	2984.	11904.	(1994)	6.0	37.0	-6.1	3.7
MANGANESE	(TONNES)	334.	835.	650.	974.	(1994)	3.7	7.4	2.8	3.9
CHROMIUM	(TONNES)	133.	741.	497.	741.	(2000)	21.8	1.1	6.0	7.4
NICKEL	(TONNES)	8.	111.	69.	111.	(2000)	43.9	2.2	7.4	11.6
CAST IRON	(TONNES)	502.	2628.	1724.	2628.	(2000)	24.4	1.2	4.9	7.1
STEEL CASTINGS	(TONNES)	364.	1588.	979.	1588.	(2000)	12.2	9.8	3.7	6.3
ALUMINUM CASTINGS	(TONNES)	32.	132.	88.	132.	(2000)	11.3	7.1	4.5	6.1
BRASS & BRONZE CASTINGS	(TONNES)	33.	201.	130.	201.	(2000)	29.2	-1.4	5.9	7.9
IRON & STEEL FORGINGS	(TONNES)	318.	1360.	874.	1360.	(2000)	8.6	12.6	3.6	6.2
STRUCTURAL STEEL SHAPES	(TONNES)	2284.	12547.	10794.	24744.	(1994)	14.8	23.0	0.8	7.4
STEEL PLATE < 3.8 CM THICK	(TONNES)	3360.	16694.	12238.	19678.	(1994)	15.7	10.3	3.6	6.9
STEEL PLATE > 3.8 CM THICK	(TONNES)	2.	2800.	1639.	2800.	(2000)	192.3	39.0	8.1	34.4
PIPE, CARBON STEEL	(TONNES)	13172.	9797.	9363.	15986.	(1982)	-6.7	-2.7	0.8	-1.2
PIPE, ALLOY & STAINLESS STEEL	(TONNES)	98.	3974.	2379.	3974.	(2000)	52.3	19.6	7.8	16.7
OIL COUNTRY TUBULAR GOODS	(TONNES)	16166.	13901.	14426.	18061.	(1978)	0.8	-4.5	0.3	-0.6
REINFORCING BAR (REBAR)	(TONNES)	935.	15839.	9747.	15839.	(2000)	23.8	24.9	5.9	12.5
VALVES, CARBON STEEL	(TONNES)	163.	927.	645.	970.	(1995)	42.9	-12.4	6.7	7.5
VALVES, ALLOY & STAINLESS STEEL	(TONNES)	7.	367.	221.	367.	(2000)	89.4	4.9	8.0	17.9
STEAM TURBOGENERATORS	(MEGAWATTS)	331.	1260.	805.	1260.	(2000)	-3.2	9.9	6.9	5.7
STEAM TURBINES (EXCL TRBGNS)	(MEGAWATTS)	7.	25.	17.	25.	(2000)	11.3	-2.6	6.4	5.2
GAS TURBOGENERATORS	(MEGAWATTS)	136.	3.	23.	136.	(1976)	-34.0	22.2	-18.3	-14.3
DRAGLINES	(CUBIC METERS)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
DRILL RIGS, ONSHORE	(RIG YEARS)	16.	15.	15.	18.	(1978)	1.0	-3.7	0.4	-0.4
DRILL RIGS, OFFSHORE	(RIG YEARS)	5.	5.	4.	5.	(1979)	0.0	-2.8	1.0	0.0
DRILL BITS	(NUMBER)	1358.	1198.	1237.	1494.	(1978)	0.7	-1.6	-0.5	-0.5
PUMPS & DRIVERS > 745 MGAWTS (MEGAWATTS)		8.	102.	63.	102.	(2000)	29.2	10.4	7.3	11.3
PUMPS & DRIVERS < 745 MGAWTS (MEGAWATTS)		20.	29.	25.	29.	(1979)	9.6	-7.8	2.7	1.5
AXIAL COMPRESSORS > 3727 MGAWTS (MGAWTS)		0.	0.	0.	0.		0.0	0.0	0.0	0.0
CENTRIF COMP & DRV > 7455 MW (MGAWTS)		0.	19.	12.	19.	(1979)	9999.0	-24.2	9.7	9999.0
CENTRIF COMP & DRV < 7455 MW (MGAWTS)		1.	4.	3.	4.	(1979)	38.3	-19.0	6.8	5.2
HEAT EXCHANGERS	(SQUARE METERS)	7053.	84631.	54098.	84631.	(2000)	67.3	-13.6	8.0	10.9
NON-NUC PRESS VESS < 3.8 CM WALL (TONNES)		54.	2062.	1349.	2095.	(1984)	148.4	-23.3	9.2	16.3
NON-NUC PRESS VESS 3.8-10 CM W (TONNES)		4.	4.	4.	4.	(1979)	0.0	-2.8	1.0	0.0
NON-NUC PRESS VESS > 10 CM WALL (TONNES)		0.	0.	0.	0.		0.0	0.0	0.0	0.0
BOILERS	(TONNES STEAM PER HOUR)	981656.	313796.	361498.	1486156.	(1978)	-6.3	-21.3	2.1	-4.6
NUCLEAR STEAM SUPPLY SYSTEMS (MEGAWATTS)		0.	1233.	731.	1233.	(2000)	9999.0	29.1	7.8	9999.0

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A THE RATE EQUAL TO 9999 IMPLIES INFINITE GROWTH

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 34 (Continued)

GROWTH IN ANNUAL COSTS (MILLION POUNDS JANUARY 1978)
FOR THE OPERATION AND MAINTENANCE OF ENERGY-RELATED FACILITIES
Egypt - Improved Efficiency

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
NON-MANUAL TECHNICAL MANPOWER	3.	18.	10.	18.	(2000)	12.2	6.6	6.9	7.7
NON-MANUAL NON-TECHNICAL MANPOWER	1.	3.	2.	3.	(2000)	12.0	5.4	7.4	7.7
MANUAL MANPOWER	9.	42.	26.	42.	(2000)	14.0	6.4	5.1	6.8
MANPOWER TOTAL	12.	63.	38.	63.	(2000)	13.4	6.4	5.6	7.1
WOOD PRODUCTS (20)	1.	5.	2.	5.	(2000)	6.3	9.5	7.6	7.8
CHEMICALS & ALLIED PROD. (27,28,30,32)	8.	33.	18.	33.	(2000)	-0.7	6.5	7.6	6.0
PETROLEUM PRODUCTS (31)	4.	15.	12.	15.	(1998)	18.4	6.0	2.1	5.5
GLASS, CLAY & STONE PRODUCTS (35,36)	1.	2.	1.	2.	(2000)	0.5	4.9	4.9	4.2
PRIMARY IRON & STEEL PRODUCTS (37)	1.	11.	5.	11.	(2000)	23.5	4.0	9.6	10.6
PRIMARY NON-FERROUS METALS (38)	0.	4.	2.	4.	(2000)	10.7	10.0	7.6	8.6
FABRICATED STRUCTURAL PRODUCTS (40) *	0.	3.	2.	3.	(2000)	14.8	5.4	6.7	7.7
OTHER FABRICATED PRODUCTS (42)	2.	9.	5.	9.	(2000)	6.4	6.9	6.8	6.8
MATERIALS TOTAL	17.	80.	47.	80.	(2000)	8.2	6.3	6.2	6.5
HVAC HEATING & COOLING UNITS (52) ++	0.	0.	0.	0.	(1982)	35.1	3.1	-0.3	5.6
HVAC DUCTWORK & ACCESSORIES (40) *	0.	0.	0.	0.	(1982)	35.1	3.1	-0.3	5.6
TURBINES (43)	0.	4.	2.	4.	(2000)	14.0	5.0	10.7	10.0
GAS WELDING SETS (47) ++	1.	9.	4.	9.	(2000)	1.1	3.9	13.1	9.1
ELECTRIC WELDING SETS (53) **	0.	0.	0.	0.		0.0	0.0	0.0	0.0
CONSTRUCTION, MINING & OIL FIELD EOP (45)	0.	2.	1.	2.	(2000)	15.7	5.9	13.1	12.0
MATERIALS HANDLING EQUIPMENT (46)	0.	0.	0.	0.	(2000)	21.4	11.0	11.3	12.8
GENERAL INDUSTRY EQUIPMENT (49)	4.	10.	6.	10.	(2000)	-2.3	4.7	6.3	4.5
INSTRUMENTATION & CONTROLS (62)	1.	4.	3.	4.	(2000)	8.4	3.8	5.9	5.9
ELECTRICAL EQUIPMENT (53) **	3.	14.	7.	14.	(2000)	7.1	7.1	7.4	7.3
FABRICATED PLATE PRODUCTS (40) *	0.	0.	0.	0.		0.0	0.0	0.0	0.0
EQUIPMENT TOTAL	8.	35.	19.	35.	(2000)	4.2	5.5	7.4	6.5
ELECTRICITY	5.	13.	9.	13.	(1998)	-3.4	6.4	5.6	4.2
NATURAL GAS	0.	1.	0.	1.	(1998)	14.7	9.2	25.4	20.0
WATER	2.	22.	8.	22.	(2000)	8.6	6.3	13.1	10.9
UTILITY TOTAL	7.	35.	17.	35.	(2000)	0.3	6.3	9.4	7.2
RENTS, ROYALTIES, ETC.	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TAXES	0.	0.	0.	0.		0.0	0.0	0.0	0.0
SERVICES & MISCELLANEOUS	10.	53.	30.	53.	(2000)	11.9	5.7	6.6	7.3
ANNUAL OPERATING COST (EX FUEL)	53.	258.	147.	258.	(2000)	8.9	6.2	6.5	6.8

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

#BEA (BUREAU OF ECONOMIC ANALYSIS) TWO-DIGIT CATEGORIES ARE IN PARENTHESIS.

* PARTIAL BEA CATEGORY 40. TOTAL IS SUM OF 3 SEPARATE ENTRIES FOR CATEGORY 40.

++ PARTIAL BEA CATEGORY 52. REMAINDER IS PART OF MISCELLANEOUS ENTRY.

** PARTIAL BEA CATEGORY 53. TOTAL IS SUM OF 2 SEPARATE ENTRIES FOR CATEGORY 53.

H F C H I E L E N E R G Y S U P P L Y P L A N N I N G M O D E L

Table 34 (Continued)

GROWTH IN MANPOWER REQUIREMENTS (MAN-YEARS)
FOR THE OPERATION AND MAINTENANCE OF ENERGY-RELATED FACILITIES
Egypt - Improved Efficiency

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
CHEMICAL ENGINEERS	30.	78.	51.	81.	(1998)	-4.5	6.7	5.7	4.1
CIVIL ENGINEERS	18.	101.	59.	101.	(2000)	14.7	6.4	6.0	7.5
ELECTRICAL ENGINEERS	34.	182.	110.	182.	(2000)	15.5	7.1	5.3	7.3
MECHANICAL ENGINEERS	33.	159.	91.	159.	(2000)	9.5	6.2	6.3	6.8
MINING ENGINEERS	0.	14.	5.	15.	(1998)	0.0	0.0	9999.0	9999.0
NUCLEAR ENGINEERS	0.	23.	6.	23.	(2000)	0.0	0.0	9999.0	9999.0
GEOLOGICAL ENGINEERS	0.	7.	2.	7.	(1998)	0.0	0.0	9999.0	9999.0
PETROLEUM ENGINEERS	0.	0.	0.	0.		0.0	0.0	0.0	0.0
OTHER ENGINEERS	31.	135.	85.	135.	(2000)	8.6	6.5	5.7	6.3
ENGINEERS TOTAL	144.	700.	409.	700.	(2000)	9.2	6.6	6.2	6.8
DESIGNERS & DRAFTSMEN	28.	140.	82.	140.	(2000)	9.6	7.2	6.2	7.0
SUPERVISORS & MANAGERS	383.	1505.	1069.	1505.	(2000)	14.8	6.2	3.5	5.9
OTHER TECHNICAL	75.	464.	234.	464.	(2000)	3.9	8.4	8.8	7.9
NON-MANUAL, TECHNICAL TOTAL	630.	2809.	1793.	2809.	(2000)	12.2	6.6	4.9	6.4
NON-MANUAL, NON-TECHNICAL	224.	1331.	724.	1331.	(2000)	12.0	5.4	7.4	7.7
NON-MANUAL TOTAL	854.	4140.	2517.	4140.	(2000)	12.1	6.3	5.6	6.8
PIPEFITTERS	182.	449.	368.	450.	(1999)	10.7	4.1	2.0	3.8
WELDERS	77.	258.	193.	258.	(1999)	12.8	5.9	3.0	5.2
ELECTRICIANS	222.	1022.	614.	1022.	(2000)	9.9	7.1	5.5	6.6
BOILERMAKERS	25.	66.	43.	68.	(1998)	-4.5	6.7	5.7	4.1
MECHANICS	767.	3018.	2192.	3018.	(2000)	15.6	6.1	3.4	5.9
MACHINISTS	195.	707.	543.	714.	(1998)	16.0	5.9	2.8	5.5
IRONWORKERS	14.	32.	21.	32.	(1999)	0.0	2.3	4.7	3.4
CARPENTERS	28.	58.	42.	60.	(1998)	-2.7	4.0	4.2	3.0
EQUIPMENT OPERATORS	68.	791.	394.	791.	(2000)	12.9	11.6	8.0	9.6
OTHER OPERATORS	858.	4916.	2487.	4916.	(2000)	4.0	6.7	8.8	7.5
METER READERS	281.	1916.	1176.	1916.	(2000)	24.0	7.0	4.9	8.3
TEAMSTERS & LABORERS	1797.	6392.	5025.	6394.	(1999)	16.5	6.3	2.4	5.4
LINEMEN	61.	559.	281.	559.	(2000)	13.5	11.9	7.9	9.7
OTHER	482.	2856.	1626.	2856.	(2000)	14.6	6.5	6.3	7.7
MANUAL TOTAL	4990.	22249.	14611.	22249.	(2000)	14.0	6.4	4.5	6.4
MANPOWER TOTAL	5844.	26389.	17127.	26389.	(2000)	13.7	6.4	4.7	6.5

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A GROWTH RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

FECHTEL ENERGY SUPPLY PLANNING MODEL

Table 34 (Continued)

CUMULATIVE CAPITAL REQUIREMENTS (MILLION POUNDS, JAN 1978) OF THE ENERGY INDUSTRY
BY FACILITY GROUPING

(1978-1985)

Egypt - Improved Efficiency/Imports

FACILITY	CONSTRUCTION COSTS	OWNER'S COSTS PRIOR TO STARTUP	TOTAL
OIL			
EXPLORATION, DEVELOPMENT, & PRODUCTION	581.0	89.4	670.3
REFINING AND PROCESSING	314.3	50.4	364.7
PIPELINES	29.2	5.0	34.2
TANKERS, BARGES, TRUCKS	107.3	18.8	126.0
BULK STATIONS	7.3	1.2	8.6
OTHER	0.0	0.0	0.0
TOTAL OIL	1039.1	164.7	1203.8
OIL SHALE	0.0	0.0	0.0
GAS			
EXPLORATION, DEVELOPMENT, & PRODUCTION	6.5	1.0	7.6
GEOPRESSURED METHANE	0.0	0.0	0.0
PIPELINES	0.0	0.0	0.0
LNG TANKERS	0.0	0.0	0.0
DISTRIBUTION	21.1	3.6	24.6
OTHER	0.0	0.0	0.0
TOTAL GAS	27.6	4.6	32.2
COAL			
UNDERGROUND MINING	0.0	0.0	0.0
SURFACE MINING	0.0	0.0	0.0
RAIL	3.8	0.6	4.4
PIPELINES	0.0	0.0	0.0
BARGES, TRUCKS	0.5	0.1	0.6
TOTAL COAL	4.3	0.7	5.0
COAL SYNTHETICS			
LIQUEFACTION	0.0	0.0	0.0
METHANOL	0.0	0.0	0.0
SOLVENT REFINING	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.0	0.0	0.0
TOTAL SYNTHETICS	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	5.4	0.8	6.2
SOLAR	0.0	0.0	0.0
ELECTRIC UTILITIES			
COAL-FIRED	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.0	0.0	0.0
NUCLEAR	620.4	69.9	690.2
HYDRO & PUMPED STORAGE	29.0	3.1	32.1
OIL & GAS	193.1	21.8	214.9
GEOTHERMAL	0.0	0.0	0.0
TOTAL GENERATION	842.5	94.7	937.2
TRANSMISSION	203.6	23.6	227.2
DISTRIBUTION	135.3	15.4	150.7
TOTAL UTILITIES	1181.4	133.8	1315.2
TOTAL ENERGY INDUSTRY	2257.7	304.6	2562.4

HECHTEL ENERGY SUPPLY PLANNING MODEL

Table 34 (Continued)

CUMULATIVE CAPITAL REQUIREMENTS (MILLION EPOUNDS, JAN 1978) OF THE ENERGY INDUSTRY
BY FACILITY GROUPING

(1978-2000)

Egypt - Improved Efficiency/Imports

FACILITY	CONSTRUCTION COSTS	OWNER'S COSTS PRIOR TO STARTUP	TOTAL
OIL			
EXPLORATION, DEVELOPMENT, & PRODUCTION	1504.8	231.4	1736.3
REFINING AND PROCESSING	911.4	146.2	1057.6
PIPELINES	57.1	9.7	66.8
TANKERS, BARGES, TRUCKS	300.5	52.6	353.1
BULK STATIONS	16.1	2.7	18.9
OTHER	0.0	0.0	0.0
TOTAL OIL	2789.9	442.7	3232.6
OIL SHALE	0.0	0.0	0.0
GAS			
EXPLORATION, DEVELOPMENT, & PRODUCTION	18.1	2.8	20.9
GEOPRESSURED METHANE	0.0	0.0	0.0
PIPELINES	0.0	0.0	0.0
LNG TANKERS	0.0	0.0	0.0
DISTRIBUTION	21.1	3.6	24.6
OTHER	0.0	0.0	0.0
TOTAL GAS	39.2	6.4	45.5
COAL			
UNDERGROUND MINING	0.0	0.0	0.0
SURFACE MINING	0.0	0.0	0.0
RAIL	21.3	3.6	25.0
PIPELINES	0.0	0.0	0.0
BARGES, TRUCKS	7.4	1.3	8.7
TOTAL COAL	28.8	4.9	33.7
COAL SYNTHETICS			
LIQUEFACTION	0.0	0.0	0.0
METHANOL	0.0	0.0	0.0
SOLVENT REFINING	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.0	0.0	0.0
TOTAL SYNTHETICS	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	62.1	9.3	71.4
SOLAR	0.0	0.0	0.0
ELECTRIC UTILITIES			
COAL-FIRED	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.0	0.0	0.0
NUCLEAR	5615.0	632.2	6247.2
HYDRO & PUMPED STORAGE	455.1	47.8	502.9
OIL & GAS	223.3	25.2	248.5
GEOTHERMAL	0.0	0.0	0.0
TOTAL GENERATION	6293.3	705.3	6998.6
TRANSMISSION	449.9	52.2	502.1
DISTRIBUTION	556.9	63.5	620.4
TOTAL UTILITIES	7300.1	820.9	8121.1
TOTAL ENERGY INDUSTRY	10220.1	1284.2	11504.3

GROWTH IN CAPITAL REQUIREMENTS* (MILLION POUNDS, JANUARY 1974)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
Egypt - Improved Efficiency/Imports

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
NON-MANUAL TECHNICAL MANPOWER	11.	74.	49.	74.	(2000)	16.8	12.1	5.1	8.4
NON-MANUAL NON-TECHNICAL MANPOWER	0.	9.	6.	9.	(2000)	26.5	23.7	7.2	13.5
MANUAL MANPOWER	9.	52.	35.	52.	(2000)	12.5	11.3	5.0	7.5
MANPOWER TOTAL	20.	135.	84.	135.	(2000)	15.2	12.2	5.2	8.2
WOOD PRODUCTS (20)	1.	5.	3.	5.	(2000)	11.2	14.2	6.3	8.7
CHEMICALS & ALLIED PROD. (27,28,30,32)	3.	3.	3.	4.	(1998)	-4.9	9.0	-2.0	-0.3
PETROLEUM PRODUCTS (31)	2.	4.	3.	4.	(2000)	2.6	2.4	3.5	3.1
GLASS, CLAY & STONE PRODUCTS (35,36)	3.	15.	11.	19.	(1994)	6.6	18.3	4.7	7.7
PRIMARY IRON & STEEL PRODUCTS (37)	15.	17.	16.	19.	(1982)	3.3	-3.4	1.2	0.6
PRIMARY NON-FERROUS METALS (38)	2.	11.	12.	33.	(1994)	10.4	28.4	-0.3	6.9
FABRICATED STRUCTURAL PRODUCTS (40) *	4.	37.	30.	61.	(1994)	14.9	29.3	2.3	9.6
OTHER FABRICATED PRODUCTS (42)	32.	119.	81.	119.	(2000)	9.1	4.6	5.2	5.7
MATERIALS TOTAL	33.	108.	87.	151.	(1994)	6.1	12.1	2.5	5.0
HVAC HEATING & COOLING UNITS (52) ++	0.	5.	3.	5.	(2000)	50.7	22.4	7.2	16.6
HVAC DUCTWORK & ACCESSORIES (40) *	0.	2.	1.	2.	(2000)	50.2	29.7	7.5	18.2
TURBINES (43)	22.	59.	39.	59.	(2000)	-7.3	14.0	4.2	4.1
GAS WELDING SETS (47) ++	0.	0.	0.	0.	(1980)	4.1	-9.8	1.9	-0.3
ELECTRIC WELDING SETS (53) **	0.	1.	1.	1.	(2000)	16.6	7.8	5.6	7.8
CONSTRUCTION, MINING & OIL FIELD EOP (45)	31.	33.	31.	34.	(1978)	-0.2	1.5	-0.1	0.2
MATERIALS HANDLING EQUIPMENT (46)	0.	2.	1.	2.	(2000)	9.8	19.5	5.5	9.0
GENERAL INDUSTRY EQUIPMENT (49)	2.	12.	8.	12.	(2000)	38.7	-6.7	4.3	6.9
INSTRUMENTATION & CONTROLS (62)	2.	8.	6.	8.	(2000)	29.2	1.3	3.5	6.9
ELECTRICAL EQUIPMENT (53) **	4.	24.	17.	27.	(1994)	13.3	11.4	4.6	7.4
FABRICATED PLATE PRODUCTS (40) *	12.	88.	55.	88.	(2000)	22.5	4.8	6.6	8.7
EQUIPMENT TOTAL	74.	234.	161.	234.	(2000)	6.7	5.6	4.2	4.9
MISCELLANEOUS MATERIALS & EQUIPMENT	8.	11.	9.	11.	(2000)	6.4	-3.8	1.9	1.4
MOBILE FACILITY	13.	10.	14.	19.	(1990)	-6.9	8.7	-2.2	-0.8
OTHER CONSTRUCTOR COSTS	20.	127.	83.	134.	(1994)	8.2	15.2	5.8	8.1
CONSTRUCTOR COST TOTAL **	168.	625.	444.	646.	(1994)	7.0	9.2	4.1	5.6

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

#BEA (BUREAU OF ECONOMIC ANALYSIS) TWO-DIGIT CATEGORIES ARE IN PARENTHESIS.

* PARTIAL BEA CATEGORY 40. TOTAL IS SUM OF 3 SEPARATE ENTRIES FOR CATEGORY 40.

++ PARTIAL BEA CATEGORY 52. REMAINDER IS PART OF MISCELLANEOUS ENTRY.

** PARTIAL BEA CATEGORY 53. TOTAL IS SUM OF 2 SEPARATE ENTRIES FOR CATEGORY 53.

** CONSTRUCTION CAPITAL COST TOTAL INCLUDES MANPOWER, MATERIALS AND EQUIPMENT SUBTOTALS ABOVE PLUS OTHER (OVERHEAD, PROFIT, ETC.) COSTS. IT EXCLUDES OWNER'S COSTS. (LAND COSTS, INTEREST DURING CONSTRUCTION, ETC.)

REFCHIEL ENERGY SUPPLY PLANNING MODEL

Table 34 (Continued)

GROWTH IN MANPOWER REQUIREMENTS (MAN-YEARS)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
Egypt - Improved Efficiency/Imports

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
CHEMICAL ENGINEERS	0.	7.	8.	15.	(1987)	9999.0	-24.2	10.1	9999.0
CIVIL ENGINEERS	43.	598.	356.	598.	(2000)	19.9	22.6	6.0	11.5
ELECTRICAL ENGINEERS	41.	474.	299.	481.	(1993)	19.3	20.5	5.6	10.8
MECHANICAL ENGINEERS	31.	376.	228.	376.	(2000)	22.9	15.1	6.6	11.0
MINING ENGINEERS	0.	1.	1.	1.	(1991)	0.0	9999.0	1.9	9999.0
NUCLEAR ENGINEERS	0.	58.	31.	58.	(2000)	9999.0	25.6	7.9	9999.0
GEOLOGICAL ENGINEERS	29.	30.	29.	32.	(1978)	0.6	-1.6	0.5	0.1
PETROLEUM ENGINEERS	29.	25.	26.	32.	(1978)	0.6	-4.7	0.4	-0.7
OTHER ENGINEERS	0.	4.	5.	9.	(1991)	64.7	-3.6	3.7	10.3
ENGINEERS TOTAL	174.	1572.	984.	1572.	(2000)	16.3	16.3	5.8	9.6
DESIGNERS & DRAFTSMEN	62.	584.	377.	584.	(2000)	19.8	14.6	5.7	9.8
SUPERVISORS & MANAGERS	54.	316.	198.	316.	(2000)	6.1	16.0	5.4	7.6
NON-MANUAL, TECHNICAL TOTAL	290.	2472.	1559.	2472.	(2000)	15.4	15.8	5.7	9.3
NON-MANUAL, NON-TECHNICAL	11.	456.	247.	456.	(2000)	51.9	21.8	7.6	16.9
NON-MANUAL TOTAL	301.	2928.	1806.	2928.	(2000)	17.4	16.5	6.0	9.9
PIPEFITTERS	123.	902.	538.	902.	(2000)	25.8	2.5	6.6	8.7
PIPEFITTER/WELDERS	70.	405.	249.	405.	(2000)	16.4	4.9	6.3	7.6
ELECTRICIANS	56.	902.	543.	902.	(2000)	22.9	21.2	6.8	12.3
BOILERMAKERS	44.	108.	69.	108.	(2000)	2.1	-1.6	6.1	3.8
BOILERMAKER/WELDERS	15.	74.	45.	74.	(1996)	-6.8	23.9	5.7	7.0
IRON WORKERS	21.	480.	353.	839.	(1994)	23.9	44.6	2.9	13.9
CARPENTERS	23.	632.	371.	632.	(2000)	34.7	25.1	7.0	14.9
EQUIPMENT OPERATORS	122.	461.	309.	461.	(2000)	6.0	9.4	4.4	5.7
LINEMEN	35.	119.	151.	445.	(1994)	8.4	33.7	-3.5	5.3
TEAMSTERS & LABORERS	174.	992.	635.	992.	(2000)	8.6	13.8	5.2	7.5
OTHER	263.	442.	360.	444.	(1996)	2.4	0.2	2.8	2.2
MANUAL TOTAL	945.	5517.	3624.	5638.	(1994)	11.9	12.5	5.0	7.6
CONSTRUCTION MANPOWER TOTAL	1246.	8445.	5430.	8445.	(2000)	13.3	13.7	5.3	8.3

• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A GROWTH RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

GROWTH IN ANNUAL COSTS (MILLION POUNDS JANUARY 1978)
FOR THE OPERATION AND MAINTENANCE OF ENERGY-RELATED FACILITIES
Egypt - Improved Efficiency/Imports

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
NON-MANUAL TECHNICAL MANPOWER	0.	3.	1.	3.	(2000)	0.0	0.0	9999.0	9999.0
NON-MANUAL NON-TECHNICAL MANPOWER	0.	0.	0.	0.		0.0	0.0	0.0	0.0
MANUAL MANPOWER	0.	1.	0.	1.	(2000)	0.0	0.0	9999.0	9999.0
MANPOWER TOTAL	0.	4.	1.	4.	(2000)	0.0	0.0	9999.0	9999.0
WOOD PRODUCTS (20)	0.	0.	0.	0.	(2000)	0.0	0.0	9999.0	9999.0
CHEMICALS & ALLIED PROD. (27,28,30,32)	4.	19.	10.	19.	(2000)	1.0	6.5	7.8	6.3
PETROLEUM PRODUCTS (31)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
GLASS, CLAY & STONE PRODUCTS (35,36)	0.	0.	0.	0.	(2000)	14.0	12.0	7.8	9.7
PRIMARY IRON & STEEL PRODUCTS (37)	0.	8.	3.	8.	(2000)	31.3	3.5	18.8	17.4
PRIMARY NON-FERROUS METALS (38)	0.	1.	0.	1.	(2000)	6.2	4.9	6.3	6.0
FABRICATED STRUCTURAL PRODUCTS (40) *	0.	2.	1.	2.	(2000)	0.0	0.0	9999.0	9999.0
OTHER FABRICATED PRODUCTS (42)	1.	5.	2.	5.	(2000)	5.6	7.0	10.4	8.9
MATERIALS TOTAL	5.	36.	17.	36.	(2000)	3.3	6.3	10.1	8.2
HVAC HEATING & COOLING UNITS (52) ++	0.	0.	0.	0.	(1982)	35.1	3.1	-0.3	5.6
HVAC DUCTWORK & ACCESSORIES (40) *	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TURBINES (43)	0.	4.	2.	4.	(2000)	14.0	5.0	10.7	10.0
GAS WELDING SETS (47) ++	0.	0.	0.	0.		0.0	0.0	0.0	0.0
ELECTRIC WELDING SETS (53) **	0.	0.	0.	0.		0.0	0.0	0.0	0.0
CONSTRUCTION, MINING & OIL FIELD EGP (45)	0.	0.	0.	0.	(2000)	15.7	5.9	6.8	8.0
MATERIALS HANDLING EQUIPMENT (46)	0.	0.	0.	0.	(2000)	21.4	11.0	11.3	12.8
GENERAL INDUSTRY EQUIPMENT (49)	1.	4.	2.	4.	(2000)	-0.8	2.5	6.7	4.5
INSTRUMENTATION & CONTROLS (62)	1.	4.	2.	4.	(2000)	8.4	3.8	5.9	5.9
ELECTRICAL EQUIPMENT (53) **	1.	8.	4.	8.	(2000)	5.3	6.4	8.5	7.5
FABRICATED PLATE PRODUCTS (40) *	0.	0.	0.	0.		0.0	0.0	0.0	0.0
EQUIPMENT TOTAL	4.	20.	10.	20.	(2000)	5.6	4.6	7.9	6.8
ELECTRICITY	0.	0.	0.	0.		0.0	0.0	0.0	0.0
NATURAL GAS	0.	0.	0.	0.		0.0	0.0	0.0	0.0
WATER	0.	0.	0.	0.		0.0	0.0	0.0	0.0
UTILITY TOTAL	0.	0.	0.	0.		0.0	0.0	0.0	0.0
RENTS, ROYALTIES, ETC.	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TAXES	0.	0.	0.	0.		0.0	0.0	0.0	0.0
SERVICES & MISCELLANEOUS	1.	7.	4.	7.	(2000)	10.7	5.8	7.1	7.4
ANNUAL OPERATING COST (EX FUEL)	11.	67.	32.	67.	(2000)	5.2	5.6	9.4	7.9

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A GROWTH RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

#BEA (BUREAU OF ECONOMIC ANALYSIS) TWO-DIGIT CATEGORIES ARE IN PARENTHESES.

* PARTIAL BEA CATEGORY 40. TOTAL IS SUM OF 3 SEPARATE ENTRIES FOR CATEGORY 40.

++ PARTIAL BEA CATEGORY 52. REMAINDER IS PART OF MISCELLANEOUS ENTRY.

** PARTIAL BEA CATEGORY 53. TOTAL IS SUM OF 2 SEPARATE ENTRIES FOR CATEGORY 53.

Table 35

RESOURCE REQUIREMENTS FOR RENEWABLE ENERGY SOURCES*

35a Financial Requirements (Millions of Egyptian Pounds, 1978)

	1985		1990		2000	
	Refer- ence	In- creased Renew- ables	Refer- ence	In- creased Renew- ables	Refer- ence	In- creased Renew- ables
Investment	2.7	99	90	303	200	334
O&M	.2	7	.7	40	50	160
Total	2.9	106	97	343	250	494

35b Labor Requirements (Person-Years)

Construction	205	5,700	5,580	18,120	11,950	21,700
O&M	25	670	750	3,770	4,800	14,000

35c Material Requirements (Tons)

Steel	600	17,000	17,000	55,000	34,200	65,000
Glass	300	8,500	7,500	27,500	20,000	31,000
Aluminum	80	400	3,000	11,000	9,000	11,000
Cement	1,500	72,000	64,000	215,000	160,000	223,000

*Source: A.D. Little, Inc.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 36

ELECTRIC GENERATING CAPACITY (MWE)

Egypt - Acc. Renewable Resources

	1975	1982	1985	2000	AVERAGE ANNUAL GROWTH
COAL AND COAL/WASTE PLANTS	0.0	0.0	0.0	0.0	-----
OIL-STEAM PLANTS	1420.0	2904.0	2868.0	1617.0	0.52%
GAS-STEAM PLANTS	0.0	0.0	0.0	0.0	-----
LOW-BTU GAS-STEAM PLANTS	0.0	0.0	0.0	0.0	-----
GAS TURBINE PLANTS	137.0	437.0	437.0	0.0	-----
COMBINED CYCLE PLANTS	0.0	0.0	900.0	900.0	-----
FUEL CELLS	0.0	0.0	0.0	0.0	-----
NUCLEAR POWER PLANTS	0.0	0.0	0.0	12600.0	-----
CONVENTIONAL HYDRO PLANTS	2445.0	2445.0	2445.0	2603.0	0.25%
PUMPED STORAGE PLANTS	0.0	0.0	0.0	2550.0	-----
GEOTHERMAL PLANTS	0.0	0.0	0.0	20.0	-----
TOTAL CAPACITY	4002.0	5786.0	6650.0	20290.0	6.71%

B E C H T E L E N E R G Y S U P P L Y P L A N N I N G M O D E L

Table 36 (Continued)

SCHEDULE OF ANNUAL ENERGY FACILITIES ADDITIONS TO SUPPLY FUEL MIX: EGYPT - ACC. Renewable Resources 1976-2010

FACILITY NAME	1975 TOTALS	1976	1977	1978	1979	1980	1981	1982	TOTAL ADDED (1978- 1982)
1 ONSHORE PRIMARY OIL RECOVERY-(1,000 MBPD)	66.0	17*	17*	17*	18*	17	18	17	87
2 ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	0.0	0	0	0	0	0	0	0	0
3 ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	0.0	0	0	0	0	0	0	0	0
4 OFFSHORE OIL RECOVERY (12.5 MBPD)	11.8	3*	3*	3*	3*	4*	3	3	16
6 HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	0.0	0	0	0	0	0	0	0	0
7 LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	2.0	0	0	0	0	0	0	1	1
19 ONSHORE CONVENTIONAL GAS RECOVERY (100 MMCF/D)	0.4	1*	0	0	1*	0	0	0	1
20 ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	0.0	0	0	0	0	0	0	0	0
21 OFFSHORE GAS RECOVERY (25 MMCF/D)	-0.0	0	0	0	0	0	0	0	0
24 LNG EXPORT (3030 MMCF/D)	0.0	0	0	0	0	0	0	0	0
27 UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	0.0	0	0	0	0	0	0	0	0
37 SURFACE URANIUM MINE (275.4 M TONNES/Y)	0.0	0	0	0	0	0	0	0	0
38 UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	0.0	0	0	0	0	0	0	0	0
39 URANIUM MILL (275.4 M TONNES/Y)	0.0	0	0	0	0	0	0	0	0
42 LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	0.0	0	0	0	0	0	0	0	0
43 LWR FUEL FABRICATION - PU RECYCLE (150 MTH/Y)	0.0	0	0	0	0	0	0	0	0
49 HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	0.0	0	0	0	0	0	0	0	0
50 OIL-FIRED POWER PLANT (800 MWE)	0.0	0	0	0	0	0	0	0	0
51 OIL-FIRED POWER PLANT (600 MWE)	0.0	0	0	0	0	1*	1*	0	2
52 OIL-FIRED POWER PLANT (450 MWE)	3.2	0	0	0	1*	0	0	0	1
53 COAL FIRED POWER PLANT-LOW BTU (800 MWE)	0.0	0	0	0	0	0	0	0	0
54 COAL FIRED POWER PLANT-HIGH BTU (800 MWE)	0.0	0	0	0	0	0	0	0	0
55 COAL FIRED POWER PLANT-LOW BTU (600 MWE)	0.0	0	0	0	0	0	0	0	0
56 COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	0.0	0	0	0	0	0	0	0	0
59 HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	0.0	0	0	0	0	0	0	0	0
60 HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	0.0	0	0	0	0	0	0	0	0
61 COMBINED CYCLE POWER PLANT (400 MWE)	0.0	0	0	0	0	0	0	0	0
62 GAS TURBINE POWER PLANT (133 MWE)	1.0	0	1*	1*	0	0	0	0	1
63 FUEL CELLS (26 MWE)	0.0	0	0	0	0	0	0	0	0
64 LIGHT WATER REACTOR (LWR) (1200 MWE)	0.0	0	0	0	0	0	0	0	0
65 LIGHT WATER REACTOR (LWR) (900 MWE)	0.0	0	0	0	0	0	0	0	0
66 LIGHT WATER REACTOR (LWR) (600 MWE)	0.0	0	0	0	0	0	0	0	0
67 DAM & HYDROELECTRIC POWER PLANT (200 MWE)	12.2	0	0	0	0	0	0	0	0
68 PUMPED STORAGE (500 MWE)	0.0	0	0	0	0	0	0	0	0
69 GEOTHERMAL POWER COMPLEX (200 MWE)	0.0	0	0	0	0	0	0	0	0

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 36 (Continued)

SCHEDULE OF ANNUAL ENERGY FACILITIES ADDITIONS TO SUPPLY FUEL MIX: EGYPT - ACC. Renewable Resources 1976-2010

FACILITY NAME	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	TOTAL ADDED (1978- 1993)
1 ONSHORE PRIMARY OIL RECOVERY-(1,000 MBPD)	17	16	16	14	13	14	13	13	14	13	14	244
2 ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	0	0	0	0	0	0	0	0	0	0	0	0
3 ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	0	0	0	0	0	0	0	0	0	0	0	0
4 OFFSHORE OIL RECOVERY (12.5 MBPD)	3	3	3	3	2	3	2	3	2	3	2	45
6 HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	0	0	0	0	0	0	0	0	0	0	0	0
7 LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	0	0	0	1	0	0	0	1	0	0	0	3
19 ONSHORE CONVENTIONAL GAS RECOVERY (100 MMCF/D)	1	0	0	0	0	1	0	0	0	0	1	4
20 ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0	0
21 OFFSHORE GAS RECOVERY (25 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0	0
24 LNG EXPORT (3030 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0	0
27 UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0	0
37 SURFACE URANIUM MINE (275.4 M TONNES/Y)	0	0	0	0	0	1	0	0	0	1	0	2
38 UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0	0
39 URANIUM MILL (275.4 M TONNES/Y)	0	0	0	0	0	1	0	0	0	1	0	2
42 LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	0	0	0	0	0	0	0	0	0	0	0	0
43 LWR FUEL FABRICATION - PU RECYCLE (150 MTH/Y)	0	0	0	0	0	0	0	0	0	0	0	0
49 HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	0	0	0	0	0	0	0	0	0	0	0	0
50 OIL-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
51 OIL-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	0	0	0	0	2
52 OIL-FIRED POWER PLANT (450 MWE)	0	0	0	0	0	0	0	0	0	0	0	1
53 COAL FIRED POWER PLANT-LOW BTU (800 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
54 COAL FIRED POWER PLANT-HIGH BTU (800 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
55 COAL FIRED POWER PLANT-LOW BTU (600 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
56 COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
59 HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
60 HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
61 COMBINED CYCLE POWER PLANT (400 MWE)	0	1	1	0	0	0	0	0	0	0	0	2
62 GAS TURBINE POWER PLANT (133 MWE)	0	0	0	0	0	0	0	0	0	0	0	1
63 FUEL CELLS (26 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
64 LIGHT WATER REACTOR (LWR) (1200 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
65 LIGHT WATER REACTOR (LWR) (900 MWE)	0	0	0	0	0	0	0	1	0	1	1	3
66 LIGHT WATER REACTOR (LWR) (600 MWE)	0	0	0	1*	0	1	1	0	0	0	0	3
67 DAM & HYDROELECTRIC POWER PLANT (200 MWE)	0	0	0	0	0	1	0	0	0	0	0	1
68 PUMPED STORAGE (500 MWE)	0	0	0	0	0	0	0	1	0	0	0	1
69 GEOTHERMAL POWER COMPLEX (200 MWE)	0	0	0	0	0	0	0	0	0	0	0	0

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 36 (Continued)

SCHEDULE OF ANNUAL ENERGY FACILITIES ADDITIONS TO SUPPLY FUEL MIX: EGYPT - ACC. Renewable Resources 1976-2010

FACILITY NAME	1994	1995	1996	1997	1998	1999	2000	TOTAL ADDED (1978- 2000)
1 ONSHORE PRIMARY OIL RECOVERY-(1,000 MHPD)	13	14	14	14	14	15	14	342
2 ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	0	0	0	0	0	0	0	0
3 ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	0	0	0	0	0	0	0	0
4 OFFSHORE OIL RECOVERY (12.5 MBPD)	3	2	3	3	2	3	3	64
6 HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	0	0	0	0	0	0	0	0
7 LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	1	0	0	0	1	0	0	5
19 ONSHORE CONVENTIONAL GAS RECOVERY (100 MMCF/D)	0	0	0	0	1	0	0	5
20 ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	0	0	0	0	0	0	0	0
21 OFFSHORE GAS RECOVERY (25 MMCF/D)	0	0	0	0	0	0	0	0
24 LNG EXPORT (3030 MMCF/D)	0	0	0	0	0	0	0	0
27 UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	0	0	0	0	0	0	0	0
37 SURFACE URANIUM MINE (275.4 M TONNES/Y)	0	1	0	1	0	0	0	4
38 UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	0	0	0	0	0	0	0	0
39 URANIUM MILL (275.4 M TONNES/Y)	0	1	0	1	0	0	0	4
42 LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	0	0	0	0	0	0	0	0
43 LWR FUEL FABRICATION - PU RECYCLE (150 MTH/Y)	0	0	0	0	0	0	0	0
49 HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	0	0	0	0	0	0	0	0
50 OIL-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0
51 OIL-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	2
52 OIL-FIRED POWER PLANT (450 MWE)	0	0	0	0	0	0	0	1
53 COAL FIRED POWER PLANT-LOW BTU (800 MWE)	0	0	0	0	0	0	0	0
54 COAL FIRED POWER PLANT-HIGH BTU (800 MWE)	0	0	0	0	0	0	0	0
55 COAL FIRED POWER PLANT-LOW BTU (600 MWE)	0	0	0	0	0	0	0	0
56 COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	0	0	0	0	0	0	0	0
59 HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0
60 HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	0
61 COMBINED CYCLE POWER PLANT (400 MWE)	0	0	0	0	0	0	0	2
62 GAS TURBINE POWER PLANT (133 MWE)	0	0	0	0	0	0	0	1
63 FUEL CELLS (26 MWE)	0	0	0	0	0	0	0	0
64 LIGHT WATER REACTOR (LWR) (1200 MWE)	0	1	1	1	1	1	1	6
65 LIGHT WATER REACTOR (LWR) (900 MWE)	1	0	0	0	0	0	0	4
66 LIGHT WATER REACTOR (LWR) (600 MWE)	0	0	0	0	0	0	0	3
67 DAM & HYDROELECTRIC POWER PLANT (200 MWE)	0	0	0	0	0	0	0	1
68 PUMPED STORAGE (500 MWE)	1	0	0	1	1	1	0	5
69 GEOTHERMAL POWER COMPLEX (200 MWE)	0	0	0	0	0	0	0	0

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

HECHTEL ENERGY SUPPLY PLANNING MODEL

Table 36 (Continued)

SCHEDULE OF ANNUAL TRANSPORTATION ADDITIONS TO SUPPLY FUEL MIX: EGYPT - ACC. Renewable Resources 1976-2010

FACILITY NAME	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	TOTAL ADDED (1978- 1993)
1 CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0	0
3 OIL TANKER (90,000 DWT; 620,000 B)	0	0	0	0	0	0	0	0	0	0	0	0
4 OIL BARGES (90,000 BRL)	0	1	0	1	0	0	1	0	0	0	0	7
5 OIL TANK TRUCK (226 BBL)	168	179	179	176	182	186	188	189	187	184	181	2674
6 PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	1	0	0	0	0	0	0	0	0	0	0	1
7 HOT OIL PIPELINE (40 MB/D, 80.5 KM)	1	0	0	1	0	0	1	0	0	0	1	5
8 REFINED PRODUCTS BULK STATION (69 MB/D)	0	0	1	0	0	0	0	1	0	0	0	3
9 RAIL LINE (64.4 KM, SINGLE TRACK)	0	0	0	0	0	0	0	0	0	0	0	0
10 MIXED TRAIN (6556 TONNES)	0	0	1	0	1	0	1	1	1	1	1	8
11 COAL UNIT TRAIN (9,528 TONNES)	0	0	0	0	0	0	0	0	0	0	0	0
12 COAL SLURRY PIPELINE (22.69 MM TONNES/Y, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0	0
13 COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0	0
14 COAL SLURRY DEWATERING (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0	0
15 COAL BARGES (19,048 TONNES)	0	0	0	0	0	0	0	1	0	0	0	1
16 COAL TRUCK (22.7 TONNES)	2	1	2	2	2	3	3	3	3	3	4	33
17 GAS PIPELINE (.87 BSCF/D, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0	0
18 GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	0	0	0	0	0	0	0	0	0	0	0	3
20 LNG TANKER (2.6 BCF)	0	0	0	0	0	0	0	0	0	0	0	0
21 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	0	0	0	1	0	0	0	1	0	0	0	3
22 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	0	0	0	0	0	0	0	0	0	0	0	0
23 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	1	0	0	0	0	0	0	0	0	0	0	1
24 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	0	0	0	0	0	0	0	0	0	0	0	0
25 +-400 KVDC TRANSMISSION LINE (1500 MWE, 1287 KM)	0	0	0	0	0	0	0	0	0	0	0	0
26 ELECTRICITY DISTRIBUTION-AERIAL LINES(131.6MWE)	3	4	3	4	3	4	4	4	5	4	5	53

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

BECHTEL ENERGY SUPPLY PLANNING MODEL

SCHEDULE OF ANNUAL TRANSPORTATION ADDITIONS TO SUPPLY FUEL MIX: EGYPT - ACC. Renewable Resources 1976-2010

Table 36 (Continued)

FACILITY NAME	1994	1995	1996	1997	1998	1999	2000	TOTAL ADDED (1978- 2000)
1 CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	0	0	0	0	0	0	0	0
3 OIL TANKER (90,000 DWT; 620,000 B)	0	0	0	0	0	0	0	0
4 OIL BARGES (90,000 BBL)	0	0	0	0	0	0	0	7
5 OIL TANK TRUCK (226 BBL)	174	166	157	146	134	119	104	3674
6 PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	0	0	0	0	0	0	0	1
7 HOT OIL PIPELINE (40 MB/D, 80.5 KM)	0	0	0	0	0	1	0	6
8 REFINED PRODUCTS BULK STATION (69 MB/D)	0	0	1	0	0	0	0	4
9 RAIL LINE (64.4 KM, SINGLE TRACK)	0	0	0	0	0	0	0	0
10 MIXED TRAIN (6556 TONNES)	1	1	2	1	1	1	2	17
11 COAL UNIT TRAIN (9,528 TONNES)	0	0	0	0	0	0	0	0
12 COAL SLURRY PIPELINE (22.69 MM TONNES/Y, 241.4 KM)	0	0	0	0	0	0	0	0
13 COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0
14 COAL SLURRY Dewatering (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0
15 COAL BARGES (19,048 TONNES)	0	0	0	0	0	0	0	1
16 COAL TRUCK (22.7 TONNES)	4	4	5	5	5	5	6	67
17 GAS PIPELINE (1.87 BSCF/D, 241.4 KM)	0	0	0	0	0	0	0	0
18 GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	0	0	0	0	0	0	0	3
20 LNG TANKER (2.6 BCF)	0	0	0	0	0	0	0	0
21 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	1	0	0	0	1	0	0	5
22 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	0	0	0	0	0	0	0	0
23 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	1	0	0	0	0	0	0	2
24 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	0	0	0	0	0	0	0	0
25 +/-400 KVDC TRANSMISSION LINE (1500 MWE, 1287 KM)	0	0	0	0	0	0	0	0
26 ELECTRICITY DISTRIBUTION-AERIAL LINES (131.6 MWE)	4	5	5	5	6	5	6	89

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 36 (Continued)

SCHEDULE OF ANNUAL TRANSPORTATION ADDITIONS TO SUPPLY FUEL MIX; EGYPT - ACC. Renewable Resources 1976-2010

FACILITY NAME	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL ADDED (1978- 2010)
1 CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0
3 OIL TANKER (90,000 DWT, 620,000 B)	0	0	0	0	0	0	0	0	0	0	0
4 OIL BARGES (90,000 BBL)	0	0	0	0	0	0	0	0	0	0	7
5 OIL TANK TRUCK (226 BBL)	104	104	104	104	104	104	104	104	104	104	4714
6 PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	0	0	0	0	0	0	0	0	0	0	1
7 HOT OIL PIPELINE (40 MB/D, 80.5 KM)	0	0	0	0	0	1	0	0	0	0	7
8 REFINED PRODUCTS BULK STATION (69 MB/D)	0	0	0	0	0	1	0	0	0	0	5
9 RAIL LINE (64.4 KM, SINGLE TRACK)	0	0	0	0	0	0	0	0	0	0	0
10 MIXED TRAIN (6556 TONNES)	2	2	2	2	2	2	2	2	2	2	37
11 COAL UNIT TRAIN (9,528 TONNES)	0	0	0	0	0	0	0	0	0	0	0
12 COAL SLURRY PIPELINE (22.69 MM TONNES/Y, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0
13 COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0
14 COAL SLURRY DEWATERING (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0
15 COAL BARGES (19,048 TONNES)	0	0	0	0	0	0	0	0	0	0	1
16 COAL TRUCK (22.7 TONNES)	6	6	6	6	6	6	6	6	6	6	127
17 GAS PIPELINE (1.87 BSCF/D, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0
18 GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	0	0	0	0	0	0	0	0	0	0	3
20 LNG TANKER (2.6 BCF)	0	0	0	0	0	0	0	0	0	0	0
21 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	0	0	0	0	0	1	0	0	0	0	6
22 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	0	0	0	0	0	0	0	0	0	0	0
23 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	0	0	0	0	0	0	0	0	0	0	2
24 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	0	0	0	0	0	0	0	0	0	0	0
25 +-400 KVDC TRANSMISSION LINE (1500 MWE, 1287 KM)	0	0	0	0	0	0	0	0	0	0	0
26 ELECTRICITY DISTRIBUTION-AERIAL LINES (131.6MWE)	6	6	6	6	6	6	6	6	6	6	149

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

BECHTEL ENERGY SUPPLY PLANNING MODEL

CUMULATIVE CAPITAL REQUIREMENTS (MILLION POUNDS, JAN 1978) OF THE ENERGY INDUSTRY
BY FACILITY GROUPING

(1978-1985)

Egypt - Acc. Renewable Resources

Table 36 (Continued)

FACILITY	CONSTRUCTION COSTS	OWNER'S COSTS PRIOR TO STARTUP	TOTAL
OIL			
EXPLORATION, DEVELOPMENT, & PRODUCTION	643.2	98.9	742.1
REFINING AND PROCESSING	436.4	70.0	506.4
PIPELINES	35.4	6.0	41.4
TANKERS, BARGES, TRUCKS	117.1	20.5	137.6
BULK STATIONS	9.7	1.6	11.3
OTHER	0.0	0.0	0.0
TOTAL OIL	1241.7	197.1	1438.7
OIL SHALE	0.0	0.0	0.0
GAS			
EXPLORATION, DEVELOPMENT, & PRODUCTION	7.3	1.1	8.4
GEOPRESSURED METHANE	0.0	0.0	0.0
PIPELINES	0.0	0.0	0.0
LNG TANKERS	0.0	0.0	0.0
DISTRIBUTION	39.5	6.7	46.2
OTHER	0.0	0.0	0.0
TOTAL GAS	46.8	7.8	54.7
COAL			
UNDERGROUND MINING	0.0	0.0	0.0
SURFACE MINING	0.0	0.0	0.0
RAIL	11.1	1.9	12.9
PIPELINES	0.0	0.0	0.0
BARGES, TRUCKS	0.6	0.1	0.7
TOTAL COAL	11.6	2.0	13.6
COAL SYNTHETICS			
LIQUEFACTION	0.0	0.0	0.0
METHANOL	0.0	0.0	0.0
SOLVENT REFINING	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.0	0.0	0.0
TOTAL SYNTHETICS	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	8.0	1.2	9.2
SOLAR	0.0	0.0	0.0
ELECTRIC UTILITIES			
COAL-FIRED	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.0	0.0	0.0
NUCLEAR	829.4	93.4	922.8
HYDRO & PUMPED STORAGE	46.5	4.9	51.4
OIL & GAS	289.0	32.7	321.7
GEOTHERMAL	0.0	0.0	0.0
TOTAL GENERATION	1164.9	130.9	1295.9
TRANSMISSION	270.8	31.4	302.2
DISTRIBUTION	233.5	26.6	260.1
TOTAL UTILITIES	1669.2	189.0	1858.2
TOTAL ENERGY INDUSTRY	2977.3	397.0	3374.4

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 36 (Continued)

CUMULATIVE CAPITAL REQUIREMENTS (MILLION POUNDS, JAN 1978) OF THE ENERGY INDUSTRY
BY FACILITY GROUPING
Egypt - Acc. Renewable Resources

(1978-2000)

FACILITY	CONSTRUCTION COSTS	OWNER'S COSTS PRIOR TO STARTUP	TOTAL
OIL			
EXPLORATION, DEVELOPMENT, & PRODUCTION	1665.8	256.2	1922.0
REFINING AND PROCESSING	1265.5	203.0	1468.4
PIPELINES	68.6	11.7	80.3
TANKERS, BARGES, TRUCKS	327.9	57.4	385.3
BULK STATIONS	21.3	3.6	24.9
OTHER	0.0	0.0	0.0
TOTAL OIL	3349.1	531.9	3881.0
OIL SHALE	0.0	0.0	0.0
GAS			
EXPLORATION, DEVELOPMENT, & PRODUCTION	20.2	3.1	23.3
GEOPRESSURED METHANE	0.0	0.0	0.0
PIPELINES	0.0	0.0	0.0
LNG TANKERS	0.0	0.0	0.0
DISTRIBUTION	39.5	6.7	46.2
OTHER	0.0	0.0	0.0
TOTAL GAS	59.7	9.8	69.5
COAL			
UNDERGROUND MINING	0.0	0.0	0.0
SURFACE MINING	0.0	0.0	0.0
RAIL	62.7	10.7	73.3
PIPELINES	0.0	0.0	0.0
BARGES, TRUCKS	8.1	1.4	9.5
TOTAL COAL	70.8	12.0	82.9
COAL SYNTHETICS			
LIQUEFACTION	0.0	0.0	0.0
METHANOL	0.0	0.0	0.0
SOLVENT REFINING	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.0	0.0	0.0
TOTAL SYNTHETICS	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	93.5	14.0	107.5
SOLAR	0.0	0.0	0.0
ELECTRIC UTILITIES			
COAL-FIRED	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.0	0.0	0.0
NUCLEAR	6984.7	786.5	7771.2
HYDRO & PUMPED STORAGE	922.9	96.9	1019.8
OIL & GAS	289.0	32.7	321.7
GEOTHERMAL	0.0	0.0	0.0
TOTAL GENERATION	8196.6	916.0	9112.7
TRANSMISSION	599.9	69.6	669.5
DISTRIBUTION	943.5	107.6	1051.1
TOTAL UTILITIES	9740.1	1093.2	10833.3
TOTAL ENERGY INDUSTRY	13313.2	1660.9	14974.2

GROWTH IN REQUIREMENTS FOR CONSTRUCTOR COST TOTAL ## (MILLION POUNDS, JANUARY 1978)
 FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
 For The Egypt - Acc. Renewable Resources Case

CATEGORY	ANNUAL REQUIREMENTS				AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1976-2000 AVERAGE	PEAK YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
OIL								
EXPLORATION, DEVELOPMENT, & PRODUCTION	82.	73.	72.	88. (1979)	0.6	-3.9	0.4	-0.5
REFINING AND PROCESSING	0.	87.	55.	87. (1980)	9999.0	-12.9	4.7	9999.0
PIPELINES	2.	0.	3.	21. (1982)	-100.0	9999.0	-100.0	-100.0
TANKERS, BARGES, TRUCKS	14.	9.	14.	19. (1989)	-7.0	6.8	-3.6	-2.1
BULK STATIONS	0.	0.	1.	4. (1978)	0.0	0.0	0.0	0.0
OTHER	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TOTAL OIL	98.	168.	146.	186. (1984)	16.8	-5.6	1.4	2.3
OIL SHALE	0.	0.	0.	0.	0.0	0.0	0.0	0.0
GAS								
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	0.	1.	3. (1978)	0.0	0.0	0.0	0.0
GEOPRESSURED METHANE	0.	0.	0.	0.	0.0	0.0	0.0	0.0
PIPELINES	0.	0.	0.	0.	0.0	0.0	0.0	0.0
LNG TANKERS	0.	0.	0.	0.	0.0	0.0	0.0	0.0
DISTRIBUTION	20.	0.	2.	20. (1976)	-25.0	-100.0	0.0	-100.0
OTHER	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TOTAL GAS	20.	0.	3.	20. (1976)	-25.0	-100.0	0.0	-100.0
COAL								
UNDERGROUND MINING	0.	0.	0.	0.	0.0	0.0	0.0	0.0
SURFACE MINING	0.	0.	0.	0.	0.0	0.0	0.0	0.0
RAIL	0.	7.	3.	7. (1996)	0.0	9999.0	4.7	9999.0
PIPELINES	0.	0.	0.	0.	0.0	0.0	0.0	0.0
BARGES, TRUCKS	0.	0.	0.	4. (1990)	0.0	14.9	7.6	7.8
TOTAL COAL	0.	8.	3.	8. (1990)	0.0	130.7	4.8	22.6
COAL SYNTHETICS								
LIQUEFACTION	0.	0.	0.	0.	0.0	0.0	0.0	0.0
METHANOL	0.	0.	0.	0.	0.0	0.0	0.0	0.0
SOLVENT REFINING	0.	0.	0.	0.	0.0	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.0	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TOTAL SYNTHETICS	0.	0.	0.	0.	0.0	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	0.	11.	4.	11. (1991)	0.0	9999.0	8.0	9999.0
SOLAR	0.	0.	0.	0.	0.0	0.0	0.0	0.0
ELECTRIC UTILITIES								
COAL-FIRED	0.	0.	0.	0.	0.0	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.0	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.0	0.0	0.0	0.0
NUCLEAR	0.	491.	304.	491. (2000)	9999.0	44.1	5.0	9999.0
HYDRO & PUMPED STORAGE	0.	66.	40.	94. (1995)	0.0	9999.0	3.7	9999.0
OIL & GAS	78.	0.	13.	104. (1977)	-21.4	-100.0	0.0	-100.0
GEOTHERMAL	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TOTAL GENERATION	78.	557.	356.	557. (1995)	-3.6	32.2	4.9	8.5
TRANSMISSION	0.	0.	26.	127. (1993)	0.0	9999.0	-100.0	0.0
DISTRIBUTION	12.	58.	41.	58. (1999)	20.1	6.7	3.5	6.8
TOTAL UTILITIES	91.	615.	423.	697. (1993)	0.6	29.9	4.0	8.3
TOTAL ENERGY INDUSTRY	208.	802.	579.	835. (1993)	7.8	11.6	3.4	5.8

CONSTRUCTOR COST TOTAL DOES NOT INCLUDE OWNER'S COSTS

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 36 (Continued)

GROWTH IN REQUIREMENTS FOR CONSTRUCTOR COST TOTAL ** (MILLION POUNDS, JANUARY 1978)
 FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
 For The Egypt - Acc. Renewable Resources Case

RESOURCES	1976	1977	1978	1979	1980	1981	1982
OIL							
EXPLORATION, DEVELOPMENT, & PRODUCTION	82.	85.	87.	88.	84.	82.	81.
REFINING AND PROCESSING	0.	0.	22.	65.	87.	44.	22.
PIPELINES	2.	9.	0.	0.	0.	4.	21.
TANKERS, BARGES, TRUCKS	14.	18.	14.	14.	11.	15.	16.
BULK STATIONS	0.	2.	4.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL OIL	98.	114.	127.	167.	182.	144.	139.
OIL SHALE	0.	0.	0.	0.	0.	0.	0.
GAS							
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	1.	3.	0.	0.	1.	3.
GEOPRESSURED METHANE	0.	0.	0.	0.	0.	0.	0.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
LNG TANKERS	0.	0.	0.	0.	0.	0.	0.
DISTRIBUTION	20.	13.	15.	12.	6.	6.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL GAS	20.	14.	18.	12.	6.	8.	3.
COAL							
UNDERGROUND MINING	0.	0.	0.	0.	0.	0.	0.
SURFACE MINING	0.	0.	0.	0.	0.	0.	0.
RAIL	0.	0.	4.	0.	0.	0.	4.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
BARGES, TRUCKS	0.	0.	0.	0.	0.	0.	0.
TOTAL COAL	0.	0.	4.	0.	0.	0.	4.
COAL SYNTHETICS							
LIQUEFACTION	0.	0.	0.	0.	0.	0.	0.
METHANOL	0.	0.	0.	0.	0.	0.	0.
SOLVENT REFINING	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.	0.	0.
TOTAL SYNTHETICS	0.	0.	0.	0.	0.	0.	0.
NUCLEAR FUEL CYCLE	0.	0.	0.	0.	0.	0.	0.
SOLAR	0.	0.	0.	0.	0.	0.	0.
ELECTRIC UTILITIES							
COAL-FIRED	0.	0.	0.	0.	0.	0.	0.
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.	0.	0.
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.	0.	0.
NUCLEAR	0.	3.	5.	11.	38.	66.	118.
HYDRO & PUMPED STORAGE	0.	0.	0.	0.	0.	0.	0.
OIL & GAS	78.	104.	89.	55.	30.	24.	30.
GEOTHERMAL	0.	0.	0.	0.	0.	0.	0.
TOTAL GENERATION	78.	106.	95.	66.	68.	90.	158.
TRANSMISSION	0.	0.	23.	35.	0.	62.	92.
DISTRIBUTION	12.	16.	22.	23.	25.	28.	33.
TOTAL UTILITIES	91.	122.	140.	124.	93.	180.	283.
TOTAL ENERGY INDUSTRY	208.	251.	289.	303.	281.	331.	429.

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** CONSTRUCTOR COST TOTAL DOES NOT INCLUDE OWNER'S COSTS.

MECHANICAL ENERGY SUPPLY PLANNING MODEL

Table 36 (Continued)

GROWTH IN REQUIREMENTS FOR CONSTRUCTOR COST TOTAL ** (MILLION POUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
For The Egypt - Acc. Renewable Resources Case

RESOURCES	1983	1984	1985	1986	1987	1988	1989
OIL							
EXPLORATION, DEVELOPMENT, & PRODUCTION	79.	75.	69.	63.	69.	63.	67.
REFINING AND PROCESSING	65.	87.	44.	22.	65.	87.	44.
PIPELINES	0.	2.	9.	0.	2.	9.	0.
TANKERS, BARGES, TRUCKS	14.	18.	15.	18.	15.	15.	19.
BULK STATIONS	2.	4.	0.	0.	0.	2.	4.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL OIL	160.	186.	136.	103.	151.	177.	134.
OIL SHALE	0.	0.	0.	0.	0.	0.	0.
GAS							
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	0.	0.	1.	3.	0.	0.
GEOPRESSURED METHANE	0.	0.	0.	0.	0.	0.	0.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
LNG TANKERS	0.	0.	0.	0.	0.	0.	0.
DISTRIBUTION	0.	0.	0.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL GAS	0.	0.	0.	1.	3.	0.	0.
COAL							
UNDERGROUND MINING	0.	0.	0.	0.	0.	0.	0.
SURFACE MINING	0.	0.	0.	0.	0.	0.	0.
RAIL	0.	0.	4.	0.	4.	0.	4.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
BARGES, TRUCKS	0.	0.	0.	0.	0.	0.	0.
TOTAL COAL	0.	0.	4.	0.	4.	0.	4.
COAL SYNTHETICS							
LIQUEFACTION	0.	0.	0.	0.	0.	0.	0.
METHANOL	0.	0.	0.	0.	0.	0.	0.
SOLVENT REFINING	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.	0.	0.
TOTAL SYNTHETICS	0.	0.	0.	0.	0.	0.	0.
NUCLEAR FUEL CYCLE	0.	5.	3.	4.	6.	5.	3.
SOLAR	0.	0.	0.	0.	0.	0.	0.
ELECTRIC UTILITIES							
COAL-FIRED	0.	0.	0.	0.	0.	0.	0.
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.	0.	0.
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.	0.	0.
NUCLEAR	153.	203.	235.	253.	257.	289.	345.
HYDRO & PUMPED STORAGE	0.	8.	38.	56.	51.	28.	31.
OIL & GAS	36.	15.	0.	0.	0.	0.	0.
GEOTHERMAL	0.	0.	0.	0.	0.	0.	0.
TOTAL GENERATION	189.	227.	273.	310.	308.	318.	377.
TRANSMISSION	0.	23.	35.	0.	0.	23.	35.
DISTRIBUTION	35.	33.	35.	35.	39.	41.	43.
TOTAL UTILITIES	224.	283.	343.	345.	347.	382.	454.
TOTAL ENERGY INDUSTRY	384.	474.	487.	453.	511.	563.	596.

** CONSTRUCTOR COST TOTAL DOES NOT INCLUDE OWNER'S COSTS.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 36 (Continued)

GROWTH IN REQUIREMENTS FOR CONSTRUCTOR COST TOTAL ** (MILLION POUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
For The Egypt - Acc. Renewable Resources

RESOURCES	1990	1991	1992	1993	1994	1995	1996
OIL							
EXPLORATION, DEVELOPMENT, & PRODUCTION	65.	67.	65.	67.	68.	71.	70.
REFINING AND PROCESSING	22.	65.	87.	44.	22.	65.	87.
PIPELINES	0.	2.	9.	0.	0.	0.	0.
TANKERS, BARGES, TRUCKS	16.	15.	15.	15.	14.	14.	13.
BULK STATIONS	0.	0.	0.	0.	2.	4.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL OIL	102.	150.	177.	126.	106.	154.	170.
OIL SHALE	0.	0.	0.	0.	0.	0.	0.
GAS							
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	1.	3.	0.	0.	0.	1.
GEOPRESSURED METHANE	0.	0.	0.	0.	0.	0.	0.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
LNG TANKERS	0.	0.	0.	0.	0.	0.	0.
DISTRIBUTION	0.	0.	0.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL GAS	0.	1.	3.	0.	0.	0.	1.
COAL							
UNDERGROUND MINING	0.	0.	0.	0.	0.	0.	0.
SURFACE MINING	0.	0.	0.	0.	0.	0.	0.
RAIL	4.	4.	0.	4.	4.	4.	7.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
BARGES, TRUCKS	4.	0.	0.	0.	0.	0.	0.
TOTAL COAL	8.	4.	0.	4.	4.	4.	8.
COAL SYNTHETICS							
LIQUEFACTION	0.	0.	0.	0.	0.	0.	0.
METHANOL	0.	0.	0.	0.	0.	0.	0.
SOLVENT REFINING	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.	0.	0.
TOTAL SYNTHETICS	0.	0.	0.	0.	0.	0.	0.
NUCLEAR FUEL CYCLE	4.	11.	3.	8.	10.	4.	6.
SOLAR	0.	0.	0.	0.	0.	0.	0.
ELECTRIC UTILITIES							
COAL-FIRED	0.	0.	0.	0.	0.	0.	0.
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.	0.	0.
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.	0.	0.
NUCLEAR	384.	428.	449.	459.	463.	463.	463.
HYDRO & PUMPED STORAGE	31.	38.	44.	66.	81.	94.	91.
OIL & GAS	0.	0.	0.	0.	0.	0.	0.
GEOTHERMAL	0.	0.	0.	0.	0.	0.	0.
TOTAL GENERATION	416.	466.	492.	524.	545.	557.	554.
TRANSMISSION	0.	0.	85.	127.	0.	0.	23.
DISTRIBUTION	44.	43.	44.	45.	48.	51.	52.
TOTAL UTILITIES	460.	508.	622.	697.	593.	608.	630.
TOTAL ENERGY INDUSTRY	574.	674.	805.	835.	712.	769.	815.

** CONSTRUCTOR COST TOTAL DOES NOT INCLUDE OWNER'S COSTS.

MECHTEL ENERGY SUPPLY PLANNING MODEL

Table 36 (Continued)

GROWTH IN REQUIREMENTS FOR CONSTRUCTOR COST TOTAL ** (MILLION EPOUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
For The Egypt - Acc. Renewable Resources

RESOURCES	1997	1998	1999	2000	TOTAL 1978-2000
OIL					
EXPLORATION, DEVELOPMENT, & PRODUCTION	69.	75.	73.	73.	1666.
REFINING AND PROCESSING	44.	22.	65.	87.	1265.
PIPELINES	2.	9.	0.	0.	69.
TANKERS, BARGES, TRUCKS	12.	11.	10.	9.	328.
BULK STATIONS	0.	0.	0.	0.	21.
OTHER	0.	0.	0.	0.	0.
TOTAL OIL	126.	117.	148.	168.	3349.
OIL SHALE	0.	0.	0.	0.	0.
GAS					
EXPLORATION, DEVELOPMENT, & PRODUCTION	3.	0.	0.	0.	20.
GEOPRESSURED METHANE	0.	0.	0.	0.	0.
PIPELINES	0.	0.	0.	0.	0.
LNG TANKERS	0.	0.	0.	0.	0.
DISTRIBUTION	0.	0.	0.	0.	40.
OTHER	0.	0.	0.	0.	0.
TOTAL GAS	3.	0.	0.	0.	60.
COAL					
UNDERGROUND MINING	0.	0.	0.	0.	0.
SURFACE MINING	0.	0.	0.	0.	0.
RAIL	4.	4.	4.	7.	63.
PIPELINES	0.	0.	0.	0.	0.
BARGES, TRUCKS	0.	0.	0.	0.	8.
TOTAL COAL	4.	4.	4.	8.	71.
COAL SYNTHETICS					
LIQUEFACTION	0.	0.	0.	0.	0.
METHANOL	0.	0.	0.	0.	0.
SOLVENT REFINING	0.	0.	0.	0.	0.
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.
TOTAL SYNTHETICS	0.	0.	0.	0.	0.
NUCLEAR FUEL CYCLE	5.	3.	4.	11.	94.
SOLAR	0.	0.	0.	0.	0.
ELECTRIC UTILITIES					
COAL-FIRED	0.	0.	0.	0.	0.
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.
NUCLEAR	463.	468.	477.	491.	6985.
HYDRO & PUMPED STORAGE	75.	66.	59.	66.	923.
OIL & GAS	0.	0.	0.	0.	289.
GEOTHERMAL	0.	0.	0.	0.	0.
TOTAL GENERATION	538.	534.	537.	557.	8197.
TRANSMISSION	35.	0.	0.	0.	600.
DISTRIBUTION	54.	55.	58.	58.	944.
TOTAL UTILITIES	628.	589.	595.	615.	9740.
TOTAL ENERGY INDUSTRY	765.	713.	750.	802.	13313.

** CONSTRUCTOR COST TOTAL DOES NOT INCLUDE OWNER'S COSTS.

BECHTEL ENERGY SUPPLY PLANNING MODEL

GROWTH IN CAPITAL REQUIREMENTS* (MILLION POUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
Egypt - Acc. Renewable Resources

Table 36 (Continued)

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)				
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000	
NON-MANUAL TECHNICAL MANPOWER	12.	80.	54.	80.	(1996)	18.4	14.7	3.9	8.4	
NON-MANUAL NON-TECHNICAL MANPOWER	1.	16.	10.	16.	(2000)	20.4	24.2	4.5	10.9	
MANUAL MANPOWER	17.	88.	62.	91.	(1993)	13.4	13.0	3.6	7.1	
MANPOWER TOTAL	30.	183.	126.	185.	(1993)	15.7	14.4	3.8	7.8	
WOOD PRODUCTS (20)	2.	11.	8.	11.	(2000)	16.9	10.4	4.0	7.4	
CHEMICALS & ALLIED PROD. (27,28,30,32)	3.	3.	3.	4.	(1998)	-4.9	9.2	-2.1	-0.3	
PETROLEUM PRODUCTS (31)	6.	7.	6.	8.	(1996)	-7.8	4.2	2.6	1.1	
GLASS, CLAY & STONE PRODUCTS (35,36)	4.	19.	14.	24.	(1993)	12.5	16.0	3.4	7.4	
PRIMARY IRON & STEEL PRODUCTS (37)	19.	21.	19.	21.	(1992)	2.8	-4.1	1.3	0.4	
PRIMARY NON-FERROUS METALS (38)	2.	13.	14.	36.	(1993)	18.3	27.8	-0.2	8.1	
FABRICATED STRUCTURAL PRODUCTS (40) *	5.	42.	34.	68.	(1993)	14.1	31.5	1.5	9.2	
OTHER FABRICATED PRODUCTS (42)	6.	20.	14.	20.	(2000)	11.5	4.5	4.0	5.3	
MATERIALS TOTAL	46.	136.	110.	180.	(1993)	6.2	11.8	1.9	4.6	
HVAC HEATING & COOLING UNITS (52) ++	0.	6.	3.	6.	(2000)	50.7	30.9	4.8	16.6	
HVAC DUCTWORK & ACCESSORIES (40) *	0.	2.	1.	2.	(2000)	37.3	36.7	4.9	15.9	
TURBINES (43)	26.	65.	44.	65.	(1996)	-8.4	13.6	4.3	3.9	
GAS WELDING SETS (47) ++	0.	0.	0.	0.	(1980)	4.1	-9.8	1.9	-0.3	
ELECTRIC WELDING SETS (53) **	0.	1.	1.	1.	(2000)	16.5	12.6	4.1	7.8	
CONSTRUCTION, MINING & OIL FIELD EQP (45)	37.	55.	48.	62.	(1993)	-0.1	5.6	1.0	1.7	
MATERIALS HANDLING EQUIPMENT (46)	0.	3.	2.	3.	(2000)	9.7	23.9	4.3	9.0	
GENERAL INDUSTRY EQUIPMENT (49)	3.	14.	10.	14.	(2000)	42.6	-6.3	3.9	7.2	
INSTRUMENTATION & CONTROLS (62)	2.	10.	7.	10.	(2000)	34.4	2.1	3.4	7.7	
ELECTRICAL EQUIPMENT (53) **	4.	29.	21.	31.	(1993)	22.1	12.3	4.1	8.6	
FABRICATED PLATE PRODUCTS (40) *	13.	96.	62.	96.	(2000)	22.5	10.1	4.9	8.7	
EQUIPMENT TOTAL	84.	281.	198.	281.	(2000)	7.1	8.2	3.6	5.1	
MISCELLANEOUS MATERIALS & EQUIPMENT	9.	12.	10.	12.	(2000)	6.1	-3.5	1.8	1.4	
MOBILE FACILITY	14.	16.	17.	23.	(1990)	-7.0	11.7	-0.9	0.6	
OTHER CONSTRUCTOR COSTS	26.	174.	116.	182.	(1993)	9.2	18.9	4.7	8.3	
CONSTRUCTOR COST TOTAL **	208.	802.	579.	835.	(1993)	7.8	11.6	3.4	5.8	

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

*BEA (BUREAU OF ECONOMIC ANALYSIS) TWO-DIGIT CATEGORIES ARE IN PARENTHESIS.

* PARTIAL BEA CATEGORY 40, TOTAL IS SUM OF 3 SEPARATE ENTRIES FOR CATEGORY 40.

++ PARTIAL BEA CATEGORY 52, REMAINDER IS PART OF MISCELLANEOUS ENTRY.

** PARTIAL BEA CATEGORY 53, TOTAL IS SUM OF 2 SEPARATE ENTRIES FOR CATEGORY 53.

** CONSTRUCTION CAPITAL COST TOTAL INCLUDES MANPOWER, MATERIALS AND EQUIPMENT SUBTOTALS ABOVE PLUS OTHER (OVERHEAD, PROFIT, ETC.) COSTS, IT EXCLUDES OWNER'S COSTS, (LAND COSTS, INTEREST DURING CONSTRUCTION, ETC.)

BECHTEL ENERGY SUPPLY PLANNING MODEL

GROWTH IN MANPOWER REQUIREMENTS (MAN-YEARS)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
Egypt - Acc. Renewable Resources

Table 36 (Continued)

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
CHEMICAL ENGINEERS	0.	18.	22.	39.	(1987)	9999.0	-24.2	10.1	9999.0
CIVIL ENGINEERS	96.	738.	496.	738.	(2000)	9.9	22.2	4.5	8.9
ELECTRICAL ENGINEERS	87.	598.	438.	721.	(1992)	13.1	18.8	3.9	8.4
MECHANICAL ENGINEERS	62.	445.	311.	468.	(1999)	17.1	11.6	5.4	8.5
MINING ENGINEERS	0.	4.	2.	5.	(1994)	0.0	9999.0	1.9	9999.0
NUCLEAR ENGINEERS	0.	58.	32.	58.	(2000)	9999.0	31.0	6.0	9999.0
GEOLOGICAL ENGINEERS	29.	38.	34.	40.	(1994)	0.6	2.6	0.8	1.1
PETROLEUM ENGINEERS	29.	25.	26.	32.	(1978)	0.6	-4.7	0.4	-0.7
OTHER ENGINEERS	1.	12.	14.	24.	(1991)	71.2	-4.5	4.0	11.0
ENGINEERS TOTAL	305.	1936.	1375.	1996.	(1992)	12.7	15.7	4.4	8.0
DESIGNERS & DRAFTSMEN	115.	756.	566.	806.	(1999)	17.9	12.1	4.5	8.2
SUPERVISORS & MANAGERS	96.	407.	282.	413.	(1995)	0.8	17.4	4.2	6.2
NON-MANUAL, TECHNICAL TOTAL	515.	3099.	2224.	3168.	(1992)	12.0	15.0	4.4	7.8
NON-MANUAL, NON-TECHNICAL	346.	2890.	1863.	2890.	(2000)	13.6	18.8	5.1	9.2
NON-MANUAL TOTAL	861.	5990.	4087.	5990.	(2000)	12.7	16.6	4.7	8.4
PIPEFITTERS	748.	3877.	2366.	3877.	(2000)	27.0	-2.7	5.7	7.1
PIPEFITTER/WELDERS	391.	1646.	1044.	1646.	(2000)	17.8	-0.0	5.4	6.2
ELECTRICIANS	356.	3587.	2266.	3659.	(1996)	22.2	15.1	5.5	10.1
BOILERMAKERS	309.	481.	330.	533.	(1977)	1.3	-9.2	6.0	1.9
BOILERMAKER/WELDERS	103.	379.	242.	477.	(1996)	-8.5	19.9	5.2	5.6
IRON WORKERS	148.	1846.	1632.	4402.	(1993)	18.0	44.3	0.2	11.1
CARPENTERS	160.	2499.	1527.	2643.	(1996)	29.4	19.6	5.6	12.1
EQUIPMENT OPERATORS	546.	2395.	1569.	2506.	(1996)	10.6	9.6	4.2	6.4
LINEMEN	167.	1004.	1121.	3123.	(1993)	26.4	27.7	-2.4	7.8
TEAMSTERS & LABORERS	1014.	4594.	3050.	4857.	(1996)	10.7	10.5	4.1	6.5
OTHER	978.	1737.	1403.	1737.	(2000)	4.0	0.3	2.7	2.4
MANUAL TOTAL	4919.	24046.	16550.	25957.	(1993)	14.8	10.0	3.8	6.8
CONSTRUCTION MANPOWER TOTAL	5780.	30036.	20637.	31448.	(1993)	14.5	11.0	4.0	7.1

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A GROWTH RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

HECHTEL ENERGY SUPPLY PLANNING MODEL

SCHEDULE OF MANPOWER RESOURCES (MAN-YEARS) FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES Egypt - Acc. Renewable Resources

Table 36 (Continued)

RESOURCES	1976	1977	1978	1979	1980	1981	1982
CHEMICAL ENGINEERS	0.	0.	26.	38.	17.	4.	26.
CIVIL ENGINEERS	96.	125.	207.	197.	140.	264.	316.
ELECTRICAL ENGINEERS	87.	115.	239.	214.	142.	350.	357.
MECHANICAL ENGINEERS	62.	80.	166.	187.	117.	146.	225.
MINING ENGINEERS	0.	0.	0.	0.	0.	0.	0.
NUCLEAR ENGINEERS	0.	1.	2.	4.	6.	10.	13.
GEOLOGICAL ENGINEERS	29.	32.	32.	30.	30.	30.	30.
PETROLEUM ENGINEERS	29.	32.	32.	30.	30.	30.	30.
OTHER ENGINEERS	1.	2.	13.	19.	9.	4.	16.
ENGINEERS TOTAL	305.	386.	715.	720.	491.	840.	1013.
DESIGNERS & DRAFTSMEN	115.	147.	336.	363.	222.	333.	450.
SUPERVISORS & MANAGERS	96.	110.	140.	140.	99.	133.	180.
NON-MANUAL, TECHNICAL TOTAL	515.	643.	1191.	1222.	812.	1306.	1643.
NON-MANUAL, NON-TECHNICAL	346.	446.	698.	750.	577.	934.	1257.
NON-MANUAL TOTAL	861.	1088.	1889.	1972.	1389.	2240.	2900.
PIPEFITTERS	748.	987.	990.	1603.	1949.	1059.	705.
PIPEFITTER/WELDERS	391.	499.	506.	670.	752.	459.	373.
ELECTRICIANS	356.	591.	604.	708.	793.	664.	955.
BOILERMAKERS	309.	533.	524.	452.	325.	150.	178.
BOILERMAKER/WELDERS	103.	178.	175.	128.	72.	39.	67.
IRON WORKERS	148.	268.	595.	1239.	286.	807.	2051.
CARPENTERS	160.	270.	259.	352.	448.	327.	391.
EQUIPMENT OPERATORS	546.	670.	701.	784.	817.	700.	815.
LINEMEN	167.	243.	620.	1265.	427.	918.	2101.
TEAMSTERS & LABORERS	1014.	1154.	1266.	1672.	1522.	1293.	1615.
OTHER	978.	1141.	1202.	1151.	1143.	1072.	1191.
MANUAL TOTAL	4919.	6534.	7442.	10022.	8535.	7487.	10443.
CONSTRUCTION MANPOWER TOTAL	5780.	7622.	9331.	11994.	9924.	9727.	13343.

• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

HECHTEL ENERGY SUPPLY PLANNING MODEL

SCHEDULE OF MANPOWER RESOURCES (MAN-YEARS) FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES Egypt - Acc. Renewable Resources

Table 36 (Continued)

RESOURCES	1983	1984	1985	1986	1987	1988	1989
CHEMICAL ENGINEERS	38.	17.	4.	26.	39.	17.	4.
CIVIL ENGINEERS	318.	378.	383.	412.	466.	484.	471.
ELECTRICAL ENGINEERS	283.	354.	336.	334.	377.	454.	430.
MECHANICAL ENGINEERS	256.	227.	203.	274.	335.	293.	266.
MINING ENGINEERS	0.	2.	3.	3.	2.	2.	3.
NUCLEAR ENGINEERS	17.	20.	24.	28.	30.	32.	35.
GEOLOGICAL ENGINEERS	29.	34.	34.	34.	33.	30.	32.
PETROLEUM ENGINEERS	28.	26.	23.	24.	25.	22.	23.
OTHER ENGINEERS	19.	11.	7.	15.	22.	12.	5.
ENGINEERS TOTAL	989.	1070.	1017.	1149.	1330.	1346.	1269.
DESIGNERS & DRAFTSMEN	462.	446.	392.	486.	588.	545.	479.
SUPERVISORS & MANAGERS	193.	218.	221.	245.	287.	264.	246.
NON-MANUAL, TECHNICAL TOTAL	1645.	1733.	1630.	1881.	2205.	2156.	1994.
NON-MANUAL, NON-TECHNICAL	1240.	1293.	1364.	1554.	1761.	1800.	1862.
NON-MANUAL TOTAL	2884.	3026.	2994.	3435.	3966.	3956.	3857.
PIPEFITTERS	1878.	2639.	1696.	1240.	2286.	2915.	2100.
PIPEFITTER/WELDERS	798.	1076.	751.	613.	979.	1199.	944.
ELECTRICIANS	1343.	1771.	1605.	1694.	2138.	2240.	2132.
BOILERMAKERS	359.	381.	201.	136.	279.	366.	250.
BOILERMAKER/WELDERS	110.	128.	179.	241.	279.	206.	203.
IRON WORKERS	606.	1161.	1789.	922.	1112.	1439.	2076.
CARPENTERS	795.	1134.	1099.	1216.	1522.	1523.	1438.
EQUIPMENT OPERATORS	937.	1222.	1292.	1404.	1699.	1533.	1452.
LINEMEN	594.	862.	1449.	577.	669.	954.	1599.
TEAMSTERS & LABORERS	1797.	2467.	2507.	2270.	2974.	3114.	2961.
OTHER	1251.	1330.	1162.	1134.	1336.	1322.	1306.
MANUAL TOTAL	10468.	14171.	13728.	11446.	15274.	16810.	16460.
CONSTRUCTION MANPOWER TOTAL	13352.	17197.	16722.	14881.	19240.	20766.	20317.

• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

BECHTEL ENERGY SUPPLY PLANNING MODEL

SCHEDULE OF MANPOWER RESOURCES (MAN-YEARS) FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES Egypt - Acc. Renewable Resources

Table 36 (Continued)

RESOURCES	1990	1991	1992	1993	1994	1995	1996
CHEMICAL ENGINEERS	26.	39.	17.	5.	27.	39.	18.
CIVIL ENGINEERS	508.	598.	730.	702.	661.	697.	706.
ELECTRICAL ENGINEERS	432.	478.	721.	644.	513.	538.	601.
MECHANICAL ENGINEERS	341.	412.	406.	369.	410.	444.	405.
MINING ENGINEERS	3.	4.	3.	4.	5.	3.	2.
NUCLEAR ENGINEERS	40.	43.	45.	46.	47.	47.	47.
GEOLOGICAL ENGINEERS	30.	36.	37.	39.	40.	38.	39.
PETROLEUM ENGINEERS	23.	25.	24.	23.	24.	24.	25.
OTHER ENGINEERS	15.	24.	13.	6.	18.	22.	10.
ENGINEERS TOTAL	1419.	1660.	1996.	1839.	1745.	1853.	1854.
DESIGNERS & DRAFTSMEN	581.	705.	793.	700.	709.	782.	739.
SUPERVISORS & MANAGERS	279.	352.	379.	367.	386.	413.	395.
NON-MANUAL, TECHNICAL TOTAL	2279.	2717.	3168.	2905.	2840.	3048.	2989.
NON-MANUAL, NON-TECHNICAL	2088.	2325.	2584.	2585.	2461.	2548.	2519.
NON-MANUAL TOTAL	4367.	5041.	5752.	5491.	5301.	5596.	5507.
PIPEFITTERS	1867.	3009.	3743.	2907.	2325.	3250.	3874.
PIPEFITTER/WELDERS	908.	1318.	1589.	1316.	1121.	1442.	1643.
ELECTRICIANS	2384.	2934.	3333.	3382.	3077.	3411.	3659.
BOILERMAKERS	210.	364.	463.	346.	263.	392.	481.
BOILERMAKER/WELDERS	182.	243.	284.	328.	345.	434.	477.
IRON WORKERS	1233.	1505.	2568.	4402.	1678.	1852.	2268.
CARPENTERS	1590.	2005.	2242.	2226.	2176.	2459.	2643.
EQUIPMENT OPERATORS	1440.	1830.	1912.	2014.	2056.	2292.	2506.
LINEMEN	761.	745.	1554.	3123.	837.	837.	1197.
TEAMSTERS & LABORERS	2754.	3554.	4205.	4378.	3723.	4335.	4857.
OTHER	1360.	1529.	1655.	1537.	1543.	1642.	1721.
MANUAL TOTAL	14689.	19037.	23549.	25957.	19144.	22345.	25326.
CONSTRUCTION MANPOWER TOTAL	19056.	24079.	29301.	31448.	24445.	27941.	30834.

• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

BECHTEL ENERGY SUPPLY PLANNING MODEL

SCHEDULE OF MANPOWER RESOURCES (MAN-YEARS) FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES Egypt - Acc. Renewable Resources

Table 36 (Continued)

RESOURCES	1997	1998	1999	2000	TOTAL 1978-2000
CHEMICAL ENGINEERS	4.	26.	39.	18.	515.
CIVIL ENGINEERS	651.	667.	711.	738.	11407.
ELECTRICAL ENGINEERS	554.	537.	580.	598.	10067.
MECHANICAL ENGINEERS	351.	410.	468.	445.	7156.
MINING ENGINEERS	2.	3.	3.	4.	47.
NUCLEAR ENGINEERS	47.	49.	53.	58.	744.
GEOLOGICAL ENGINEERS	38.	38.	36.	38.	786.
PETROLEUM ENGINEERS	26.	25.	25.	25.	594.
OTHER ENGINEERS	5.	17.	22.	12.	318.
ENGINEERS TOTAL	1677.	1772.	1934.	1936.	31634.
DESIGNERS & DRAFTSMEN	636.	717.	806.	756.	13027.
SUPERVISORS & MANAGERS	357.	383.	401.	407.	6485.
NON-MANUAL, TECHNICAL TOTAL	2670.	2872.	3141.	3099.	51144.
NON-MANUAL, NON-TECHNICAL	2437.	2550.	2784.	2890.	42857.
NON-MANUAL TOTAL	5107.	5422.	5925.	5990.	94001.
PIPEFITTERS	2931.	2325.	3244.	3877.	54410.
PIPEFITTER/WELDERS	1333.	1133.	1436.	1646.	24002.
ELECTRICIANS	3294.	3066.	3340.	3587.	52113.
BOILERMAKERS	347.	260.	392.	481.	7595.
BOILERMAKER/WELDERS	398.	345.	326.	379.	5568.
IRON WORKERS	2736.	1649.	1723.	1846.	37542.
CARPENTERS	2335.	2152.	2292.	2499.	35125.
EQUIPMENT OPERATORS	2180.	1999.	2100.	2395.	36082.
LINEMEN	1783.	912.	1004.	1004.	25793.
TEAMSTERS & LABOREWS	4383.	3795.	4127.	4594.	70161.
OTHER	1665.	1600.	1670.	1737.	32259.
MANUAL TOTAL	23385.	19236.	21655.	24046.	380651.
CONSTRUCTION MANPOWER TOTAL	28492.	24659.	27580.	30036.	474652.

• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

RECHIFE ENERGY SUPPLY PLANNING MODEL

Table 36 (Continued)

GROWTH IN REQUIREMENTS FOR CONSTRUCTION MANPOWER TOTAL (MAN-YEARS/YEAR)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
For The Egypt - Acc. Renewable Resources Case

CATEGORY	ANNUAL REQUIREMENTS				AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
OIL								
EXPLORATION, DEVELOPMENT, & PRODUCTION	1602.	1375.	1403.	1686. (1978)	0.8	-4.4	0.3	-0.6
REFINING AND PROCESSING	0.	4770.	2663.	4770. (1980)	9999.0	-17.2	6.5	9999.0
PIPELINES	76.	0.	83.	547. (1982)	-100.0	9999.0	-100.0	-100.0
TANKERS, BARGES, TRUCKS	0.	0.	0.	0.	0.0	0.0	0.0	0.0
BULK STATIONS	0.	0.	26.	96. (1978)	0.0	0.0	0.0	0.0
OTHER	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TOTAL OIL	1677.	6145.	4175.	6423. (1980)	39.9	-12.0	4.0	5.6
OIL SHALE	0.	0.	0.	0.	0.0	0.0	0.0	0.0
GAS								
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	0.	26.	88. (1978)	0.0	0.0	0.0	0.0
GEOPRESSURED METHANE	0.	0.	0.	0.	0.0	0.0	0.0	0.0
PIPELINES	0.	0.	0.	0.	0.0	0.0	0.0	0.0
LNG TANKERS	0.	0.	0.	0.	0.0	0.0	0.0	0.0
DISTRIBUTION	999.	0.	82.	999. (1976)	-25.3	-100.0	0.0	-100.0
OTHER	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TOTAL GAS	999.	0.	108.	999. (1976)	-25.3	-100.0	0.0	-100.0
COAL								
UNDERGROUND MINING	0.	0.	0.	0.	0.0	0.0	0.0	0.0
SURFACE MINING	0.	0.	0.	0.	0.0	0.0	0.0	0.0
RAIL	0.	0.	0.	0.	0.0	0.0	0.0	0.0
PIPELINES	0.	0.	0.	0.	0.0	0.0	0.0	0.0
BARGES, TRUCKS	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TOTAL COAL	0.	0.	0.	0.	0.0	0.0	0.0	0.0
COAL SYNTHETICS								
LIQUEFACTION	0.	0.	0.	0.	0.0	0.0	0.0	0.0
METHANOL	0.	0.	0.	0.	0.0	0.0	0.0	0.0
SOLVENT REFINING	0.	0.	0.	0.	0.0	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.0	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TOTAL SYNTHETICS	0.	0.	0.	0.	0.0	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	0.	560.	229.	568. (1994)	0.0	9999.0	8.8	9999.0
SOLAR	0.	0.	0.	0.	0.0	0.0	0.0	0.0
ELECTRIC UTILITIES								
COAL-FIRED	0.	0.	0.	0.	0.0	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.0	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.0	0.0	0.0	0.0
NUCLEAR	0.	17448.	10587.	17448. (2000)	9999.0	49.7	5.8	9999.0
HYDRO & PUMPED STORAGE	0.	2558.	1510.	3651. (1996)	0.0	9999.0	4.2	9999.0
OIL & GAS	2513.	0.	460.	4096. (1977)	-25.6	-100.0	0.0	-100.0
GEOTHERMAL	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TOTAL GENERATION	2513.	20006.	12557.	20265. (1996)	-8.4	38.1	5.5	9.0
TRANSMISSION	0.	0.	1250.	6575. (1993)	0.0	9999.0	-100.0	0.0
DISTRIBUTION	591.	3324.	2320.	3324. (1994)	24.4	6.8	3.5	7.5
TOTAL UTILITIES	3104.	23330.	16126.	27844. (1993)	0.7	32.8	3.9	8.8
TOTAL ENERGY INDUSTRY	5780.	30036.	20637.	31448. (1993)	14.5	11.0	4.0	7.1

BECHTEL ENERGY SUPPLY PLANNING MODEL

GROWTH IN SELECTED MATERIALS AND EQUIPMENT ITEMS REQUIRED
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
Egypt - Acc. Renewable Resources

Table 36 (Continued)

CATEGORY		ANNUAL REQUIREMENTS				AVERAGE GROWTH RATES (%/YEAR)			
		1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
CEMENT	(TONNES)	17594.	91265.	62450.	93822. (1996)	7.2	16.6	4.1	7.1
CONCRETE (INCLUDES CEMENT)	(TONNES)	93526.	810288.	531550.	837222. (1996)	11.6	23.7	4.5	9.4
BENTONITE (IN DRILLING MUD)	(TONNES)	2719.	2300.	2399.	2971. (1978)	0.9	-4.7	0.3	-0.7
BARITE (IN DRILLING MUD)	(TONNES)	2636.	2277.	2339.	2893. (1978)	0.8	-4.5	0.3	-0.6
CARBON STEEL	(TONNES)	41076.	99117.	79793.	123218. (1993)	1.8	11.0	1.9	3.7
ALLOY STEEL	(TONNES)	2601.	8999.	6500.	8999. (2000)	10.0	6.3	3.8	5.3
STAINLESS STEEL	(TONNES)	178.	2786.	1772.	2786. (2000)	47.7	6.9	5.9	12.1
STEEL TOTAL	(TONNES)	43854.	110903.	88063.	134147. (1993)	2.7	10.6	2.1	3.9
COPPER	(TONNES)	432.	3625.	2747.	5351. (1993)	24.8	17.6	2.9	9.3
ALUMINUM	(TONNES)	625.	1546.	3021.	11920. (1993)	6.6	37.7	-6.1	3.8
MANGANESE	(TONNES)	332.	839.	665.	971. (1993)	3.4	10.1	2.1	3.9
CHROMIUM	(TONNES)	131.	747.	515.	747. (2000)	21.7	6.1	4.5	7.5
NICKEL	(TONNES)	8.	111.	71.	111. (2000)	42.6	9.2	5.3	11.6
CAST IRON	(TONNES)	502.	2628.	1754.	2685. (1996)	24.0	3.4	4.3	7.1
STEEL CASTINGS	(TONNES)	363.	1589.	990.	1615. (1996)	12.0	10.9	3.4	6.3
ALUMINUM CASTINGS	(TONNES)	31.	134.	91.	134. (1996)	11.6	9.4	3.8	6.3
BRASS & BRONZE CASTINGS	(TONNES)	31.	205.	134.	205. (2000)	30.4	1.0	5.2	8.1
IRON & STEEL FORGINGS	(TONNES)	318.	1360.	887.	1427. (1996)	8.2	14.3	3.2	6.2
STRUCTURAL STEEL SHAPES	(TONNES)	2274.	12575.	11081.	24724. (1993)	13.9	26.5	0.1	7.4
STEEL PLATE < 3.8 CM THICK	(TONNES)	3333.	16770.	12456.	19370. (1993)	15.6	12.4	3.0	7.0
STEEL PLATE > 3.8 CM THICK	(TONNES)	2.	2800.	1699.	3079. (1995)	177.8	53.6	6.0	34.4
PIPE, CARBON STEEL	(TONNES)	13168.	9808.	9492.	16137. (1982)	-6.9	-1.6	0.5	-1.2
PIPE, ALLOY & STAINLESS STEEL	(TONNES)	98.	3974.	2505.	3974. (2000)	47.3	32.9	5.0	16.7
OIL COUNTRY TUBULAR GOODS	(TONNES)	16166.	13901.	14426.	18061. (1978)	0.8	-4.5	0.3	-0.6
REINFORCING BAR (REBAR)	(TONNES)	935.	15839.	10162.	16149. (1995)	20.6	34.3	4.1	12.5
VALVES, CARBON STEEL	(TONNES)	163.	927.	655.	978. (1995)	42.6	-10.2	5.8	7.5
VALVES, ALLOY & STAINLESS STEEL	(TONNES)	7.	367.	231.	367. (2000)	86.6	14.0	5.5	17.9
STEAM TURBOGENERATORS	(MEGAWATTS)	331.	1260.	846.	1260. (2000)	-5.0	17.7	4.9	5.7
STEAM TURBINES (EXCL TRGENS)	(MEGAWATTS)	7.	25.	17.	25. (2000)	10.5	-0.3	5.7	5.2
GAS TURBOGENERATORS	(MEGAWATTS)	136.	3.	23.	161. (1982)	-34.0	-35.3	1.0	-14.3
DRAGLINES	(CUBIC METERS)	0.	0.	0.	0.	0.0	0.0	0.0	0.0
DRILL RIGS, ONSHORE	(RIG YEARS)	16.	15.	15.	18. (1978)	1.0	-3.7	0.4	-0.4
DRILL RIGS, OFFSHORE	(RIG YEARS)	5.	5.	4.	5. (1979)	0.0	-2.8	1.0	0.0
DRILL BITS	(NUMBER)	1358.	1198.	1237.	1494. (1978)	0.7	-1.6	-0.5	-0.5
PUMPS & DRIVERS > 745 MGAWTS	(MEGAWATTS)	8.	102.	66.	102. (2000)	26.8	19.8	5.0	11.3
PUMPS & DRIVERS < 745 MGAWTS	(MEGAWATTS)	20.	29.	25.	29. (1995)	9.6	-7.5	2.6	1.5
AXIAL COMPRESSORS > 3727 MGAWTS	(MGAWTS)	0.	0.	0.	0.	0.0	0.0	0.0	0.0
CENTRIF COMP & DRV > 7455 MW	(MGAWTS)	0.	19.	12.	19. (1979)	9999.0	-24.2	9.7	9999.0
CENTRIF COMP & DRV < 7455 MW	(MGAWTS)	1.	4.	3.	4. (1979)	38.3	-19.0	6.8	5.2
HEAT EXCHANGERS	(SQUARE METERS)	7053.	84631.	55255.	84631. (2000)	66.8	-10.5	6.8	10.9
NON-NUC PRESS VESS < 3.8 CM WALL	(TONNES)	54.	2062.	1349.	2095. (1984)	148.4	-23.3	9.2	16.3
NON-NUC PRESS VESS 3.8-10 CM W.	(TONNES)	4.	4.	4.	4. (1979)	0.0	-2.8	1.0	0.0
NON-NUC PRESS VESS > 10 CM WALL	(TONNES)	0.	0.	0.	0.	0.0	0.0	0.0	0.0
BOILERS	(TONNES STEAM PER HOUR)	981656.	313796.	361498.	1486156. (1978)	-6.3	-36.2	9.6	-4.6
NUCLEAR STEAM SUPPLY SYSTEMS	(MEGAWATTS)	0.	1233.	772.	1233. (2000)	9999.0	46.1	4.9	9999.0

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• I DES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A GROWTH RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

BECHTEL ENERGY SUPPLY PLANNING MODEL

GROWTH IN ANNUAL COSTS (MILLION POUNDS JANUARY 1978)
FOR THE OPERATION AND MAINTENANCE OF ENERGY-RELATED FACILITIES
Egypt - Acc. Renewable Resources

Table 36 (Continued)

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
NON-MANUAL TECHNICAL MANPOWER	3.	19.	10.	19.	(2000)	12.0	7.0	7.0	7.8
NON-MANUAL NON-TECHNICAL MANPOWER	1.	4.	2.	4.	(2000)	12.0	5.8	7.4	7.8
MANUAL MANPOWER	9.	43.	27.	43.	(2000)	13.8	6.8	5.2	6.9
MANPOWER TOTAL	12.	65.	39.	65.	(2000)	13.2	6.8	5.8	7.2
WOOD PRODUCTS (20)	1.	5.	2.	5.	(2000)	5.2	10.9	7.8	8.0
CHEMICALS & ALLIED PROD. (27,28,30,32)	8.	33.	19.	33.	(2000)	-0.7	6.6	7.7	6.0
PETROLEUM PRODUCTS (31)	4.	15.	12.	15.	(1997)	18.4	6.1	2.1	5.5
GLASS, CLAY & STONE PRODUCTS (35,36)	1.	2.	1.	2.	(2000)	0.4	5.7	4.8	4.2
PRIMARY IRON & STEEL PRODUCTS (37)	1.	11.	5.	11.	(2000)	23.5	4.3	10.0	10.9
PRIMARY NON-FERROUS METALS (38)	0.	4.	2.	4.	(2000)	9.5	11.9	7.7	8.8
FABRICATED STRUCTURAL PRODUCTS (40) *	0.	3.	2.	3.	(2000)	14.8	6.0	6.9	8.0
OTHER FABRICATED PRODUCTS (42)	2.	9.	5.	9.	(2000)	6.4	8.8	6.4	6.9
MATERIALS TOTAL	17.	82.	48.	82.	(2000)	8.1	6.7	6.3	6.7
HVAC HEATING & COOLING UNITS (52) ++	0.	0.	0.	0.	(1982)	35.1	3.1	-0.3	5.6
HVAC DUCTWORK & ACCESSORIES (40) *	0.	0.	0.	0.	(1982)	35.1	3.1	-0.3	5.6
TURBINES (43)	0.	5.	2.	5.	(2000)	14.0	5.7	10.9	10.3
GAS WELDING SETS (47) ++	1.	9.	4.	9.	(2000)	1.1	3.9	13.3	9.2
ELECTRIC WELDING SETS (53) **	0.	0.	0.	0.	(2000)	0.0	0.0	0.0	0.0
CONSTRUCTION, MINING & OIL FIELD EOP (45)	0.	2.	1.	2.	(2000)	15.6	7.7	12.7	12.1
MATERIALS HANDLING EQUIPMENT (46)	0.	0.	0.	0.	(2000)	21.4	17.7	9.6	13.1
GENERAL INDUSTRY EQUIPMENT (49)	4.	10.	6.	10.	(2000)	-2.3	4.7	6.3	4.5
INSTRUMENTATION & CONTROLS (62)	1.	5.	3.	5.	(2000)	8.4	4.2	6.0	6.0
ELECTRICAL EQUIPMENT (53) **	3.	15.	8.	15.	(2000)	6.6	8.8	7.3	7.5
FABRICATED PLATE PRODUCTS (40) *	0.	0.	0.	0.	(2000)	0.0	0.0	0.0	0.0
EQUIPMENT TOTAL	8.	37.	20.	37.	(2000)	4.0	6.4	7.5	6.7
ELECTRICITY	5.	13.	9.	13.	(1998)	-3.4	6.4	5.6	4.2
NATURAL GAS	0.	1.	0.	1.	(1997)	14.7	13.1	23.9	20.0
WATER	2.	23.	9.	23.	(2000)	8.6	7.6	13.1	11.2
UTILITY TOTAL	7.	37.	18.	37.	(2000)	0.3	6.8	9.5	7.3
RENTS, ROYALTIES, ETC.	0.	0.	0.	0.	(2000)	0.0	0.0	0.0	0.0
TAXES	0.	0.	0.	0.	(2000)	0.0	0.0	0.0	0.0
SERVICES & MISCELLANEOUS	10.	55.	31.	55.	(2000)	11.8	6.0	6.8	7.5
ANNUAL OPERATING COST (EX FUEL)	53.	266.	150.	266.	(2000)	8.8	6.6	6.6	7.0

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

#BEA (BUREAU OF ECONOMIC ANALYSIS) TWO-DIGIT CATEGORIES ARE IN PARENTHESIS.

* PARTIAL BEA CATEGORY 40. TOTAL IS SUM OF 3 SEPARATE ENTRIES FOR CATEGORY 40.

++ PARTIAL BEA CATEGORY 52. REMAINDER IS PART OF MISCELLANEOUS ENTRY.

** PARTIAL BEA CATEGORY 53. TOTAL IS SUM OF 2 SEPARATE ENTRIES FOR CATEGORY 53.

BECHTEL ENERGY SUPPLY PLANNING MODEL

GROWTH IN MANPOWER REQUIREMENTS (MAN-YEARS) FOR THE OPERATION AND MAINTENANCE OF ENERGY-RELATED FACILITIES Egypt - Acc. Renewable Resources

Table 36 (Continued)

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
CHEMICAL ENGINEERS	30.	78.	51.	81.	(1998)	-4.5	6.7	5.7	4.1
CIVIL ENGINEERS	18.	105.	60.	105.	(2000)	14.2	7.0	6.2	7.6
ELECTRICAL ENGINEERS	34.	191.	114.	191.	(2000)	15.0	8.6	5.2	7.5
MECHANICAL ENGINEERS	33.	164.	94.	164.	(2000)	9.4	8.0	6.0	7.0
MINING ENGINEERS	0.	14.	5.	15.	(1997)	0.0	0.0	9999.0	9999.0
NUCLEAR ENGINEERS	0.	25.	7.	25.	(2000)	0.0	0.0	9999.0	9999.0
GEOLOGICAL ENGINEERS	0.	7.	3.	7.	(1997)	0.0	0.0	9999.0	9999.0
PETROLEUM ENGINEERS	0.	0.	0.	0.		0.0	0.0	0.0	0.0
OTHER ENGINEERS	31.	137.	86.	137.	(2000)	8.6	6.5	5.8	6.4
ENGINEERS TOTAL	144.	722.	419.	722.	(2000)	8.9	7.6	6.2	6.9
DESIGNERS & DRAFTSMEN	28.	145.	83.	145.	(2000)	9.2	8.1	6.2	7.1
SUPERVISORS & MANAGERS	383.	1545.	1084.	1545.	(2000)	14.6	6.6	3.6	6.0
OTHER TECHNICAL	75.	474.	238.	474.	(2000)	3.9	8.4	9.0	8.0
NON-MANUAL, TECHNICAL TOTAL	630.	2886.	1825.	2886.	(2000)	12.0	7.0	5.0	6.5
NON-MANUAL, NON-TECHNICAL	224.	1363.	740.	1363.	(2000)	12.0	5.8	7.4	7.8
NON-MANUAL TOTAL	854.	4249.	2565.	4249.	(2000)	12.0	6.7	5.7	6.9
PIPEFITTERS	182.	451.	369.	452.	(1999)	10.7	4.4	1.9	3.9
WELDERS	77.	260.	195.	260.	(1999)	12.8	6.9	2.7	5.2
ELECTRICIANS	222.	1067.	631.	1067.	(2000)	9.4	8.3	5.6	6.8
BOILERMAKERS	25.	66.	43.	68.	(1998)	-4.5	6.7	5.7	4.1
MECHANICS	767.	3050.	2211.	3050.	(2000)	15.5	6.3	3.4	5.9
MACHINISTS	195.	713.	546.	719.	(1998)	16.0	6.1	2.8	5.6
IRONWORKERS	14.	32.	21.	32.	(1999)	0.0	2.3	4.7	3.4
CARPENTERS	28.	58.	42.	60.	(1998)	-2.7	4.0	4.2	3.0
EQUIPMENT OPERATORS	88.	838.	411.	838.	(2000)	11.3	13.6	8.2	9.8
OTHER OPERATORS	858.	5062.	2554.	5062.	(2000)	3.6	7.7	8.8	7.7
METER READERS	281.	2015.	1211.	2015.	(2000)	23.2	7.9	5.2	8.6
TEAMSTERS & LABORERS	1797.	6484.	5064.	6484.	(2000)	16.4	6.5	2.4	5.5
LINEMEN	61.	595.	295.	595.	(2000)	11.7	14.1	8.1	9.9
OTHER	482.	2905.	1649.	2905.	(2000)	14.6	6.8	6.3	7.8
MANUAL TOTAL	4990.	22758.	14830.	22758.	(2000)	13.8	6.8	4.6	6.5
MANPOWER TOTAL	5844.	27007.	17395.	27007.	(2000)	13.5	6.8	4.7	6.6

• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A GROWTH RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

BECHTEL ENERGY SUPPLY PLANNING MODEL

CUMULATIVE CAPITAL REQUIREMENTS (MILLION POUNDS, JAN 1978) OF THE ENERGY INDUSTRY
BY FACILITY GROUPING

(1978-1985)

Egypt - Acc. Renewable Resources/Imports

Table 36 (Continued)

FACILITY	CONSTRUCTION COSTS	OWNER'S COSTS PRIOR TO STARTUP	TOTAL
OIL			
EXPLORATION, DEVELOPMENT, & PRODUCTION	581.0	89.4	670.3
REFINING AND PROCESSING	314.3	50.4	364.7
PIPELINES	29.2	5.0	34.2
TANKERS, BARGES, TRUCKS	107.3	18.8	126.0
BULK STATIONS	7.3	1.2	8.6
OTHER	0.0	0.0	0.0
TOTAL OIL	1039.1	164.7	1203.8
OIL SHALE	0.0	0.0	0.0
GAS			
EXPLORATION, DEVELOPMENT, & PRODUCTION	6.5	1.0	7.6
GEOPRESSURED METHANE	0.0	0.0	0.0
PIPELINES	0.0	0.0	0.0
LNG TANKERS	0.0	0.0	0.0
DISTRIBUTION	21.1	3.6	24.6
OTHER	0.0	0.0	0.0
TOTAL GAS	27.6	4.6	32.2
COAL			
UNDERGROUND MINING	0.0	0.0	0.0
SURFACE MINING	0.0	0.0	0.0
RAIL	3.8	0.6	4.4
PIPELINES	0.0	0.0	0.0
BARGES, TRUCKS	0.5	0.1	0.6
TOTAL COAL	4.3	0.7	5.0
COAL SYNTHETICS			
LIQUEFACTION	0.0	0.0	0.0
METHANOL	0.0	0.0	0.0
SOLVENT REFINING	0.0	0.0	0.0
GASIFICATION (HIGH HTU)	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM HTU)	0.0	0.0	0.0
TOTAL SYNTHETICS	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	5.4	0.8	6.2
SOLAR	0.0	0.0	0.0
ELECTRIC UTILITIES			
COAL-FIRED	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.0	0.0	0.0
NUCLEAR	702.7	79.1	781.8
HYDRO & PUMPED STORAGE	29.0	3.1	32.1
OIL & GAS	223.3	25.2	248.5
GEOTHERMAL	0.0	0.0	0.0
TOTAL GENERATION	955.0	107.4	1062.4
TRANSMISSION	203.6	23.6	227.2
DISTRIBUTION	151.6	17.3	168.9
TOTAL UTILITIES	1310.2	148.3	1458.5
TOTAL ENERGY INDUSTRY	2386.5	319.2	2705.7

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 33 (Continued)

CUMULATIVE CAPITAL REQUIREMENTS (MILLION POUNDS, JAN 1978) OF THE ENERGY INDUSTRY
BY FACILITY GROUPING

(1978-2000)

Egypt - Acc. Renewable Resources/Imports

FACILITY	CONSTRUCTION COSTS	OWNER'S COSTS PRIOR TO STARTUP	TOTAL
OIL			
EXPLORATION, DEVELOPMENT, & PRODUCTION	1504.8	231.4	1736.3
REFINING AND PROCESSING	911.4	146.2	1057.6
PIPELINES	57.1	9.7	66.8
TANKERS, BARGES, TRUCKS	300.5	52.6	353.1
BULK STATIONS	16.1	2.7	18.9
OTHER	0.0	0.0	0.0
TOTAL OIL	2789.9	442.7	3232.6
OIL SHALE	0.0	0.0	0.0
GAS			
EXPLORATION, DEVELOPMENT, & PRODUCTION	18.1	2.8	20.9
GEOPRESSURED METHANE	0.0	0.0	0.0
PIPELINES	0.0	0.0	0.0
LNG TANKERS	0.0	0.0	0.0
DISTRIBUTION	21.1	3.6	24.6
OTHER	0.0	0.0	0.0
TOTAL GAS	39.2	6.4	45.5
COAL			
UNDERGROUND MINING	0.0	0.0	0.0
SURFACE MINING	0.0	0.0	0.0
RAIL	21.3	3.6	25.0
PIPELINES	0.0	0.0	0.0
BARGES, TRUCKS	7.4	1.3	8.7
TOTAL COAL	28.8	4.9	33.7
COAL SYNTHETICS			
LIQUEFACTION	0.0	0.0	0.0
METHANOL	0.0	0.0	0.0
SOLVENT REFINING	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.0	0.0	0.0
TOTAL SYNTHETICS	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	62.1	9.3	71.4
SOLAR	0.0	0.0	0.0
ELECTRIC UTILITIES			
COAL-FIRED	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.0	0.0	0.0
NUCLEAR	5923.0	666.9	6589.9
HYDRO & PUMPED STORAGE	455.1	47.8	502.9
OIL & GAS	223.3	25.2	248.5
GEOTHERMAL	0.0	0.0	0.0
TOTAL GENERATION	6601.3	739.9	7341.3
TRANSMISSION	449.9	52.2	502.1
DISTRIBUTION	612.8	69.9	682.7
TOTAL UTILITIES	7664.0	862.0	8526.0
TOTAL ENERGY INDUSTRY	10584.0	1325.2	11909.2

HECHTEL ENERGY SUPPLY PLANNING MODEL

GROWTH IN CAPITAL REQUIREMENTS* (MILLION POUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
EGYPT - ACC. RENEWABLES/IMPORTS #

Table 36 (Continued)

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
NON-MANUAL TECHNICAL MANPOWER	10.	75.	51.	75.	(2000)	18.0	15.9	3.9	8.6
NON-MANUAL NON-TECHNICAL MANPOWER	0.	9.	6.	9.	(2000)	26.5	32.3	4.8	13.5
MANUAL MANPOWER	9.	53.	36.	53.	(1993)	13.7	15.2	3.8	7.7
MANPOWER TOTAL	20.	137.	93.	137.	(2000)	16.3	16.3	3.9	8.4
WOOD PRODUCTS (20)	1.	5.	3.	5.	(2000)	11.2	19.2	4.8	8.7
CHEMICALS & ALLIED PROD. (27,28,30,32)	3.	3.	3.	4.	(1998)	-4.9	9.2	-2.1	-0.3
PETROLEUM PRODUCTS (31)	2.	4.	3.	4.	(2000)	2.6	4.9	2.7	3.1
GLASS, CLAY & STONE PRODUCTS (35,36)	2.	15.	11.	19.	(1993)	7.0	23.1	3.3	7.8
PRIMARY IRON & STEEL PRODUCTS (37)	15.	17.	16.	19.	(1982)	3.3	-2.9	1.1	0.6
PRIMARY NON-FERROUS METALS (38)	2.	12.	12.	33.	(1993)	18.4	27.8	-0.2	8.1
FABRICATED STRUCTURAL PRODUCTS (40) *	4.	37.	30.	61.	(1993)	15.0	32.6	1.5	9.6
OTHER FABRICATED PRODUCTS (42)	32.	119.	83.	119.	(2000)	9.1	8.3	4.0	5.7
MATERIALS TOTAL	33.	109.	90.	152.	(1993)	6.6	14.5	1.8	5.1
HVAC HEATING & COOLING UNITS (52) ++	0.	5.	3.	5.	(2000)	50.7	30.9	4.8	16.6
HVAC DUCTWORK & ACCESSORIES (40) *	0.	2.	1.	2.	(2000)	50.2	39.6	4.9	18.2
TUREINES (43)	22.	59.	40.	60.	(1996)	-7.3	13.6	4.3	4.1
GAS WELDING SETS (47) ++	0.	0.	0.	0.	(1980)	4.1	-9.8	1.9	-0.3
ELECTRIC WELDING SETS (53) **	0.	1.	1.	1.	(2000)	16.6	12.6	4.1	7.8
CONSTRUCTION, MINING & OIL FIELD EOP (45)	31.	33.	31.	34.	(1978)	-0.2	1.7	-0.1	0.2
MATERIALS HANDLING EQUIPMENT (46)	0.	2.	2.	2.	(2000)	9.8	23.9	4.3	9.0
GENERAL INDUSTRY EQUIPMENT (49)	2.	12.	8.	12.	(2000)	38.7	-5.5	3.9	6.9
INSTRUMENTATION & CONTROLS (62)	1.	9.	6.	9.	(2000)	34.4	2.1	3.4	7.7
ELECTRICAL EQUIPMENT (53) **	4.	25.	18.	27.	(1993)	19.6	13.0	4.0	8.3
FABRICATED PLATE PRODUCTS (40) *	12.	88.	57.	88.	(2000)	22.5	10.1	4.9	8.7
EQUIPMENT TOTAL	73.	236.	167.	236.	(2000)	7.2	7.5	3.6	5.0
MISCELLANEOUS MATERIALS & EQUIPMENT	8.	11.	9.	11.	(2000)	6.4	-3.5	1.8	1.4
MOBILE FACILITY	13.	10.	14.	19.	(1990)	-6.9	8.7	-2.2	-0.8
OTHER CONSTRUCTOR COSTS	19.	129.	87.	135.	(1993)	10.0	19.4	4.4	8.3
CONSTRUCTOR COST TOTAL ##	165.	632.	460.	659.	(1993)	7.7	11.8	3.3	5.7

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

#BEA (BUREAU OF ECONOMIC ANALYSIS) TWO-DIGIT CATEGORIES ARE IN PARENTHESIS.

* PARTIAL BEA CATEGORY 40. TOTAL IS SUM OF 3 SEPARATE ENTRIES FOR CATEGORY 40.

++ PARTIAL BEA CATEGORY 52. REMAINDER IS PART OF MISCELLANEOUS ENTRY.

** PARTIAL BEA CATEGORY 53. TOTAL IS SUM OF 2 SEPARATE ENTRIES FOR CATEGORY 53.

CONSTRUCTION CAPITAL COST TOTAL INCLUDES MANPOWER, MATERIALS AND EQUIPMENT SUBTOTALS ABOVE PLUS OTHER (OVERHEAD, PROFIT, ETC.) COSTS. IT EXCLUDES OWNER'S COSTS. (LAND COSTS, INTEREST DURING CONSTRUCTION, ETC.)

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 36 (Continued)

GROWTH IN MANPOWER REQUIREMENTS (MAN-YEARS)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
EGYPT - ACC. RENEWABLES/IMPORTS *

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
CHEMICAL ENGINEERS	0.	7.	8.	15.	(1987)	9999.0	-24.2	10.1	9999.0
CIVIL ENGINEERS	41.	603.	373.	603.	(2000)	22.5	24.9	5.2	11.8
ELECTRICAL ENGINEERS	36.	484.	315.	487.	(1992)	23.8	22.8	4.8	11.4
MECHANICAL ENGINEERS	30.	378.	238.	378.	(2000)	24.4	18.2	5.6	11.1
MINING ENGINEERS	0.	1.	1.	2.	(1994)	0.0	9999.0	1.9	9999.0
NUCLEAR ENGINEERS	0.	58.	32.	58.	(2000)	9999.0	31.0	6.0	9999.0
GEOLOGICAL ENGINEERS	29.	30.	29.	32.	(1978)	0.6	-1.8	0.6	0.1
PETROLEUM ENGINEERS	29.	25.	26.	32.	(1978)	0.6	-4.7	0.4	-0.7
OTHER ENGINEERS	0.	4.	5.	9.	(1991)	64.7	-3.6	3.7	10.3
ENGINEERS TOTAL	167.	1589.	1026.	1589.	(2000)	18.3	18.7	5.0	9.8
DESIGNERS & DRAFTSMEN	59.	591.	393.	591.	(2000)	22.0	16.7	5.0	10.1
SUPERVISORS & MANAGERS	54.	317.	205.	317.	(2000)	6.9	17.8	4.7	7.7
NON-MANUAL, TECHNICAL TOTAL	280.	2498.	1624.	2498.	(2000)	17.2	18.1	4.9	9.6
NON-MANUAL, NON-TECHNICAL	11.	456.	260.	456.	(2000)	53.3	26.9	5.9	16.9
NON-MANUAL TOTAL	290.	2953.	1884.	2953.	(2000)	19.2	19.1	5.1	10.1
PIPEFITTERS	123.	902.	560.	902.	(2000)	25.8	5.5	5.5	8.7
PIPEFITTER/WELDERS	70.	405.	259.	405.	(2000)	16.4	8.0	5.3	7.6
ELECTRICIANS	54.	908.	571.	918.	(1996)	25.2	25.1	5.6	12.5
BOILERMAKERS	44.	108.	72.	108.	(1996)	2.1	-0.8	5.9	3.8
BOILERMAKER/WELDERS	15.	74.	47.	88.	(1996)	-6.8	25.2	5.3	7.0
IRON WORKERS	21.	480.	368.	842.	(1993)	23.9	47.8	2.1	13.9
CARPENTERS	23.	632.	390.	653.	(1996)	34.7	29.9	5.6	14.9
EQUIPMENT OPERATORS	117.	473.	320.	489.	(1996)	8.3	10.0	4.1	6.0
LINEMEN	24.	143.	160.	445.	(1993)	26.4	27.7	-2.4	7.8
TEAMSTERS & LABORERS	166.	1010.	663.	1047.	(1996)	11.0	15.6	4.5	7.8
OTHER	260.	448.	369.	448.	(2000)	2.9	1.0	2.5	2.3
MANUAL TOTAL	916.	5583.	3778.	5823.	(1993)	13.5	14.6	4.2	7.8
CONSTRUCTION MANPOWER TOTAL	1206.	8536.	5662.	8536.	(2000)	14.9	15.9	4.5	8.5

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A GROWTH RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

GROWTH IN ANNUAL COSTS (MILLION POUNDS JANUARY 1978)
FOR THE OPERATION AND MAINTENANCE OF ENERGY-RELATED FACILITIES
EGYPT - ACC. RENEWABLES/IMPORTS •

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
NON-MANUAL TECHNICAL MANPOWER	0.	3.	1.	3.	(2000)	0.0	0.0	9999.0	9999.0
NON-MANUAL NON-TECHNICAL MANPOWER	0.	0.	0.	0.		0.0	0.0	0.0	0.0
MANUAL MANPOWER	0.	1.	0.	1.	(2000)	0.0	0.0	9999.0	9999.0
MANPOWER TOTAL	0.	4.	1.	4.	(2000)	0.0	0.0	9999.0	9999.0
WOOD PRODUCTS (20)	0.	0.	0.	0.	(2000)	0.0	0.0	9999.0	9999.0
CHEMICALS & ALLIED PROD. (27,28,30,32)	4.	19.	11.	19.	(2000)	1.0	6.5	7.9	6.4
PETROLEUM PRODUCTS (31)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
GLASS, CLAY & STONE PRODUCTS (35,36)	0.	0.	0.	0.	(2000)	12.4	14.0	8.0	10.0
PRIMARY IRON & STEEL PRODUCTS (37)	0.	9.	3.	9.	(2000)	31.3	3.5	19.3	17.7
PRIMARY NON-FERROUS METALS (38)	0.	1.	0.	1.	(2000)	6.2	6.4	6.0	6.1
FABRICATED STRUCTURAL PRODUCTS (40) *	0.	2.	1.	2.	(2000)	0.0	0.0	9999.0	9999.0
OTHER FABRICATED PRODUCTS (42)	1.	6.	3.	6.	(2000)	5.6	9.0	10.1	9.1
MATERIALS TOTAL	5.	37.	17.	37.	(2000)	3.3	6.7	10.3	8.3
HVAC HEATING & COOLING UNITS (52) ++	0.	0.	0.	0.	(1982)	35.1	3.1	-0.3	5.6
HVAC DUCTWORK & ACCESSORIES (40) *	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TURBINES (43)	0.	4.	2.	4.	(2000)	14.0	5.7	10.9	10.3
GAS WELDING SETS (47) ++	0.	0.	0.	0.		0.0	0.0	0.0	0.0
ELECTRIC WELDING SETS (53) **	0.	0.	0.	0.		0.0	0.0	0.0	0.0
CONSTRUCTION, MINING & OIL FIELD EQP (45)	0.	0.	0.	0.	(2000)	15.7	7.7	6.6	8.3
MATERIALS HANDLING EQUIPMENT (46)	0.	0.	0.	0.	(2000)	21.4	17.7	9.6	13.1
GENERAL INDUSTRY EQUIPMENT (49)	1.	4.	2.	4.	(2000)	-0.8	2.5	6.9	4.6
INSTRUMENTATION & CONTROLS (62)	1.	4.	2.	4.	(2000)	8.4	4.2	6.0	6.0
ELECTRICAL EQUIPMENT (53) **	1.	8.	4.	8.	(2000)	4.9	7.9	8.5	7.8
FABRICATED PLATE PRODUCTS (40) *	0.	0.	0.	0.		0.0	0.0	0.0	0.0
EQUIPMENT TOTAL	4.	21.	11.	21.	(2000)	5.5	5.4	8.0	7.0
ELECTRICITY	0.	0.	0.	0.		0.0	0.0	0.0	0.0
NATURAL GAS	0.	0.	0.	0.		0.0	0.0	0.0	0.0
WATER	0.	0.	0.	0.		0.0	0.0	0.0	0.0
UTILITY TOTAL	0.	0.	0.	0.		0.0	0.0	0.0	0.0
RENTS, ROYALTIES, ETC.	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TAXES	0.	0.	0.	0.		0.0	0.0	0.0	0.0
SERVICES & MISCELLANEOUS	1.	8.	4.	8.	(2000)	10.5	6.0	7.2	7.5
ANNUAL OPERATING COST (EX FUEL)	11.	70.	33.	70.	(2000)	5.1	6.1	9.6	8.1

• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A GROWTH RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

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** PARTIAL BEA CATEGORY 53. TOTAL IS SUM OF 2 SEPARATE ENTRIES FOR CATEGORY 53.

HECHTEL ENERGY SUPPLY PLANNING MODEL

Table 36 (Continued)

SCHEDULE OF ANNUAL ENERGY FACILITIES ADDITIONS TO SUPPLY FUEL MIX: EGYPT - ACC. Renewable Resources, 1976-2010

FACILITY NAME	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL ADDED (1978- 2010)
1 ONSHORE PRIMARY OIL RECOVERY-(1,000 MBPD)	14	14	14	14	14	14	14	14	14	14	482
2 ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	0	0	0	0	0	0	0	0	0	0	0
3 ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	0	0	0	0	0	0	0	0	0	0	0
4 OFFSHORE OIL RECOVERY (12.5 MBPD)	3	3	3	3	3	3	3	3	3	3	94
6 HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	0	0	0	0	0	0	0	0	0	0	0
7 LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	0	1	0	0	0	1	0	0	0	0	7
19 ONSHORE CONVENTIONAL GAS RECOVERY (100 MMCF/D)	0	0	0	0	0	1	0	0	0	0	6
20 ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0
21 OFFSHORE GAS RECOVERY (25 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0
24 LNG EXPORT (3030 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0
27 UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0
37 SURFACE URANIUM MINE (275.4 M TONNES/Y)	1	0	0	1	0	0	1	0	0	1	8
38 UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0
39 URANIUM MILL (275.4 M TONNES/Y)	1	0	0	1	0	0	1	0	0	1	8
42 LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	0	0	0	0	0	0	0	0	0	0	0
43 LWR FUEL FABRICATION - PU RECYCLE (150 MTH/Y)	0	0	0	0	0	0	0	0	0	0	0
49 HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	0	0	0	0	0	0	0	0	0	0	0
50 OIL-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0	0	0	0
51 OIL-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	0	0	0	2
52 OIL-FIRED POWER PLANT (450 MWE)	0	0	0	0	0	0	0	0	0	0	1
53 COAL FIRED POWER PLANT-LOW BTU (800 MWE)	0	0	0	0	0	0	0	0	0	0	0
54 COAL FIRED POWER PLANT-HIGH BTU (800 MWE)	0	0	0	0	0	0	0	0	0	0	0
55 COAL FIRED POWER PLANT-LOW BTU (600 MWE)	0	0	0	0	0	0	0	0	0	0	0
56 COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	0	0	0	0	0	0	0	0	0	0	0
59 HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0	0	0	0
60 HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	0	0	0	0
61 COMBINED CYCLE POWER PLANT (400 MWE)	0	0	0	0	0	0	0	0	0	0	2
62 GAS TURBINE POWER PLANT (133 MWE)	0	0	0	0	0	0	0	0	0	0	1
63 FUEL CELLS (26 MWE)	0	0	0	0	0	0	0	0	0	0	0
64 LIGHT WATER REACTOR (LWR) (1200 MWE)	1	1	1	1	1	1	2	2	2	2	20
65 LIGHT WATER REACTOR (LWR) (900 MWE)	0	0	0	0	0	0	0	0	0	0	4
66 LIGHT WATER REACTOR (LWR) (600 MWE)	0	0	0	0	0	0	0	0	0	0	3
67 DAM & HYDROELECTRIC POWER PLANT (200 MWE)	0	0	0	0	0	0	0	0	0	0	1
68 PUMPED STORAGE (500 MWE)	1	0	1	0	1	0	1	1	1	1	12
69 GEOTHERMAL POWER COMPLEX (200 MWE)	0	0	0	0	0	0	0	0	0	0	0

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 36 (Continued)

SCHEDULE OF ANNUAL TRANSPORTATION ADDITIONS TO SUPPLY FUEL MIX: EGYPT - ACC. Renewable Resources 1976-2010

FACILITY NAME	1975 TOTALS	1976	1977	1978	1979	1980	1981	1982	TOTAL ADDED (1978- 1982)
1 CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	0.1	0	0	0	0	0	0	0	0
3 OIL TANKER (90,000 DWT; 620,000 B)	0.0	0	0	0	0	0	0	0	0
4 OIL BARGES (90,000 BBL)	3.0	1*	2*	1*	1	0	1	1	4
5 OIL TANK TRUCK (226 BBL)	290.3	128*	130*	131*	130	129	136	149	675
6 PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	0.5	0	0	0	0	0	0	0	0
7 HOT OIL PIPELINE (40 MB/D, 80.5 KM)	2.4	0	0	1*	0	0	0	0	1
8 REFINED PRODUCTS BULK STATION (69 MB/D)	1.6	0	0	0	1*	0	0	0	1
9 RAIL LINE (64.4 KM; SINGLE TRACK)	0.0	0	0	0	0	0	0	0	0
10 MIXED TRAIN (6556 TONNES)	2.3	0	0	1*	0	0	0	1	2
11 COAL UNIT TRAIN (9,528 TONNES)	0.0	0	0	0	0	0	0	0	0
12 COAL SLURRY PIPELINE (22.69 MM TONNES/Y, 241.4 KM)	0.0	0	0	0	0	0	0	0	0
13 COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	0.0	0	0	0	0	0	0	0	0
14 COAL SLURRY DEWATERING (22.69 MM TONNES/Y)	0.0	0	0	0	0	0	0	0	0
15 COAL BARGES (19,048 TONNES)	0.2	0	0	0	0	0	0	0	0
16 COAL TRUCK (22.7 TONNES)	4.8	1*	1*	1*	1	1	1	1	5
17 GAS PIPELINE (.87 BSCF/D, 241.4 KM)	0.1	0	0	0	0	0	0	0	0
18 GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	0.7	1*	2*	0	1*	1*	0	1*	3
20 LNG TANKER (2.6 BCF)	0.0	0	0	0	0	0	0	0	0
21 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	0.5	0	0	0	0	1	0	0	1
22 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	0.0	0	0	0	0	0	0	0	0
23 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	0.2	0	0	0	0	0	0	0	0
24 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	0.0	0	0	0	0	0	0	0	0
25 +-400 KVDC TRANSMISSION LINE (1500 MWE, 1287 KM)	0.0	0	0	0	0	0	0	0	0
26 ELECTRICITY DISTRIBUTION-AERIAL LINES (131.6MWE)	9.0	1*	1*	1*	2*	2*	3	2	10

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

7.4 Nuclear Capacity Variations Case

In this case, a number of strategies are used to reduce the nuclear power requirements of the Comparison Case. This involves both substituting other types of generating capacity for nuclear power and increasing end-use efficiency. The use of fossil power plants is greatly increased and the application of solar-electric technologies is expanded. Fuel for the additional fossil power plants is obtained by reducing refined product exports and increasing imports, as well as by utilizing the flared gas of the Comparison Case. The renewables are at the same level as postulated for the Accelerated Renewable Resource Case. The ESPM results presented in Table 37 include the effects of reducing nuclear power and increasing fossil generation. Estimates of resource requirements of the solar-electric technologies or of those required to obtain greater end-use efficiency were not made here.

7.5 Summary of Alternative Cases Analyzed

Table 38 below presents a summary of some cumulative capital costs for the various cases. Caution should be used in comparing the cases on the basis of the estimates shown in this table. In particular, they do not reflect differences in operating costs or the foreign exchange effects of varying petroleum exports or varying utilization of indigenous labor and manufacturing capability. In addition, the ESPM-computed costs (necessarily) include the effects of assumptions made about projections beyond 2000, which were not included in the DOE scenario specifications. Though these assumptions are considered realistic, other plausible assumptions could be made that could significantly alter the estimates.

8.0 Appendix - PERSONNEL CONTACTED IN EGYPT

The following are the names of persons contacted during the Bechtel country visit to Egypt from March 25-April 5:

MINISTRY OF INDUSTRY (GOFI)

1. Engineer Kamel Maksoud, Director of Central Administration for Industrial Planning and Technical Research, Ministry of Industry and Mineral Wealth, General Organization for Industrialization (GOFI).
Phone: 27279, Telex: 389 TANFIZ UN
2. Engineer Mahrous El Amin, GOFI (Maksoud assistant)
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MINISTRY OF TRANSPORTATION

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UECHTEL ENERGY SUPPLY PLANNING MODEL

Table 37 (Continued)

GROWTH IN ANNUAL COSTS (MILLION POUNDS JANUARY 1978)
FOR THE OPERATION AND MAINTENANCE OF ENERGY-RELATED FACILITIES
EGYPT - NUCLEAR Capacity Variations/Imports

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK YEAR		1976- 1980	1980- 1985	1985- 2000	1976- 2000
NON-MANUAL TECHNICAL MANPOWER	0.	0.	0.	0.	(1990)	0.0	0.0	9999.0	9999.0
NON-MANUAL NON-TECHNICAL MANPOWER	0.	0.	0.	0.		0.0	0.0	0.0	0.0
MANUAL MANPOWER	0.	0.	0.	0.	(1990)	0.0	0.0	9999.0	9999.0
MANPOWER TOTAL	0.	1.	0.	1.	(1990)	0.0	0.0	9999.0	9999.0
WOOD PRODUCTS (20)	0.	0.	0.	0.	(1990)	0.0	0.0	9999.0	9999.0
CHEMICALS & ALLIED PROD. (27,28,30,32)	4.	13.	9.	14.	(1998)	0.7	6.5	5.4	4.8
PETROLEUM PRODUCTS (31)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
GLASS, CLAY & STONE PRODUCTS (35,36)	0.	0.	0.	0.	(2000)	14.0	12.0	7.8	9.7
PRIMARY IRON & STEEL PRODUCTS (37)	0.	2.	1.	2.	(1993)	10.9	0.9	11.8	9.3
PRIMARY NON-FERROUS METALS (38)	0.	1.	0.	1.	(2000)	7.0	6.2	5.5	5.9
FABRICATED STRUCTURAL PRODUCTS (40) *	0.	0.	0.	0.	(1990)	0.0	0.0	9999.0	9999.0
OTHER FABRICATED PRODUCTS (42)	1.	4.	2.	4.	(2000)	7.6	8.4	7.0	7.4
MATERIALS TOTAL	5.	20.	13.	20.	(1999)	2.3	6.6	6.1	5.6
HVAC HEATING & COOLING UNITS (52) ++	0.	0.	0.	0.	(1977)	11.6	-0.7	-0.7	1.2
HVAC DUCTWORK & ACCESSORIES (40) *	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TURBINES (43)	0.	4.	2.	4.	(2000)	15.4	5.5	9.4	9.6
GAS WELDING SETS (47) ++	0.	0.	0.	0.		0.0	0.0	0.0	0.0
ELECTRIC WELDING SETS (53) **	0.	0.	0.	0.		0.0	0.0	0.0	0.0
CONSTRUCTION, MINING & OIL FIELD EOP (45)	0.	1.	0.	1.	(2000)	17.1	7.3	8.0	9.3
MATERIALS HANDLING EQUIPMENT (46)	0.	0.	0.	0.	(2000)	28.1	15.1	4.7	10.4
GENERAL INDUSTRY EQUIPMENT (49)	1.	3.	2.	3.	(1998)	-0.8	2.5	4.4	3.1
INSTRUMENTATION & CONTROLS (62)	1.	3.	2.	3.	(2000)	3.8	3.9	5.4	4.8
ELECTRICAL EQUIPMENT (53) **	1.	6.	4.	6.	(2000)	6.5	7.0	6.8	6.8
FABRICATED PLATE PRODUCTS (40) *	0.	0.	0.	0.		0.0	0.0	0.0	0.0
EQUIPMENT TOTAL	4.	17.	9.	17.	(2000)	5.1	5.1	6.5	6.0
ELECTRICITY	0.	0.	0.	0.		0.0	0.0	0.0	0.0
NATURAL GAS	0.	0.	0.	0.		0.0	0.0	0.0	0.0
WATER	0.	0.	0.	0.		0.0	0.0	0.0	0.0
UTILITY TOTAL	0.	0.	0.	0.		0.0	0.0	0.0	0.0
RENTS, ROYALTIES, ETC.	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TAXES	0.	0.	0.	0.		0.0	0.0	0.0	0.0
SERVICES & MISCELLANEOUS	1.	5.	3.	5.	(2000)	10.4	5.8	4.4	5.7
ANNUAL OPERATING COST (EX FUEL)	11.	42.	26.	42.	(2000)	4.5	5.9	6.2	5.8

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A GROWTH RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

#BEA (BUREAU OF ECONOMIC ANALYSIS) TWO-DIGIT CATEGORIES ARE IN PARENTHESES.

* PARTIAL BEA CATEGORY 40. TOTAL IS SUM OF 3 SEPARATE ENTRIES FOR CATEGORY 40.

++ PARTIAL BEA CATEGORY 52. REMAINDER IS PART OF MISCELLANEOUS ENTRY.

** PARTIAL BEA CATEGORY 53. TOTAL IS SUM OF 2 SEPARATE ENTRIES FOR CATEGORY 53.

HECHTEL ENERGY SUPPLY PLANNING MODEL

Table 37 (Continued)

GROWTH IN CAPITAL REQUIREMENTS* (MILLION POUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
EGYPT - NUCLEAR Capacity Variations/Imports

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
NON-MANUAL TECHNICAL MANPOWER	10.	45.	25.	45.	(2000)	16.4	8.2	3.1	6.2
NON-MANUAL NON-TECHNICAL MANPOWER	0.	3.	1.	3.	(2000)	25.1	18.6	2.0	8.9
MANUAL MANPOWER	8.	39.	21.	39.	(2000)	13.5	7.6	4.5	6.6
MANPOWER TOTAL	19.	87.	47.	87.	(2000)	15.4	8.4	3.6	6.5
WOOD PRODUCTS (20)	1.	3.	1.	3.	(2000)	10.0	8.9	5.1	6.7
CHEMICALS & ALLIED PROD. (27,28,30,32)	2.	2.	2.	4.	(1982)	-3.3	10.3	-3.2	-0.5
PETROLEUM PRODUCTS (31)	2.	2.	2.	2.	(1982)	2.4	0.8	0.6	1.0
GLASS, CLAY & STONE PRODUCTS (35,36)	3.	8.	5.	9.	(1983)	5.7	12.9	2.2	5.0
PRIMARY IRON & STEEL PRODUCTS (37)	14.	17.	15.	19.	(1982)	4.7	-3.1	1.4	1.0
PRIMARY NON-FERROUS METALS (38)	2.	10.	10.	29.	(1994)	10.3	21.8	0.9	6.5
FABRICATED STRUCTURAL PRODUCTS (40) *	4.	19.	17.	38.	(1994)	13.3	23.2	-0.5	6.3
OTHER FABRICATED PRODUCTS (42)	31.	84.	50.	84.	(2000)	8.7	2.0	3.7	4.2
MATERIALS TOTAL	31.	76.	60.	100.	(1994)	6.8	8.8	1.3	3.8
HVAC HEATING & COOLING UNITS (52) ++	0.	2.	1.	2.	(2000)	51.8	17.9	3.3	13.2
HVAC DUCTWORK & ACCESSORIES (40) *	0.	1.	0.	1.	(2000)	48.5	24.4	3.3	14.1
TURBINES (43)	17.	68.	33.	68.	(2000)	-1.7	5.1	8.2	5.8
GAS WELDING SETS (47) ++	0.	0.	0.	0.	(1980)	9.8	-8.0	2.0	1.1
ELECTRIC WELDING SETS (53) **	0.	1.	0.	1.	(2000)	14.9	3.8	6.9	7.6
CONSTRUCTION, MINING & OIL FIELD EQP (45)	29.	32.	29.	33.	(1982)	0.8	1.1	0.1	0.4
MATERIALS HANDLING EQUIPMENT (46)	0.	2.	1.	2.	(2000)	4.9	15.0	6.4	7.9
GENERAL INDUSTRY EQUIPMENT (49)	3.	14.	8.	14.	(2000)	36.7	-8.2	6.2	7.5
INSTRUMENTATION & CONTROLS (62)	2.	9.	6.	9.	(2000)	27.9	-0.2	4.8	7.2
ELECTRICAL EQUIPMENT (53) **	4.	21.	12.	21.	(2000)	13.1	8.5	4.6	6.8
FABRICATED PLATE PRODUCTS (40) *	13.	92.	40.	92.	(2000)	18.9	0.2	8.6	8.4
EQUIPMENT TOTAL	69.	242.	131.	242.	(2000)	8.3	1.8	5.9	5.4
MISCELLANEOUS MATERIALS & EQUIPMENT	8.	12.	9.	12.	(2000)	6.9	-4.1	2.4	1.8
MOBILE FACILITY	13.	10.	14.	19.	(1990)	-6.9	8.7	-2.2	-0.8
OTHER CONSTRUCTOR COSTS	20.	104.	51.	104.	(2000)	6.9	10.0	6.2	7.1
CONSTRUCTOR COST TOTAL **	159.	531.	312.	531.	(2000)	7.7	5.5	4.3	5.1

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

*BEA (BUREAU OF ECONOMIC ANALYSIS) TWO-DIGIT CATEGORIES ARE IN PARENTHESIS.

* PARTIAL BEA CATEGORY 40, TOTAL IS SUM OF 3 SEPARATE ENTRIES FOR CATEGORY 40.

++ PARTIAL BEA CATEGORY 52, REMAINDER IS PART OF MISCELLANEOUS ENTRY.

** PARTIAL BEA CATEGORY 53, TOTAL IS SUM OF 2 SEPARATE ENTRIES FOR CATEGORY 53.

** CONSTRUCTION CAPITAL COST TOTAL INCLUDES MANPOWER, MATERIALS AND EQUIPMENT SUBTOTALS ABOVE PLUS OTHER (OVERHEAD, PROFIT, ETC.) COSTS. IT EXCLUDES OWNER'S COSTS. (LAND COSTS, INTEREST DURING CONSTRUCTION, ETC.)

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 37(Continued)

GROWTH IN MANPOWER REQUIREMENTS (MAN-YEARS) FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES EGYPT - NUCLEAR -Capacity Variations/Imports

CATEGORY	-----ANNUAL REQUIREMENTS-----					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1976-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
CHEMICAL ENGINEERS	0.	6.	8.	14.	(1995)	9999.0	-24.2	9.7	9999.0
CIVIL ENGINEERS	47.	358.	159.	358.	(2000)	15.0	14.4	5.5	8.8
ELECTRICAL ENGINEERS	43.	303.	151.	303.	(2000)	15.4	14.6	4.8	8.5
MECHANICAL ENGINEERS	31.	225.	104.	225.	(2000)	20.1	6.3	6.4	8.5
MINING ENGINEERS	0.	1.	0.	1.	(1994)	0.0	0.0	9999.0	9999.0
NUCLEAR ENGINEERS	0.	24.	6.	24.	(2000)	9999.0	13.6	6.2	9999.0
GEOLOGICAL ENGINEERS	29.	27.	27.	32.	(1978)	0.6	-2.9	0.2	-0.4
PETROLEUM ENGINEERS	29.	25.	26.	32.	(1978)	0.6	-4.7	0.4	-0.7
OTHER ENGINEERS	0.	4.	5.	8.	(1995)	64.7	-12.9	6.1	9.6
ENGINEERS TOTAL	180.	972.	486.	972.	(2000)	13.4	9.2	5.1	7.3
DESIGNERS & DRAFTSMEN	66.	374.	201.	374.	(2000)	16.4	7.9	5.1	7.5
SUPERVISORS & MANAGERS	44.	185.	96.	185.	(2000)	8.5	10.2	4.2	6.1
NON-MANUAL, TECHNICAL TOTAL	290.	1531.	783.	1531.	(2000)	13.4	9.0	5.0	7.2
NON-MANUAL, NON-TECHNICAL	11.	194.	56.	194.	(2000)	47.5	10.6	5.8	12.9
NON-MANUAL TOTAL	301.	1726.	839.	1726.	(2000)	15.2	9.2	5.1	7.5
PIPEFITTERS	100.	710.	328.	710.	(2000)	31.4	-0.1	6.0	8.5
PIPEFITTER/WELDERS	58.	309.	148.	309.	(2000)	20.5	2.4	5.5	7.2
ELECTRICIANS	57.	502.	234.	502.	(2000)	22.7	16.6	4.1	9.5
BOILERMAKERS	44.	282.	120.	282.	(2000)	2.0	-6.9	15.3	8.0
BOILERMAKER/WELDERS	15.	92.	47.	92.	(2000)	-7.0	20.3	8.3	7.9
IRON WORKERS	21.	232.	175.	483.	(1994)	24.0	30.7	1.4	10.5
CARPENTERS	22.	279.	131.	279.	(2000)	36.3	20.7	2.6	11.3
EQUIPMENT OPERATORS	114.	306.	209.	306.	(2000)	7.1	6.8	2.6	4.2
LINEMEN	37.	143.	153.	445.	(1994)	6.6	18.6	1.6	5.8
TEAMSTERS & LABORERS	128.	592.	345.	592.	(2000)	14.8	11.4	3.0	6.6
OTHER	262.	392.	299.	392.	(2000)	2.4	-1.1	2.5	1.7
MANUAL TOTAL	857.	3839.	2188.	3839.	(2000)	13.8	8.1	4.0	6.4
CONSTRUCTION MANPOWER TOTAL	1158.	5565.	3027.	5565.	(2000)	14.2	8.4	4.3	6.8

• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A GROWTH RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 37 (Continued)

CUMULATIVE CAPITAL REQUIREMENTS (MILLION POUNDS, JAN 1978) OF THE ENERGY INDUSTRY
BY FACILITY GROUPING
(1978-1985) EGYPT - NUCLEAR Capacity Variations/Imports

FACILITY	CONSTRUCTION COSTS	OWNER'S COSTS PRIOR TO STARTUP	TOTAL
OIL			
EXPLORATION, DEVELOPMENT, & PRODUCTION	581.0	89.4	670.3
REFINING AND PROCESSING	314.3	50.4	364.7
PIPELINES	29.2	5.0	34.2
TANKERS, BARGES, TRUCKS	107.3	18.8	126.0
BULK STATIONS	7.3	1.2	8.6
OTHER	0.0	0.0	0.0
TOTAL OIL	1039.1	164.7	1203.8
OIL SHALE	0.0	0.0	0.0
GAS			
EXPLORATION, DEVELOPMENT, & PRODUCTION	6.5	1.0	7.6
GEOPRESSURED METHANE	0.0	0.0	0.0
PIPELINES	0.0	0.0	0.0
LNG TANKERS	0.0	0.0	0.0
DISTRIBUTION	0.0	0.0	0.0
OTHER	0.0	0.0	0.0
TOTAL GAS	6.5	1.0	7.6
COAL			
UNDERGROUND MINING	0.0	0.0	0.0
SURFACE MINING	0.0	0.0	0.0
RAIL	3.8	0.6	4.4
PIPELINES	0.0	0.0	0.0
BARGES, TRUCKS	0.5	0.1	0.6
TOTAL COAL	4.3	0.7	5.0
COAL SYNTHETICS			
LIQUEFACTION	0.0	0.0	0.0
METHANOL	0.0	0.0	0.0
SOLVENT REFINING	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.0	0.0	0.0
TOTAL SYNTHETICS	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	0.0	0.0	0.0
SOLAR	0.0	0.0	0.0
ELECTRIC UTILITIES			
COAL-FIRED	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.0	0.0	0.0
NUCLEAR	499.5	56.2	555.7
HYDRO & PUMPED STORAGE	29.0	3.1	32.1
OIL & GAS	235.8	26.6	262.5
GEOTHERMAL	0.0	0.0	0.0
TOTAL GENERATION	764.3	85.9	850.3
TRANSMISSION	178.0	20.6	198.6
DISTRIBUTION	132.8	15.1	147.9
TOTAL UTILITIES	1075.1	121.7	1196.8
TOTAL ENERGY INDUSTRY	2125.0	288.2	2413.2

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 37 (Continued)

CUMULATIVE CAPITAL REQUIREMENTS (MILLION POUNDS, JAN 1978) OF THE ENERGY INDUSTRY
BY FACILITY GROUPING
(1978-2000) EGYPT - NUCLEAR Capacity Variations/Imports

FACILITY	CONSTRUCTION COSTS	OWNER'S COSTS PRIOR TO STARTUP	TOTAL
OIL			
EXPLORATION, DEVELOPMENT, & PRODUCTION	1504.8	231.4	1736.3
REFINING AND PROCESSING	911.4	146.2	1057.6
PIPELINES	57.1	9.7	66.8
TANKERS, BARGES, TRUCKS	300.5	52.6	353.1
BULK STATIONS	16.1	2.7	18.9
OTHER	0.0	0.0	0.0
TOTAL OIL	2789.9	442.7	3232.6
OIL SHALE	0.0	0.0	0.0
GAS			
EXPLORATION, DEVELOPMENT, & PRODUCTION	18.1	2.8	20.9
GEOPRESSURED METHANE	0.0	0.0	0.0
PIPELINES	0.0	0.0	0.0
LNG TANKERS	0.0	0.0	0.0
DISTRIBUTION	0.0	0.0	0.0
OTHER	0.0	0.0	0.0
TOTAL GAS	18.1	2.8	20.9
COAL			
UNDERGROUND MINING	0.0	0.0	0.0
SURFACE MINING	0.0	0.0	0.0
RAIL	21.3	3.6	25.0
PIPELINES	0.0	0.0	0.0
BARGES, TRUCKS	7.4	1.3	8.7
TOTAL COAL	28.8	4.9	33.7
COAL SYNTHETICS			
LIQUEFACTION	0.0	0.0	0.0
METHANOL	0.0	0.0	0.0
SOLVENT REFINING	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.0	0.0	0.0
TOTAL SYNTHETICS	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	14.9	2.2	17.1
SOLAR	0.0	0.0	0.0
ELECTRIC UTILITIES			
COAL-FIRED	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.0	0.0	0.0
NUCLEAR	932.6	105.0	1037.7
HYDRO & PUMPED STORAGE	229.8	24.1	253.9
OIL & GAS	2141.4	242.0	2383.4
GEOTHERMAL	0.0	0.0	0.0
TOTAL GENERATION	3303.8	371.1	3674.9
TRANSMISSION	449.9	52.2	502.1
DISTRIBUTION	568.9	64.9	633.7
TOTAL UTILITIES	4322.6	488.2	4810.7
TOTAL ENERGY INDUSTRY	7174.3	940.7	8115.0

H E C H T E L E N E R G Y S U P P L Y P L A N N I N G M O D E L

Table 37 (Continued)

GROWTH IN ANNUAL COSTS (MILLION EPOUNDS JANUARY 1978)
FOR THE OPERATION AND MAINTENANCE OF ENERGY-RELATED FACILITIES
EGYPT - NUCLEAR Capacity Variations

CATEGORY	-----ANNUAL REQUIREMENTS-----					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
NON-MANUAL TECHNICAL MANPOWER	3.	13.	8.	13.	(2000)	10.1	6.8	5.2	6.3
NON-MANUAL NON-TECHNICAL MANPOWER	1.	3.	2.	3.	(2000)	12.6	5.7	5.7	6.8
MANUAL MANPOWER	9.	36.	23.	36.	(2000)	12.1	6.6	4.5	6.2
MANPOWER TOTAL	12.	52.	33.	52.	(2000)	11.6	6.6	4.7	6.2
WOOD PRODUCTS (20)	1.	4.	2.	4.	(2000)	6.3	9.5	7.2	7.5
CHEMICALS & ALLIED PROD. (27,28,30,32)	8.	24.	16.	25.	(1998)	-0.9	6.6	5.6	4.7
PETROLEUM PRODUCTS (31)	4.	13.	11.	13.	(1997)	16.9	6.1	1.5	4.9
GLASS, CLAY & STONE PRODUCTS (35,36)	1.	2.	1.	2.	(2000)	0.9	5.5	5.1	4.5
PRIMARY IRON & STEEL PRODUCTS (37)	1.	6.	3.	6.	(2000)	13.4	3.5	8.2	8.1
PRIMARY NON-FERROUS METALS (38)	0.	4.	2.	4.	(2000)	10.9	10.2	7.4	8.6
FABRICATED STRUCTURAL PRODUCTS (40) *	0.	4.	2.	4.	(2000)	15.5	5.8	8.8	9.2
OTHER FABRICATED PRODUCTS (42)	2.	9.	5.	9.	(2000)	7.8	8.2	6.2	6.9
MATERIALS TOTAL	17.	66.	42.	66.	(2000)	7.1	6.6	5.1	5.7
HVAC HEATING & COOLING UNITS (52) ++	0.	0.	0.	0.	(1977)	11.6	-0.7	-0.7	1.2
HVAC DUCTWORK & ACCESSORIES (40) *	0.	0.	0.	0.	(1977)	11.6	-0.7	-0.7	1.2
TURBINES (43)	0.	4.	2.	4.	(2000)	15.4	5.5	9.4	9.6
GAS WELDING SETS (47) ++	1.	5.	2.	5.	(2000)	1.1	3.9	8.4	6.2
ELECTRIC WELDING SETS (53) **	0.	0.	0.	0.		0.0	0.0	0.0	0.0
CONSTRUCTION, MINING & OIL FIELD EQP (45)	0.	2.	1.	2.	(2000)	17.0	7.4	9.7	10.4
MATERIALS HANDLING EQUIPMENT (46)	0.	0.	0.	0.	(2000)	28.1	15.1	4.7	10.4
GENERAL INDUSTRY EQUIPMENT (49)	4.	9.	6.	9.	(1998)	-2.3	4.7	5.1	3.8
INSTRUMENTATION & CONTROLS (62)	1.	3.	2.	3.	(2000)	3.8	3.9	5.4	4.8
ELECTRICAL EQUIPMENT (53) **	3.	14.	7.	14.	(2000)	8.6	7.7	6.8	7.3
FABRICATED PLATE PRODUCTS (40) *	0.	0.	0.	0.		0.0	0.0	0.0	0.0
EQUIPMENT TOTAL	8.	32.	18.	32.	(2000)	4.1	6.0	6.5	6.0
ELECTRICITY	5.	13.	8.	13.	(1998)	-3.4	6.4	5.4	4.1
NATURAL GAS	0.	0.	0.	0.	(2000)	22.4	10.6	14.6	15.0
WATER	2.	14.	7.	14.	(2000)	10.8	7.1	9.2	9.0
UTILITY TOTAL	7.	27.	15.	27.	(2000)	1.1	6.6	7.1	6.0
RENTS, ROYALTIES, ETC.	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TAXES	0.	0.	0.	0.		0.0	0.0	0.0	0.0
SERVICES & MISCELLANEOUS	10.	41.	26.	41.	(2000)	10.5	5.7	5.2	6.2
ANNUAL OPERATING COST (EX FUEL)	53.	214.	132.	214.	(2000)	7.8	6.4	5.4	6.0

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

#BEA (BUREAU OF ECONOMIC ANALYSIS) TWO-DIGIT CATEGORIES ARE IN PARENTHESIS.

* PARTIAL BEA CATEGORY 40. TOTAL IS SUM OF 3 SEPARATE ENTRIES FOR CATEGORY 40.

++ PARTIAL BEA CATEGORY 52. REMAINDER IS PART OF MISCELLANEOUS ENTRY.

** PARTIAL BEA CATEGORY 53. TOTAL IS SUM OF 2 SEPARATE ENTRIES FOR CATEGORY 53.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 37 (Continued)

GROWTH IN MANPOWER REQUIREMENTS (MAN-YEARS) FOR THE OPERATION AND MAINTENANCE OF ENERGY-RELATED FACILITIES EGYPT - NUCLEAR Capacity Variations

CATEGORY	-----ANNUAL REQUIREMENTS-----					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
CHEMICAL ENGINEERS	30.	78.	51.	81.	(1998)	-4.5	6.7	5.7	4.1
CIVIL ENGINEERS	18.	75.	45.	75.	(2000)	5.8	6.6	6.1	6.2
ELECTRICAL ENGINEERS	34.	253.	121.	253.	(2000)	14.0	8.1	7.6	8.8
MECHANICAL ENGINEERS	33.	134.	81.	134.	(2000)	7.4	7.7	5.2	6.1
MINING ENGINEERS	0.	4.	1.	4.	(1997)	0.0	0.0	9999.0	9999.0
NUCLEAR ENGINEERS	0.	4.	2.	4.	(1990)	0.0	0.0	9999.0	9999.0
GEOLOGICAL ENGINEERS	0.	2.	0.	2.	(1997)	0.0	0.0	9999.0	9999.0
PETROLEUM ENGINEERS	0.	0.	0.	0.		0.0	0.0	0.0	0.0
OTHER ENGINEERS	31.	99.	74.	102.	(1998)	8.6	6.5	3.5	5.0
ENGINEERS TOTAL	144.	649.	375.	649.	(2000)	7.1	7.3	6.0	6.5
DESIGNERS & DRAFTSMEN	28.	138.	75.	138.	(2000)	6.5	7.7	6.8	6.9
SUPERVISORS & MANAGERS	383.	1542.	1016.	1542.	(2000)	12.5	6.3	4.2	6.0
OTHER TECHNICAL	75.	275.	179.	276.	(1999)	3.9	8.4	5.1	5.6
NON-MANUAL, TECHNICAL TOTAL	630.	2604.	1644.	2604.	(2000)	10.1	6.8	4.8	6.1
NON-MANUAL, NON-TECHNICAL	224.	1092.	615.	1092.	(2000)	12.6	5.7	5.7	6.8
NON-MANUAL TOTAL	854.	3696.	2259.	3696.	(2000)	10.8	6.5	5.1	6.3
PIPEFITTERS	182.	640.	360.	640.	(2000)	5.2	3.9	5.9	5.4
WELDERS	77.	459.	232.	459.	(2000)	14.5	6.5	6.4	7.7
ELECTRICIANS	222.	1433.	695.	1433.	(2000)	10.6	7.5	7.6	8.1
BOILERMAKERS	25.	66.	43.	68.	(1998)	-4.5	6.7	5.7	4.1
MECHANICS	767.	2765.	2000.	2765.	(2000)	14.0	6.2	3.1	5.5
MACHINISTS	195.	670.	493.	670.	(2000)	13.5	6.2	2.9	5.3
IRONWORKERS	14.	29.	20.	29.	(1999)	0.0	2.3	4.0	3.0
CARPENTERS	28.	58.	42.	60.	(1998)	-2.7	4.0	4.2	3.0
EQUIPMENT OPERATORS	88.	791.	390.	791.	(2000)	12.9	11.6	8.0	9.6
OTHER OPERATORS	858.	4085.	2142.	4085.	(2000)	4.6	7.0	7.2	6.7
METER READERS	281.	1635.	907.	1635.	(2000)	12.7	7.4	6.4	7.6
TEAMSTERS & LABORERS	1797.	6254.	4798.	6254.	(2000)	15.3	6.4	2.5	5.3
LINEMEN	61.	559.	278.	559.	(2000)	13.5	11.9	7.9	9.7
OTHER	482.	2019.	1330.	2019.	(2000)	11.7	6.8	4.5	6.1
MANUAL TOTAL	4990.	20670.	13341.	20670.	(2000)	12.1	6.6	4.4	6.1
MANPOWER TOTAL	5844.	24366.	15600.	24366.	(2000)	11.9	6.6	4.5	6.1

• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A GROWTH RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

Table 37 (Continued)

BECHTEL ENERGY SUPPLY PLANNING MODEL

GROWTH IN REQUIREMENTS FOR CONSTRUCTION MANPOWER TOTAL (MAN-YEARS/YEAR)
 FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
 FOR THE EGYPT - NUCLEAR Capacity CASE

CATEGORY	ANNUAL REQUIREMENTS				AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
OIL								
EXPLORATION, DEVELOPMENT, & PRODUCTION	1602.	1375.	1403.	1686. (1978)	0.8	-4.4	0.3	-0.6
REFINING AND PROCESSING	0.	4770.	2663.	4770. (1980)	9999.0	-17.2	6.5	9999.0
PIPELINES	76.	0.	83.	547. (1982)	-100.0	9999.0	-100.0	-100.0
TANKERS, BARGES, TRUCKS	0.	0.	0.	0.	0.0	0.0	0.0	0.0
BULK STATIONS	0.	0.	26.	96. (1978)	0.0	0.0	0.0	0.0
OTHER	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TOTAL OIL	1677.	6145.	4175.	6423. (1980)	39.9	-12.0	4.0	5.6
OIL SHALE	0.	0.	0.	0.	0.0	0.0	0.0	0.0
GAS								
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	0.	26.	88. (1978)	0.0	0.0	0.0	0.0
GEOPRESSURED METHANE	0.	0.	0.	0.	0.0	0.0	0.0	0.0
PIPELINES	0.	0.	0.	0.	0.0	0.0	0.0	0.0
LNG TANKERS	0.	0.	0.	0.	0.0	0.0	0.0	0.0
DISTRIBUTION	256.	0.	0.	256. (1976)	-100.0	0.0	0.0	-100.0
OTHER	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TOTAL GAS	256.	0.	26.	256. (1976)	-100.0	0.0	0.0	-100.0
COAL								
UNDERGROUND MINING	0.	0.	0.	0.	0.0	0.0	0.0	0.0
SURFACE MINING	0.	0.	0.	0.	0.0	0.0	0.0	0.0
RAIL	0.	0.	0.	0.	0.0	0.0	0.0	0.0
PIPELINES	0.	0.	0.	0.	0.0	0.0	0.0	0.0
BARGES, TRUCKS	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TOTAL COAL	0.	0.	0.	0.	0.0	0.0	0.0	0.0
COAL SYNTHETICS								
LIQUEFACTION	0.	0.	0.	0.	0.0	0.0	0.0	0.0
METHANOL	0.	0.	0.	0.	0.0	0.0	0.0	0.0
SOLVENT REFINING	0.	0.	0.	0.	0.0	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.0	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TOTAL SYNTHETICS	0.	0.	0.	0.	0.0	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	0.	151.	51.	409. (1996)	0.0	0.0	9999.0	9999.0
SOLAR	0.	0.	0.	0.	0.0	0.0	0.0	0.0
ELECTRIC UTILITIES								
COAL-FIRED	0.	0.	0.	0.	0.0	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.0	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.0	0.0	0.0	0.0
NUCLEAR	0.	4836.	1606.	4836. (2000)	9999.0	36.4	0.7	9999.0
HYDRO & PUMPED STORAGE	0.	114.	759.	2206. (1987)	0.0	9999.0	-15.3	9999.0
OIL & GAS	2654.	12560.	5321.	12560. (2000)	-26.6	-100.0	9999.0	6.7
GEO THERMAL	0.	0.	0.	0.	0.0	0.0	0.0	0.0
TOTAL GENERATION	2654.	17510.	7686.	17510. (2000)	-10.7	27.6	7.8	8.2
TRANSMISSION	0.	0.	1250.	6575. (1994)	0.0	9999.0	-100.0	0.0
DISTRIBUTION	863.	3324.	2151.	3324. (1999)	7.3	8.2	4.6	5.8
TOTAL UTILITIES	3517.	20834.	11087.	20834. (2000)	-5.3	24.3	6.2	7.7
TOTAL ENERGY INDUSTRY	5451.	27130.	15339.	27130. (2000)	14.2	5.0	5.7	6.9

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Table 37 (Continued)

B E C H T E L E N E R G Y S U P P L Y P L A N N I N G M O D E L

GROWTH IN SELECTED MATERIALS AND EQUIPMENT ITEMS REQUIRED
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
EGYPT - NUCLEAR Capacity Variations

CATEGORY		ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
		1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
CEMENT	(TONNES)	17391.	52859.	31970.	52859.	(2000)	7.2	8.9	2.7	4.7
CONCRETE (INCLUDES CEMENT)	(TONNES)	91451.	1138511.	240513.	438511.	(2000)	11.7	14.4	3.1	6.7
BENTONITE (IN DRILLING MUD)	(TONNES)	2719.	2300.	2399.	2971.	(1978)	0.9	-4.7	0.3	-0.7
BARITE (IN DRILLING MUD)	(TONNES)	2636.	2277.	2339.	2893.	(1978)	0.8	-4.5	0.3	-0.6
CARBON STEEL	(TONNES)	34678.	81114.	59513.	90051.	(1994)	4.2	5.4	2.9	3.6
ALLOY STEEL	(TONNES)	2673.	7467.	4532.	7467.	(2000)	8.8	0.4	4.6	4.4
STAINLESS STEEL	(TONNES)	191.	2022.	922.	2022.	(2000)	45.1	-3.6	7.3	10.3
STEEL TOTAL	(TONNES)	37542.	90603.	64966.	96154.	(1994)	4.9	4.9	3.1	3.7
COPPER	(TONNES)	473.	2819.	1792.	3744.	(1994)	21.1	6.7	4.7	7.7
ALUMINUM	(TONNES)	639.	1254.	2717.	11386.	(1994)	5.5	20.2	-3.0	2.8
MANGANESE	(TONNES)	285.	688.	492.	692.	(1994)	5.7	4.4	3.0	3.7
CHROMIUM	(TONNES)	136.	582.	319.	582.	(2000)	20.3	-1.7	5.5	6.2
NICKEL	(TONNES)	8.	79.	37.	79.	(2000)	41.1	-0.9	6.4	9.9
CAST IRON	(TONNES)	459.	2237.	1364.	2237.	(2000)	26.2	-0.7	4.7	6.8
STEEL CASTINGS	(TONNES)	348.	1498.	868.	1498.	(2000)	12.7	7.7	4.1	6.3
ALUMINUM CASTINGS	(TONNES)	29.	124.	73.	124.	(2000)	12.3	4.9	5.0	6.2
BRASS & BRONZE CASTINGS	(TONNES)	32.	201.	110.	201.	(2000)	28.8	-3.8	6.9	7.9
IRON & STEEL FORGINGS	(TONNES)	294.	1157.	714.	1157.	(2000)	9.5	10.6	3.4	5.9
STRUCTURAL STEEL SHAPES	(TONNES)	2335.	9327.	7560.	18615.	(1994)	13.0	10.8	2.6	5.9
STEEL PLATE < 3.8 CM THICK	(TONNES)	3340.	12680.	9464.	14660.	(1994)	15.2	4.6	3.7	5.7
STEEL PLATE > 3.8 CM THICK	(TONNES)	2.	677.	424.	901.	(1986)	177.8	40.2	-0.6	26.7
PIPE, CARBON STEEL	(TONNES)	6978.	15706.	10279.	16030.	(1982)	0.7	2.7	4.4	3.4
PIPE, ALLOY & STAINLESS STEEL	(TONNES)	107.	1905.	663.	1905.	(2000)	44.2	17.0	4.3	12.7
OIL COUNTRY TUBULAR GOODS	(TONNES)	16166.	13892.	14410.	18061.	(1978)	0.8	-4.6	0.3	-0.6
REINFORCING BAR (REBAR)	(TONNES)	907.	8350.	3959.	8350.	(2000)	20.9	23.9	2.6	9.7
VALVES, CARBON STEEL	(TONNES)	156.	998.	603.	998.	(2000)	44.1	-13.6	7.8	8.1
VALVES, ALLOY & STAINLESS STEEL	(TONNES)	8.	197.	83.	197.	(2000)	83.2	1.7	5.1	14.5
STEAM TURBOGENERATORS	(MEGAWATTS)	389.	2010.	826.	2010.	(2000)	-8.7	3.5	13.0	7.1
STEAM TURBINES (EXCL TRBGENS)	(MEGAWATTS)	10.	47.	21.	47.	(2000)	3.4	-10.4	14.3	6.9
GAS TURBOGENERATORS	(MEGAWATTS)	71.	3.	25.	161.	(1982)	-22.3	-35.3	1.0	-11.9
DRAGLINES	(CUBIC METERS)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
DRILL RIGS, ONSHORE	(RIG YEARS)	16.	14.	14.	18.	(1978)	1.0	-5.0	0.7	-0.4
DRILL RIGS, OFFSHORE	(RIG YEARS)	5.	5.	4.	5.	(1979)	0.0	-2.8	1.0	0.0
DRILL BITS	(NUMBER)	1358.	1195.	1233.	1494.	(1978)	0.7	-1.8	-0.5	-0.5
PUMPS & DRIVERS > 745 MGAWTS (MEGAWATTS)		9.	76.	31.	76.	(2000)	22.6	6.8	7.0	9.4
PUMPS & DRIVERS < 745 MGAWTS (MEGAWATTS)		20.	30.	25.	31.	(1995)	9.4	-8.1	3.2	1.7
AXIAL COMPRESSORS > 3727 MGAWTS (MGAWTS)		0.	0.	0.	0.		0.0	0.0	0.0	0.0
CENTRIF COMP & DRV > 7455 MW (MGAWTS)		0.	19.	12.	19.	(1979)	9999.0	-24.2	9.7	9999.0
CENTRIF COMP & DRV < 7455 MW (MGAWTS)		1.	4.	3.	4.	(1980)	48.1	-18.5	6.8	6.6
HEAT EXCHANGERS	(SQUARE METERS)	7704.	90354.	48292.	90354.	(2000)	63.2	-15.9	9.5	10.8
NON-NUC PRESS VESS < 3.8 CM WALL (TONNES)		54.	2062.	1349.	2095.	(1984)	148.4	-23.3	9.2	16.3
NON-NUC PRESS VESS 3.8-10 CM W (TONNES)		4.	4.	4.	4.	(1979)	0.0	-2.8	1.0	0.0
NON-NUC PRESS VESS > 10 CM WALL (TONNES)		0.	0.	0.	0.		0.0	0.0	0.0	0.0
BOILERS	(TONNES STEAM PER HOUR)	1130277.	4931274.	2227708.	4931274.	(2000)	-9.6	-36.2	31.7	6.3
NUCLEAR STEAM SUPPLY SYSTEMS (MEGAWATTS)		0.	423.	121.	423.	(2000)	9999.0	28.2	2.0	9999.0

• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A GROWTH RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

HECHTEL ENERGY SUPPLY PLANNING MODEL

Table 37 (Continued)

SCHEDULE OF MANPOWER RESOURCES (MAN-YEARS) FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES EGYPT - NUCLEAR Capacity Variations

RESOURCES	1990	1991	1992	1993	1994	1995	1996
CHEMICAL ENGINEERS	26.	38.	17.	4.	26.	39.	18.
CIVIL ENGINEERS	291.	320.	301.	401.	422.	365.	338.
ELECTRICAL ENGINEERS	281.	267.	255.	498.	460.	322.	312.
MECHANICAL ENGINEERS	186.	228.	178.	190.	250.	265.	217.
MINING ENGINEERS	0.	0.	0.	2.	3.	3.	2.
NUCLEAR ENGINEERS	0.	0.	0.	0.	0.	0.	2.
GEOLOGICAL ENGINEERS	27.	29.	29.	29.	31.	30.	30.
PETROLEUM ENGINEERS	23.	25.	24.	23.	24.	24.	25.
OTHER ENGINEERS	13.	20.	10.	4.	16.	22.	10.
ENGINEERS TOTAL	846.	927.	815.	1151.	1231.	1069.	954.
DESIGNERS & DRAFTSMEN	393.	453.	362.	465.	543.	506.	413.
SUPERVISORS & MANAGERS	167.	203.	181.	172.	208.	205.	178.
NON-MANUAL, TECHNICAL TOTAL	1406.	1583.	1358.	1789.	1982.	1781.	1546.
NON-MANUAL, NON-TECHNICAL	837.	909.	861.	1101.	1292.	1137.	1088.
NON-MANUAL TOTAL	2243.	2491.	2219.	2890.	3274.	2918.	2633.
PIPEFITTERS	1079.	2129.	2979.	2200.	1660.	2773.	3523.
PIPEFITTER/WELDERS	520.	890.	1203.	956.	785.	1182.	1440.
ELECTRICIANS	986.	1337.	1710.	1590.	1629.	1839.	2108.
BOILERMAKERS	745.	957.	1207.	1205.	1174.	1431.	1614.
BOILERMAKER/WELDERS	356.	394.	472.	464.	499.	551.	577.
IRON WORKERS	1433.	594.	755.	1581.	3390.	844.	929.
CARPENTERS	509.	731.	958.	772.	715.	968.	1124.
EQUIPMENT OPERATORS	1056.	1231.	1483.	1344.	1337.	1612.	1698.
LINEMEN	1524.	669.	745.	1554.	3123.	837.	837.
TEAMSTERS & LABORERS	1767.	2054.	2623.	2338.	2543.	2610.	2926.
OTHER	1103.	1245.	1429.	1334.	1325.	1512.	1609.
MANUAL TOTAL	11077.	12233.	15563.	15338.	18181.	16159.	18385.
CONSTRUCTION MANPOWER TOTAL	13320.	14725.	17783.	18228.	21455.	19077.	21019.

• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 37 (Continued)

SCHEDULE OF MANPOWER RESOURCES (MAN-YEARS) FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES EGYPT - NUCLEAR Capacity Variations

RESOURCES	1997	1998	1999	2000	TOTAL 1978-2000
CHEMICAL ENGINEERS	4.	26.	38.	17.	509.
CIVIL ENGINEERS	377.	459.	521.	587.	7274.
ELECTRICAL ENGINEERS	412.	462.	471.	511.	7104.
MECHANICAL ENGINEERS	209.	302.	365.	358.	4696.
MINING ENGINEERS	0.	0.	0.	2.	11.
NUCLEAR ENGINEERS	6.	11.	16.	24.	138.
GEOLOGICAL ENGINEERS	26.	25.	25.	30.	672.
PETROLEUM ENGINEERS	26.	25.	25.	25.	594.
OTHER ENGINEERS	3.	15.	19.	10.	282.
ENGINEERS TOTAL	1064.	1326.	1480.	1563.	21291.
DESIGNERS & DRAFTSMEN	425.	572.	656.	634.	9427.
SUPERVISORS & MANAGERS	168.	225.	265.	292.	4058.
NON-MANUAL, TECHNICAL TOTAL	1657.	2123.	2401.	2489.	34766.
NON-MANUAL, NON-TECHNICAL	1269.	1669.	1925.	2173.	23668.
NON-MANUAL TOTAL	2926.	3792.	4326.	4661.	58434.
PIPEFITTERS	2523.	1918.	3200.	4340.	45908.
PIPEFITTER/WELDERS	1104.	904.	1377.	1827.	19646.
ELECTRICIANS	1679.	1513.	2147.	2868.	31692.
BOILERMAKERS	1439.	1352.	1665.	1916.	18803.
BOILERMAKER/WELDERS	465.	451.	535.	611.	7362.
IRON WORKERS	1031.	1612.	917.	1278.	25158.
CARPENTERS	765.	640.	1031.	1512.	17151.
EQUIPMENT OPERATORS	1212.	1174.	1422.	1757.	26747.
LINEMEN	1122.	1767.	1004.	1004.	24622.
TEAMSTERS & LABORERS	2238.	2224.	2696.	3477.	47681.
OTHER	1528.	1486.	1662.	1878.	29582.
MANUAL TOTAL	15104.	15041.	17656.	22469.	294351.
CONSTRUCTION MANPOWER TOTAL	18031.	18833.	21983.	27130.	352786.

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

HECHTEL ENERGY SUPPLY PLANNING MODEL

Table 37 (Continued)

SCHEDULE OF MANPOWER RESOURCES (MAN-YEARS) FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES EGYPT - NUCLEAR Capacity Variations

RESOURCES	1976	1977	1978	1979	1980	1981	1982
CHEMICAL ENGINEERS	0.	0.	26.	38.	17.	4.	26.
CIVIL ENGINEERS	112.	139.	208.	189.	128.	152.	306.
ELECTRICAL ENGINEERS	105.	129.	235.	204.	131.	158.	376.
MECHANICAL ENGINEERS	66.	83.	164.	181.	108.	99.	212.
MINING ENGINEERS	0.	0.	0.	0.	0.	0.	0.
NUCLEAR ENGINEERS	0.	1.	2.	4.	5.	8.	9.
GEOLOGICAL ENGINEERS	29.	32.	32.	30.	30.	30.	30.
PETROLEUM ENGINEERS	29.	32.	32.	30.	30.	30.	30.
OTHER ENGINEERS	1.	2.	13.	19.	9.	4.	16.
ENGINEERS TOTAL	342.	418.	711.	696.	457.	486.	1004.
DESIGNERS & DRAFTSMEN	133.	162.	334.	352.	208.	194.	450.
SUPERVISORS & MANAGERS	75.	89.	118.	120.	85.	97.	169.
NON-MANUAL, TECHNICAL TOTAL	551.	669.	1163.	1168.	751.	777.	1623.
NON-MANUAL, NON-TECHNICAL	393.	489.	707.	726.	516.	613.	1082.
NON-MANUAL TOTAL	944.	1157.	1870.	1894.	1267.	1389.	2705.
PIPEFITTERS	586.	925.	902.	1473.	1879.	1000.	705.
PIPEFITTER/WELDERS	311.	466.	459.	606.	717.	430.	373.
ELECTRICIANS	377.	643.	654.	686.	768.	590.	791.
BOILERMAKERS	311.	593.	582.	452.	325.	150.	178.
BOILERMAKER/WELDERS	104.	198.	194.	128.	72.	39.	67.
IRON WORKERS	147.	295.	619.	1237.	285.	225.	890.
CARPENTERS	151.	290.	278.	346.	445.	324.	391.
EQUIPMENT OPERATORS	527.	634.	655.	694.	743.	677.	778.
LINEMEN	259.	243.	620.	1189.	335.	410.	1010.
TEAMSTERS & LABORERS	741.	907.	969.	1345.	1305.	1060.	1339.
OTHER	994.	1159.	1218.	1126.	1116.	1069.	1172.
MANUAL TOTAL	4507.	6353.	7149.	9281.	7990.	5973.	7694.
CONSTRUCTION MANPOWER TOTAL	5451.	7510.	9019.	11175.	9257.	7363.	10400.

• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 37 (Continued)

SCHEDULE OF MANPOWER RESOURCES (MAN-YEARS) FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES EGYPT - NUCLEAR Capacity Variations

RESOURCES	1983	1984	1985	1986	1987	1988	1989
CHEMICAL ENGINEERS	38.	17.	4.	26.	38.	17.	4.
CIVIL ENGINEERS	317.	248.	265.	273.	289.	248.	270.
ELECTRICAL ENGINEERS	339.	196.	262.	249.	218.	205.	281.
MECHANICAL ENGINEERS	242.	156.	127.	174.	204.	149.	130.
MINING ENGINEERS	0.	0.	0.	0.	0.	0.	0.
NUCLEAR ENGINEERS	11.	11.	10.	8.	6.	4.	1.
GEOLOGICAL ENGINEERS	29.	31.	30.	31.	32.	27.	28.
PETROLEUM ENGINEERS	28.	26.	23.	24.	25.	22.	23.
OTHER ENGINEERS	19.	10.	4.	13.	20.	10.	2.
ENGINEERS TOTAL	1024.	695.	725.	797.	834.	683.	740.
DESIGNERS & DRAFTSMEN	481.	305.	292.	367.	412.	307.	303.
SUPERVISORS & MANAGERS	181.	169.	162.	176.	207.	166.	144.
NON-MANUAL, TECHNICAL TOTAL	1686.	1169.	1179.	1340.	1454.	1155.	1188.
NON-MANUAL, NON-TECHNICAL	1176.	799.	746.	820.	812.	698.	714.
NON-MANUAL TOTAL	2862.	1968.	1925.	2160.	2266.	1853.	1902.
PIPEFITTERS	1789.	2400.	1337.	656.	1538.	2346.	1559.
PIPEFITTER/WELDERS	756.	963.	582.	342.	634.	924.	673.
ELECTRICIANS	1432.	1472.	1160.	1005.	1184.	1388.	1154.
BOILERMAKERS	349.	353.	159.	67.	254.	551.	680.
BOILERMAKER/WELDERS	105.	114.	158.	207.	256.	278.	369.
IRON WORKERS	2290.	680.	904.	1520.	595.	656.	891.
CARPENTERS	722.	936.	803.	731.	847.	909.	696.
EQUIPMENT OPERATORS	865.	1026.	1052.	1096.	1297.	1286.	1254.
LINEMEN	2026.	502.	787.	1432.	594.	577.	954.
TEAMSTERS & LABORERS	1969.	2063.	1892.	1867.	2068.	2296.	2011.
OTHER	1202.	1236.	1029.	955.	1090.	1129.	1128.
MANUAL TOTAL	13505.	11745.	9861.	9879.	10356.	12342.	11371.
CONSTRUCTION MANPOWER TOTAL	16367.	13713.	11786.	12039.	12622.	14194.	13272.

• INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 37 (Cont)

GROWTH IN CAPITAL REQUIREMENTS* (MILLION POUNDS, JANUARY 1976) FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES EGYPT - NUCLEAR Capacity Variations

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
NON-MANUAL TECHNICAL MANPOWER	12.	51.	29.	51.	(2000)	16.9	7.5	3.4	6.4
NON-MANUAL NON-TECHNICAL MANPOWER	1.	9.	4.	9.	(2000)	17.2	13.0	4.0	8.0
MANUAL MANPOWER	16.	76.	42.	76.	(2000)	13.3	6.4	5.1	6.7
MANPOWER TOTAL	29.	136.	75.	136.	(2000)	15.0	7.3	4.3	6.6
WOOD PRODUCTS (20)	2.	10.	6.	10.	(2000)	9.4	7.6	4.6	6.0
CHEMICALS & ALLIED PROD. (27,28,30,32)	3.	2.	3.	4.	(1982)	-3.3	10.3	-3.2	-0.5
PETROLEUM PRODUCTS (31)	4.	9.	5.	9.	(2000)	-4.9	5.3	4.7	3.1
GLASS, CLAY & STONE PRODUCTS (35,36)	3.	13.	8.	13.	(2000)	11.9	8.1	3.2	5.6
PRIMARY IRON & STEEL PRODUCTS (37)	16.	22.	18.	22.	(2000)	5.2	-3.8	2.0	1.3
PRIMARY NON-FERROUS METALS (38)	2.	11.	11.	32.	(1994)	10.3	21.8	0.9	6.5
FABRICATED STRUCTURAL PRODUCTS (40) *	5.	23.	20.	43.	(1994)	12.6	22.6	-0.0	6.4
OTHER FABRICATED PRODUCTS (42)	4.	18.	9.	18.	(2000)	16.3	-0.8	5.7	6.0
MATERIALS TOTAL	41.	107.	80.	127.	(1994)	7.4	7.5	2.2	4.1
HVAC HEATING & COOLING UNITS (52) ++	0.	2.	1.	2.	(2000)	51.8	17.9	3.3	13.2
HVAC DUCTWORK & ACCESSORIES (40) *	0.	1.	0.	1.	(2000)	36.9	22.0	4.0	12.5
TURBINES (43)	19.	74.	36.	74.	(2000)	-1.7	5.1	8.2	5.8
GAS WELDING SETS (47) ++	0.	0.	0.	0.	(1980)	9.8	-8.0	2.0	1.1
ELECTRIC WELDING SETS (53) **	0.	1.	0.	1.	(2000)	14.9	3.8	6.9	7.6
CONSTRUCTION, MINING & OIL FIELD EQP (45)	34.	52.	43.	54.	(1994)	0.8	3.4	1.5	1.8
MATERIALS HANDLING EQUIPMENT (46)	0.	2.	1.	2.	(2000)	4.9	15.0	6.4	7.9
GENERAL INDUSTRY EQUIPMENT (49)	3.	17.	10.	17.	(2000)	40.4	-8.7	6.2	7.8
INSTRUMENTATION & CONTROLS (62)	2.	10.	6.	10.	(2000)	27.9	-0.2	4.8	7.2
ELECTRICAL EQUIPMENT (53) **	5.	24.	14.	24.	(2000)	15.8	7.6	4.5	7.0
FABRICATED PLATE PRODUCTS (40) *	14.	100.	44.	100.	(2000)	18.9	0.2	8.6	8.4
EQUIPMENT TOTAL	78.	285.	156.	285.	(2000)	8.6	2.3	5.9	5.6
MISCELLANEOUS MATERIALS & EQUIPMENT	8.	13.	10.	13.	(2000)	6.8	-4.0	2.4	1.7
MOBILE FACILITY	14.	16.	17.	23.	(1990)	-7.0	11.7	-0.9	0.6
OTHER CONSTRUCTOR COSTS	27.	138.	71.	138.	(2000)	6.4	10.7	6.1	7.1
CONSTRUCTOR COST TOTAL **	196.	695.	409.	695.	(2000)	8.1	5.7	4.6	5.4

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

#BEA (BUREAU OF ECONOMIC ANALYSIS) TWO-DIGIT CATEGORIES ARE IN PARENTHESES.

* PARTIAL BEA CATEGORY 40, TOTAL IS SUM OF 3 SEPARATE ENTRIES FOR CATEGORY 40.

++ PARTIAL BEA CATEGORY 52, REMAINDER IS PART OF MISCELLANEOUS ENTRY.

** PARTIAL BEA CATEGORY 53, TOTAL IS SUM OF 2 SEPARATE ENTRIES FOR CATEGORY 53.

** CONSTRUCTION CAPITAL COST TOTAL INCLUDES MANPOWER, MATERIALS AND EQUIPMENT SUBTOTALS ABOVE PLUS OTHER (OVERHEAD, PROFIT, ETC.) COSTS. IT EXCLUDES OWNER'S COSTS. (LAND COSTS, INTEREST DURING CONSTRUCTION, ETC.)

HECHTEL ENERGY SUPPLY PLANNING MODEL

Table37 (Continued)

GROWTH IN MANPOWER REQUIREMENTS (MAN-YEARS) FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES EGYPT - Capacity Variations

CATEGORY	ANNUAL REQUIREMENTS					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
CHEMICAL ENGINEERS	0.	17.	22.	39.	(1995)	9999.0	-24.2	9.7	9999.0
CIVIL ENGINEERS	112.	587.	316.	587.	(2000)	3.4	15.7	5.4	7.2
ELECTRICAL ENGINEERS	105.	511.	309.	511.	(2000)	5.7	14.9	4.5	6.8
MECHANICAL ENGINEERS	66.	358.	204.	365.	(1999)	13.0	3.2	7.2	7.3
MINING ENGINEERS	0.	2.	0.	3.	(1994)	0.0	0.0	9999.0	9999.0
NUCLEAR ENGINEERS	0.	24.	6.	24.	(2000)	9999.0	13.6	6.2	9999.0
GEOLOGICAL ENGINEERS	29.	30.	29.	32.	(1987)	0.6	-0.0	-0.0	0.1
PETROLEUM ENGINEERS	29.	25.	26.	32.	(1978)	0.6	-4.7	0.4	-0.7
OTHER ENGINEERS	1.	10.	12.	22.	(1995)	71.2	-14.2	6.6	10.3
ENGINEERS TOTAL	342.	1563.	925.	1563.	(2000)	7.5	9.7	5.3	6.5
DESIGNERS & DRAFTSMEN	133.	634.	410.	656.	(1999)	11.9	7.0	5.3	6.7
SUPERVISORS & MANAGERS	75.	292.	176.	292.	(2000)	3.0	13.8	4.0	5.8
NON-MANUAL, TECHNICAL TOTAL	551.	2489.	1512.	2489.	(2000)	8.0	9.5	5.1	6.5
NON-MANUAL, NON-TECHNICAL	393.	2173.	1029.	2173.	(2000)	7.0	7.6	7.4	7.4
NON-MANUAL TOTAL	944.	4661.	2541.	4661.	(2000)	7.6	8.7	6.1	6.9
PIPEFITTERS	586.	4340.	1996.	4340.	(2000)	33.8	-6.6	8.2	8.7
PIPEFITTER/WELDERS	311.	1827.	854.	1827.	(2000)	23.3	-4.1	7.9	7.7
ELECTRICIANS	377.	2868.	1378.	2868.	(2000)	19.5	8.6	6.2	8.8
BOILERMAKERS	311.	1916.	818.	1916.	(2000)	1.1	-13.3	18.1	7.9
BOILERMAKER/WELDERS	104.	611.	320.	611.	(2000)	-8.7	16.9	9.5	7.7
IRON WORKERS	147.	1278.	1094.	3390.	(1994)	18.1	25.9	2.3	9.4
CARPENTERS	151.	1512.	746.	1512.	(2000)	31.0	12.5	4.3	10.1
EQUIPMENT OPERATORS	527.	1757.	1163.	1757.	(2000)	9.0	7.2	3.5	5.1
LINEMEN	259.	1004.	1071.	3123.	(1994)	6.6	18.6	1.6	5.8
TEAMSTERS & LABORERS	741.	3477.	2073.	3477.	(2000)	15.2	7.7	4.1	6.7
OTHER	994.	1878.	1286.	1878.	(2000)	3.0	-1.6	4.1	2.7
MANUAL TOTAL	4507.	22469.	12798.	22469.	(2000)	15.4	4.3	5.6	6.8
CONSTRUCTION MANPOWER TOTAL	5451.	27130.	15339.	27130.	(2000)	14.2	5.0	5.7	6.9

* INCLUDES REQUIREMENTS FOR ENERGY SUPPLY AND TRANSPORTATION FACILITIES

A GROWTH RATE EQUAL TO 9999.0% IMPLIES INFINITE GROWTH

HECHTEL ENERGY SUPPLY PLANNING MODEL

Table 37 (Continued)

RESOURCES	CONSTRUCTOR COST TOTAL ##		(MILLION POUNDS, JANUARY 1978)				
	FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES		FOR THE EGYPT - NUCLEAR Capacity CASE				
	Variations						
	1990	1991	1992	1993	1994	1995	1996
OIL							
EXPLORATION, DEVELOPMENT, & PRODUCTION	65.	67.	65.	67.	68.	71.	70.
REFINING AND PROCESSING	22.	65.	87.	44.	22.	65.	87.
PIPELINES	0.	2.	9.	0.	0.	0.	0.
TANKERS, BARGES, TRUCKS	16.	15.	15.	15.	14.	14.	13.
BULK STATIONS	0.	0.	0.	0.	2.	4.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL OIL	102.	150.	177.	126.	106.	154.	170.
OIL SHALE	0.	0.	0.	0.	0.	0.	0.
GAS							
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	1.	3.	0.	0.	0.	1.
GEOPRESSURED METHANE	0.	0.	0.	0.	0.	0.	0.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
LNG TANKERS	0.	0.	0.	0.	0.	0.	0.
DISTRIBUTION	0.	0.	0.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL GAS	0.	1.	3.	0.	0.	0.	1.
COAL							
UNDERGROUND MINING	0.	0.	0.	0.	0.	0.	0.
SURFACE MINING	0.	0.	0.	0.	0.	0.	0.
RAIL	4.	4.	0.	4.	4.	4.	7.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
BARGES, TRUCKS	4.	0.	0.	0.	0.	0.	0.
TOTAL COAL	8.	4.	0.	4.	4.	4.	8.
COAL SYNTHETICS							
LIQUEFACTION	0.	0.	0.	0.	0.	0.	0.
METHANOL	0.	0.	0.	0.	0.	0.	0.
SOLVENT REFINING	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.	0.	0.
TOTAL SYNTHETICS	0.	0.	0.	0.	0.	0.	0.
NUCLEAR FUEL CYCLE	0.	0.	0.	5.	3.	4.	6.
SOLAR	0.	0.	0.	0.	0.	0.	0.
ELECTRIC UTILITIES							
COAL-FIRED	0.	0.	0.	0.	0.	0.	0.
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.	0.	0.
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.	0.	0.
NUCLEAR	0.	0.	0.	0.	0.	0.	5.
HYDRO & PUMPED STORAGE	34.	28.	31.	31.	34.	25.	16.
OIL & GAS	136.	158.	185.	200.	221.	238.	237.
GEOTHERMAL	0.	0.	0.	0.	0.	0.	0.
TOTAL GENERATION	170.	186.	216.	231.	255.	263.	257.
TRANSMISSION	35.	0.	0.	85.	127.	0.	0.
DISTRIBUTION	39.	41.	43.	44.	45.	48.	48.
TOTAL UTILITIES	244.	227.	259.	361.	427.	311.	305.
TOTAL ENERGY INDUSTRY	354.	382.	439.	445.	540.	472.	490.

CONSTRUCTION COST TOTAL DOES NOT INCLUDE OWNER'S COSTS.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 37(Continued)

GROWTH IN REQUIREMENTS FOR CONSTRUCTOR COST TOTAL ## (MILLION POUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
FOR THE EGYPT - NUCLEAR Capacity Variations

RESOURCES	1997	1998	1999	2000	TOTAL 1978-2000
OIL					
EXPLORATION, DEVELOPMENT, & PRODUCTION	69.	75.	73.	73.	1666.
REFINING AND PROCESSING	44.	22.	65.	87.	1265.
PIPELINES	2.	9.	0.	0.	69.
TANKERS, BARGES, TRUCKS	12.	11.	10.	9.	328.
BULK STATIONS	0.	0.	0.	0.	21.
OTHER	0.	0.	0.	0.	0.
TOTAL OIL	126.	117.	148.	168.	3349.
OIL SHALE	0.	0.	0.	0.	0.
GAS					
EXPLORATION, DEVELOPMENT, & PRODUCTION	3.	0.	0.	0.	20.
GEOPRESSURED METHANE	0.	0.	0.	0.	0.
PIPELINES	0.	0.	0.	0.	0.
LNG TANKERS	0.	0.	0.	0.	0.
DISTRIBUTION	0.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.
TOTAL GAS	3.	0.	0.	0.	0.
COAL					
UNDERGROUND MINING	0.	0.	0.	0.	0.
SURFACE MINING	0.	0.	0.	0.	0.
RAIL	4.	4.	4.	7.	63.
PIPELINES	0.	0.	0.	0.	0.
BARGES, TRUCKS	0.	0.	0.	0.	0.
TOTAL COAL	4.	4.	4.	8.	8.
COAL SYNTHETICS					
LIQUEFACTION	0.	0.	0.	0.	0.
METHANOL	0.	0.	0.	0.	0.
SOLVENT REFINING	0.	0.	0.	0.	0.
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.
TOTAL SYNTHETICS	0.	0.	0.	0.	0.
NUCLEAR FUEL CYCLE	0.	0.	0.	5.	22.
SOLAR	0.	0.	0.	0.	0.
ELECTRIC UTILITIES					
COAL-FIRED	0.	0.	0.	0.	0.
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.
NUCLEAR	14.	28.	79.	167.	1101.
HYDRO & PUMPED STORAGE	0.	0.	0.	3.	448.
OIL & GAS	245.	254.	263.	286.	2924.
GEOTHERMAL	0.	0.	0.	0.	0.
TOTAL GENERATION	259.	282.	342.	456.	4472.
TRANSMISSION	23.	35.	0.	0.	600.
DISTRIBUTION	51.	55.	58.	58.	876.
TOTAL UTILITIES	333.	372.	400.	514.	5948.
TOTAL ENERGY INDUSTRY	466.	493.	551.	695.	9410.

CONSTRUCTOR COST TOTAL DOES NOT INCLUDE OWNER'S COSTS.

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BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 37 (Continued)

GROWTH IN REQUIREMENTS FOR CONSTRUCTOR COST TOTAL ## (MILLION POUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
FOR THE EGYPT - NUCLEAR Capacity CASE

RESOURCES	Variations 1976	1977	1978	1979	1980	1981	1982
OIL							
EXPLORATION, DEVELOPMENT, & PRODUCTION	82.	85.	87.	88.	84.	82.	81.
REFINING AND PROCESSING	0.	0.	22.	65.	87.	44.	22.
PIPELINES	2.	9.	0.	0.	0.	4.	21.
TANKERS, BARGES, TRUCKS	14.	18.	14.	14.	11.	15.	16.
BULK STATIONS	0.	2.	4.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL OIL	98.	114.	127.	167.	182.	144.	139.
OIL SHALE	0.	0.	0.	0.	0.	0.	0.
GAS							
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	1.	3.	0.	0.	1.	3.
GEOPRESSURED METHANE	0.	0.	0.	0.	0.	0.	0.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
LNG TANKERS	0.	0.	0.	0.	0.	0.	0.
DISTRIBUTION	6.	0.	0.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL GAS	6.	1.	3.	0.	0.	1.	3.
COAL							
UNDERGROUND MINING	0.	0.	0.	0.	0.	0.	0.
SURFACE MINING	0.	0.	0.	0.	0.	0.	0.
RAIL	0.	0.	4.	0.	0.	0.	4.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
BARGES, TRUCKS	0.	0.	0.	0.	0.	0.	0.
TOTAL COAL	0.	0.	4.	0.	0.	0.	4.
COAL SYNTHETICS							
LIQUEFACTION	0.	0.	0.	0.	0.	0.	0.
METHANOL	0.	0.	0.	0.	0.	0.	0.
SOLVENT REFINING	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.	0.	0.
TOTAL SYNTHETICS	0.	0.	0.	0.	0.	0.	0.
NUCLEAR FUEL CYCLE	0.	0.	0.	0.	0.	0.	0.
SOLAR	0.	0.	0.	0.	0.	0.	0.
ELECTRIC UTILITIES							
COAL-FIRED	0.	0.	0.	0.	0.	0.	0.
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.	0.	0.
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.	0.	0.
NUCLEAR	0.	3.	5.	11.	35.	60.	108.
HYDRO & PUMPED STORAGE	0.	0.	0.	0.	0.	0.	0.
OIL & GAS	77.	107.	105.	55.	30.	24.	39.
GEOTHERMAL	0.	0.	0.	0.	0.	0.	0.
TOTAL GENERATION	77.	110.	110.	66.	65.	84.	148.
TRANSMISSION	0.	0.	23.	35.	0.	0.	62.
DISTRIBUTION	15.	16.	19.	19.	22.	26.	29.
TOTAL UTILITIES	92.	126.	153.	120.	87.	109.	238.
TOTAL ENERGY INDUSTRY	196.	241.	286.	287.	269.	255.	384.

CONSTRUCTOR COST TOTAL DOES NOT INCLUDE OWNER'S COSTS.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 37(Continued)

GROWTH IN REQUIREMENTS FOR CONSTRUCTOR COST TOTAL ## (MILLION POUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
FOR THE EGYPT - NUCLEAR Capacity CASE

RESOURCES	Variations		1985	1986	1987	1988	1989
	1983	1984					
OIL							
EXPLORATION, DEVELOPMENT, & PRODUCTION	79.	75.	69.	63.	69.	63.	57.
REFINING AND PROCESSING	65.	87.	44.	22.	65.	87.	44.
PIPELINES	0.	2.	9.	0.	2.	9.	0.
TANKERS, BARGES, TRUCKS	14.	18.	15.	18.	15.	15.	19.
BULK STATIONS	2.	4.	0.	0.	0.	2.	4.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL OIL	160.	186.	136.	103.	151.	177.	134.
OIL SHALE	0.	0.	0.	0.	0.	0.	0.
GAS							
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	0.	0.	1.	3.	0.	0.
GEOPRESSURED METHANE	0.	0.	0.	0.	0.	0.	0.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
LNG TANKERS	0.	0.	0.	0.	0.	0.	0.
DISTRIBUTION	0.	0.	0.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.
TOTAL GAS	0.	0.	0.	1.	3.	0.	0.
COAL							
UNDERGROUND MINING	0.	0.	0.	0.	0.	0.	0.
SURFACE MINING	0.	0.	0.	0.	0.	0.	0.
RAIL	0.	0.	4.	0.	4.	0.	4.
PIPELINES	0.	0.	0.	0.	0.	0.	0.
BARGES, TRUCKS	0.	0.	0.	0.	0.	0.	0.
TOTAL COAL	0.	0.	4.	0.	4.	0.	4.
COAL SYNTHETICS							
LIQUEFACTION	0.	0.	0.	0.	0.	0.	0.
METHANOL	0.	0.	0.	0.	0.	0.	0.
SOLVENT REFINING	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (HIGH BTU)	0.	0.	0.	0.	0.	0.	0.
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.	0.	0.	0.
TOTAL SYNTHETICS	0.	0.	0.	0.	0.	0.	0.
NUCLEAR FUEL CYCLE	0.	0.	0.	0.	0.	0.	0.
SOLAR	0.	0.	0.	0.	0.	0.	0.
ELECTRIC UTILITIES							
COAL-FIRED	0.	0.	0.	0.	0.	0.	0.
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.	0.	0.	0.
COAL-FIRED (FLUID BED)	0.	0.	0.	0.	0.	0.	0.
NUCLEAR	116.	133.	122.	103.	73.	30.	14.
HYDRO & PUMPED STORAGE	0.	8.	38.	56.	54.	41.	47.
OIL & GAS	36.	15.	0.	4.	24.	65.	104.
GEOTHERMAL	0.	0.	0.	0.	0.	0.	0.
TOTAL GENERATION	153.	156.	160.	163.	151.	135.	165.
TRANSMISSION	92.	0.	23.	35.	0.	0.	23.
DISTRIBUTION	29.	29.	31.	33.	35.	35.	39.
TOTAL UTILITIES	274.	185.	215.	231.	186.	170.	227.
TOTAL ENERGY INDUSTRY	434.	371.	355.	336.	344.	347.	365.

CONSTRUCTOR COST TOTAL DOES NOT INCLUDE OWNER'S COSTS.

RECHTEL ENERGY SUPPLY PLANNING MODEL

Table 37 (Continued)

CUMULATIVE CAPITAL REQUIREMENTS (MILLION EPOUNDS, JAN 1978) OF THE ENERGY INDUSTRY BY FACILITY GROUPING EGYPT - NUCLEAR Capacity Variations (1978-2000)

FACILITY	CONSTRUCTION COSTS	OWNER'S COSTS PRIOR TO STARTUP	TOTAL
OIL			
EXPLORATION, DEVELOPMENT, & PRODUCTION	1665.8	256.2	1922.0
REFINING AND PROCESSING	1265.5	203.0	1468.4
PIPELINES	68.6	11.7	80.3
TANKERS, BARGES, TRUCKS	327.9	57.4	385.3
BULK STATIONS	21.3	3.6	24.9
OTHER	0.0	0.0	0.0
TOTAL OIL	3349.1	531.9	3881.0
OIL SHALE	0.0	0.0	0.0
GAS			
EXPLORATION, DEVELOPMENT, & PRODUCTION	20.2	3.1	23.3
GEOPRESSURED METHANE	0.0	0.0	0.0
PIPELINES	0.0	0.0	0.0
LNG TANKERS	0.0	0.0	0.0
DISTRIBUTION	0.0	0.0	0.0
OTHER	0.0	0.0	0.0
TOTAL GAS	20.2	3.1	23.3
COAL			
UNDERGROUND MINING	0.0	0.0	0.0
SURFACE MINING	0.0	0.0	0.0
RAIL	62.7	10.7	73.3
PIPELINES	0.0	0.0	0.0
BARGES, TRUCKS	8.1	1.4	9.5
TOTAL COAL	70.8	12.0	82.9
COAL SYNTHETICS			
LIQUEFACTION	0.0	0.0	0.0
METHANOL	0.0	0.0	0.0
SOLVENT REFINING	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.0	0.0	0.0
TOTAL SYNTHETICS	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	22.4	3.4	25.8
SOLAR	0.0	0.0	0.0
ELECTRIC UTILITIES			
COAL-FIRED	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.0	0.0	0.0
NUCLEAR	1100.7	123.9	1224.7
HYDRO & PUMPED STORAGE	447.7	47.0	494.7
OIL & GAS	2923.6	330.4	3254.0
GEOTHERMAL	0.0	0.0	0.0
TOTAL GENERATION	4472.0	501.3	4973.3
TRANSMISSION	599.9	69.6	669.5
DISTRIBUTION	875.9	99.8	975.7
TOTAL UTILITIES	5947.8	670.8	6618.5
TOTAL ENERGY INDUSTRY	9410.3	1221.1	10631.4

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 37 (Continued)

GROWTH IN REQUIREMENTS FOR CONSTRUCTOR COST TOTAL ## (MILLION EPOUNDS, JANUARY 1978)
FOR THE DESIGN, CONSTRUCTION, AND STARTUP OF ENERGY RELATED FACILITIES
FOR THE EGYPT - NUCLEAR Capacity CASE

CATEGORY	Variations					AVERAGE GROWTH RATES (%/YEAR)			
	1976 (CALC'D)	2000	1978-2000 AVERAGE	PEAK	YEAR	1976- 1980	1980- 1985	1985- 2000	1976- 2000
OIL									
EXPLORATION, DEVELOPMENT, & PRODUCTION	82.	73.	72.	88.	(1979)	0.6	-3.9	0.4	-0.5
REFINING AND PROCESSING	0.	87.	55.	87.	(1980)	9999.0	-12.9	4.7	9999.0
PIPELINES	2.	0.	3.	21.	(1982)	-100.0	9999.0	-100.0	-100.0
TANKERS, BARGES, TRUCKS	14.	9.	14.	19.	(1989)	-7.0	6.8	-3.6	-2.1
BULK STATIONS	0.	0.	1.	4.	(1978)	0.0	0.0	0.0	0.0
OTHER	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TOTAL OIL	98.	168.	146.	186.	(1984)	16.8	-5.6	1.4	2.3
OIL SHALE	0.	0.	0.	0.		0.0	0.0	0.0	0.0
GAS									
EXPLORATION, DEVELOPMENT, & PRODUCTION	0.	0.	1.	3.	(1978)	0.0	0.0	0.0	0.0
GEOPRESSURED METHANE	0.	0.	0.	0.		0.0	0.0	0.0	0.0
PIPELINES	0.	0.	0.	0.		0.0	0.0	0.0	0.0
LNG TANKERS	0.	0.	0.	0.		0.0	0.0	0.0	0.0
DISTRIBUTION	6.	0.	0.	6.	(1976)	-100.0	0.0	0.0	-100.0
OTHER	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TOTAL GAS	6.	0.	1.	6.	(1976)	-100.0	0.0	0.0	-100.0
COAL									
UNDERGROUND MINING	0.	0.	0.	0.		0.0	0.0	0.0	0.0
SURFACE MINING	0.	0.	0.	0.		0.0	0.0	0.0	0.0
RAIL	0.	7.	3.	7.	(1996)	0.0	9999.0	4.7	9999.0
PIPELINES	0.	0.	0.	0.		0.0	0.0	0.0	0.0
BARGES, TRUCKS	0.	0.	0.	4.	(1990)	0.0	14.9	7.6	7.8
TOTAL COAL	0.	8.	3.	8.	(1990)	0.0	130.7	4.8	22.6
COAL SYNTHETICS									
LIQUEFACTION	0.	0.	0.	0.		0.0	0.0	0.0	0.0
METHANOL	0.	0.	0.	0.		0.0	0.0	0.0	0.0
SOLVENT REFINING	0.	0.	0.	0.		0.0	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TOTAL SYNTHETICS	0.	0.	0.	0.		0.0	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	0.	5.	1.	6.	(1996)	0.0	0.0	9999.0	9999.0
SOLAR	0.	0.	0.	0.		0.0	0.0	0.0	0.0
ELECTRIC UTILITIES									
COAL-FIRED	0.	0.	0.	0.		0.0	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.	0.	0.	0.		0.0	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.	0.	0.	0.		0.0	0.0	0.0	0.0
NUCLEAR	0.	167.	48.	167.	(2000)	9999.0	28.2	2.1	9999.0
HYDRO & PUMPED STORAGE	0.	3.	19.	56.	(1986)	0.0	9999.0	-15.4	9999.0
OIL & GAS	77.	286.	127.	286.	(2000)	-21.0	-100.0	9999.0	5.6
GEOTHERMAL	0.	0.	0.	0.		0.0	0.0	0.0	0.0
TOTAL GENERATION	77.	456.	194.	456.	(2000)	-4.1	19.7	7.2	7.7
TRANSMISSION	0.	0.	26.	127.	(1994)	0.0	9999.0	-100.0	0.0
DISTRIBUTION	15.	58.	38.	58.	(1999)	8.9	7.6	4.2	5.7
TOTAL UTILITIES	92.	514.	259.	514.	(2000)	-1.5	19.9	6.0	7.4
TOTAL ENERGY INDUSTRY	196.	695.	409.	695.	(2000)	8.1	5.7	4.6	5.4

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CONSTRUCTOR COST TOTAL DOES NOT INCLUDE OWNER'S COSTS

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 37 (Continued)

SCHEDULE OF ANNUAL TRANSPORTATION ADDITIONS TO SUPPLY FUEL MIX: EGYPT - NUCLEAR Capacity Variations 1976-2010

FACILITY NAME	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL ADDED (1976- 2010)
1 CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0
3 OIL TANKER (90,000 DWT, 620,000 B)	0	0	0	0	0	0	0	0	0	0	0
4 OIL BARGES (90,000 BBL)	0	0	0	0	0	0	0	0	0	0	7
5 OIL TANK TRUCK (226 BBL)	104	104	104	104	104	104	104	104	104	104	4714
6 PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	0	0	0	0	0	0	0	0	0	0	1
7 HOT OIL PIPELINE (40 MB/D, 80.5 KM)	0	0	0	0	0	1	0	0	0	0	7
8 REFINED PRODUCTS BULK STATION (69 MB/D)	0	0	0	0	0	1	0	0	0	0	5
9 RAIL LINE (64.4 KM, SINGLE TRACK)	0	0	0	0	0	0	0	0	0	0	0
10 MIXED TRAIN (6556 TONNES)	2	2	2	2	2	2	2	2	2	2	37
11 COAL UNIT TRAIN (9,528 TONNES)	0	0	0	0	0	0	0	0	0	0	0
12 COAL SLURRY PIPELINE (22,69 MM TONNES/Y, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0
13 COAL SLURRY PREPARATION (22,69 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0
14 COAL SLURRY DEWATERING (22,69 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0
15 COAL BARGES (19,048 TONNES)	0	0	0	0	0	0	0	0	0	0	1
16 COAL TRUCK (22,7 TONNES)	6	6	6	6	6	6	6	6	6	6	127
17 GAS PIPELINE (1.87 BSCF/D, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0
18 GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	0	0	0	0	0	0	0	0	0	0	0
20 LNG TANKER (2.6 BCF)	0	0	0	0	0	0	0	0	0	0	0
21 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	0	0	1	0	0	1	0	0	1	0	8
22 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	0	0	0	0	0	0	0	0	0	0	0
23 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	0	0	0	0	0	1	0	0	0	0	3
24 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	0	0	0	0	0	0	0	0	0	0	0
25 +-400 KVDC TRANSMISSION LINE (1500 MWE, 1287 KM)	0	0	0	0	0	0	0	0	0	0	0
26 ELECTRICITY DISTRIBUTION-AERIAL LINES (131.6 MWE)	6	6	6	6	6	6	6	6	6	6	142

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 37 (Continued)

CUMULATIVE CAPITAL REQUIREMENTS (MILLION EPOUNDS, JAN 1978) OF THE ENERGY INDUSTRY
BY FACILITY GROUPING
EGYPT - NUCLEAR Capacity Variations

(1978-1985)

FACILITY	CONSTRUCTION COSTS	OWNER'S COSTS PRIOR TO STARTUP	TOTAL
OIL			
EXPLORATION, DEVELOPMENT, & PRODUCTION	643.2	98.9	742.1
REFINING AND PROCESSING	436.4	70.0	506.4
PIPELINES	35.4	6.0	41.4
TANKERS, BARGES, TRUCKS	117.1	20.5	137.6
BULK STATIONS	9.7	1.6	11.3
OTHER	0.0	0.0	0.0
TOTAL OIL	1241.7	197.1	1438.7
OIL SHALE	0.0	0.0	0.0
GAS			
EXPLORATION, DEVELOPMENT, & PRODUCTION	7.3	1.1	8.4
GEOPRESSURED METHANE	0.0	0.0	0.0
PIPELINES	0.0	0.0	0.0
LNG TANKERS	0.0	0.0	0.0
DISTRIBUTION	0.0	0.0	0.0
OTHER	0.0	0.0	0.0
TOTAL GAS	7.3	1.1	8.4
COAL			
UNDERGROUND MINING	0.0	0.0	0.0
SURFACE MINING	0.0	0.0	0.0
RAIL	11.1	1.9	12.9
PIPELINES	0.0	0.0	0.0
BARGES, TRUCKS	0.6	0.1	0.7
TOTAL COAL	11.6	2.0	13.6
COAL SYNTHETICS			
LIQUEFACTION	0.0	0.0	0.0
METHANOL	0.0	0.0	0.0
SOLVENT REFINING	0.0	0.0	0.0
GASIFICATION (HIGH BTU)	0.0	0.0	0.0
GASIFICATION (LOW & MEDIUM BTU)	0.0	0.0	0.0
TOTAL SYNTHETICS	0.0	0.0	0.0
NUCLEAR FUEL CYCLE	0.0	0.0	0.0
SOLAR	0.0	0.0	0.0
ELECTRIC UTILITIES			
COAL-FIRED	0.0	0.0	0.0
SULFUR REMOVAL FACILITIES	0.0	0.0	0.0
COAL-FIRED (FLUID BED)	0.0	0.0	0.0
NUCLEAR	589.7	66.4	656.1
HYDRO & PUMPED STORAGE	46.5	4.9	51.4
OIL & GAS	304.2	34.4	338.5
GEOTHERMAL	0.0	0.0	0.0
TOTAL GENERATION	940.3	105.7	1046.0
TRANSMISSION	235.8	27.4	263.2
DISTRIBUTION	204.5	23.3	227.8
TOTAL UTILITIES	1380.6	156.3	1536.9
TOTAL ENERGY INDUSTRY	2641.2	356.5	2997.7

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 37 (Continued)

SCHEDULE OF ANNUAL TRANSPORTATION ADDITIONS TO SUPPLY FUEL MIX: EGYPT - NUCLEAR Capacity Variations 1976-2010

FACILITY NAME	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	TOTAL ADDED (1978- 1993)
1 CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0	0
3 OIL TANKER (90,000 DWT; 620,000 B)	0	0	0	0	0	0	0	0	0	0	0	0
4 OIL BARGES (90,000 BBL)	0	1	0	1	0	0	1	0	0	0	0	7
5 OIL TANK TRUCK (226 BBL)	168	179	179	176	182	186	188	189	187	184	181	2674
6 PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	1	0	0	0	0	0	0	0	0	0	0	1
7 HOT OIL PIPELINE (40 MB/D, 80.5 KM)	1	0	0	1	0	0	1	0	0	0	1	5
8 REFINED PRODUCTS BULK STATION (69 MB/D)	0	0	1	0	0	0	0	1	0	0	0	3
9 RAIL LINE (64.4 KM, SINGLE TRACK)	0	0	0	0	0	0	0	0	0	0	0	0
10 MIXED TRAIN (6556 TONNES)	0	0	1	0	1	0	1	1	1	0	1	8
11 COAL UNIT TRAIN (9,528 TONNES)	0	0	0	0	0	0	0	0	0	0	0	0
12 COAL SLURRY PIPELINE (22.69 MM TONNES/Y, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0	0
13 COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0	0
14 COAL SLURRY DEWATERING (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0	0
15 COAL BARGES (19,048 TONNES)	0	0	0	0	0	0	0	1	0	0	0	1
16 COAL TRUCK (22.7 TONNES)	2	1	2	2	2	3	3	3	3	3	4	33
17 GAS PIPELINE (.87 BSCF/D, 241.4 KM)	0	0	0	0	0	0	0	0	0	0	0	0
18 GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	0	0	0	0	0	0	0	0	0	0	0	0
20 LNG TANKER (2.6 BCF)	0	0	0	0	0	0	0	0	0	0	0	0
21 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	0	0	0	0	1	0	0	0	1	0	0	3
22 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	0	0	0	0	0	0	0	0	0	0	0	0
23 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	0	1	0	0	0	0	0	0	0	0	0	1
24 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	0	0	0	0	0	0	0	0	0	0	0	0
25 +-400 KVDC TRANSMISSION LINE (1500 MWE, 1287 KM)	0	0	0	0	0	0	0	0	0	0	0	0
26 ELECTRICITY DISTRIBUTION-AERIAL LINES (131.6 MWE)	3	3	3	3	3	4	3	4	4	4	4	47

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

HECHTEL ENERGY SUPPLY PLANNING MODEL

Table 37 (Continued)

SCHEDULE OF ANNUAL TRANSPORTATION ADDITIONS TO SUPPLY FUEL MIX: EGYPT - NUCLEAR Capacity Variations 1976-2010

FACILITY NAME	1994	1995	1996	1997	1998	1999	2000	TOTAL ADDED (1978- 2000)
1 CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	0	0	0	0	0	0	0	0
3 OIL TANKER (90,000 DWT, 620,000 B)	0	0	0	0	0	0	0	0
4 OIL BARGES (90,000 BBL)	0	0	0	0	0	0	0	7
5 OIL TANK TRUCK (226 BBL)	174	166	157	146	134	119	104	3674
6 PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	0	0	0	0	0	0	0	1
7 HO1 OIL PIPELINE (40 MB/D, 80.5 KM)	0	0	0	0	0	1	0	6
8 REFINED PRODUCTS BULK STATION (69 MB/D)	0	0	1	0	0	0	0	4
9 RAIL LINE (64.4 KM, SINGLE TRACK)	0	0	0	0	0	0	0	0
10 MIXED TRAIN (6556 TONNES)	1	1	2	1	1	1	2	17
11 COAL UNIT TRAIN (9,528 TONNES)	0	0	0	0	0	0	0	0
12 COAL SLURRY PIPELINE(22.69 MM TONNES/Y,241.4 KM)	0	0	0	0	0	0	0	0
13 COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0
14 COAL SLURRY DEWATERING (22.69 MM TONNES/Y)	0	0	0	0	0	0	0	0
15 COAL BARGES (19,048 TONNES)	0	0	0	0	0	0	0	1
16 COAL TRUCK (22.7 TONNES)	4	4	5	5	5	5	6	67
17 GAS PIPELINE (.87 BSCF/D, 241.4 KM)	0	0	0	0	0	0	0	0
18 GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	0	0	0	0	0	0	0	0
20 LNG TANKER (2.6 BCF)	0	0	0	0	0	0	0	0
21 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	0	1	0	0	0	1	0	5
22 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	0	0	0	0	0	0	0	0
23 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	0	1	0	0	0	0	0	2
24 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	0	0	0	0	0	0	0	0
25 +-400 KVDC TRANSMISSION LINE (1500 MWE,1287 KM)	0	0	0	0	0	0	0	0
26 ELECTRICITY DISTRIBUTION-AERIAL LINES(131.6MWE)	5	4	5	5	5	5	6	82

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

SCHEDULE OF ANNUAL ENERGY FACILITIES ADDITIONS TO SUPPLY FULL FIX: EGYPT - NUCLEAR Capacity
Variations 1976-2010

FACILITY NAME	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL ADDED (1976- 2010)
1 ONSHORE PRIMARY OIL RECOVERY-(1,000 MBPD)	14	14	14	14	14	14	14	14	14	14	482
2 ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	0	0	0	0	0	0	0	0	0	0	0
3 ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	0	0	0	0	0	0	0	0	0	0	0
4 OFFSHORE OIL RECOVERY (12.5 MBPD)	3	3	3	3	3	3	3	3	3	3	94
6 HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	0	0	0	0	0	0	0	0	0	0	0
7 LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	0	1	0	0	0	1	0	0	0	0	7
19 ONSHORE CONVENTIONAL GAS RECOVERY (100 MMCF/D)	0	0	0	0	0	1	0	0	0	0	6
20 ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0
21 OFFSHORE GAS RECOVERY (25 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0
24 LNG EXPORT (3030 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0
27 UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0
37 SURFACE URANIUM MINE (275.4 M TONNES/Y)	0	0	0	1	0	0	0	0	0	1	3
38 UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0
39 URANIUM MILL (275.4 M TONNES/Y)	0	0	0	1	0	0	0	0	0	1	3
42 LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	0	0	0	0	0	0	0	0	0	0	0
43 LWR FUEL FABRICATION - PU RECYCLE (150 MTH/Y)	0	0	0	0	0	0	0	0	0	0	0
49 HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	0	0	0	0	0	0	0	0	0	0	0
50 OIL-FIRED POWER PLANT (800 MWE)	2	2	2	2	1	1	1	1	0	0	20
51 OIL-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	0	0	0	7
52 OIL-FIRED POWER PLANT (450 MWE)	0	0	0	0	0	0	0	0	0	0	2
53 COAL FIRED POWER PLANT-LOW BTU (800 MWE)	0	0	0	0	0	0	0	0	0	0	0
54 COAL FIRED POWER PLANT-HIGH BTU (800 MWE)	0	0	0	0	0	0	0	0	0	0	0
55 COAL FIRED POWER PLANT-LOW BTU (600 MWE)	0	0	0	0	0	0	0	0	0	0	0
56 COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	0	0	0	0	0	0	0	0	0	0	0
59 HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0	0	0	0
60 HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	0	0	0	0
61 COMBINED CYCLE POWER PLANT (400 MWE)	0	0	0	0	0	0	0	0	0	0	3
62 GAS TURBINE POWER PLANT (133 MWE)	0	0	0	0	0	0	0	0	0	0	0
63 FUEL CELLS (26 MWE)	0	0	0	0	0	0	0	0	0	0	0
64 LIGHT WATER REACTOR (LWR) (1200 MWE)	0	0	0	0	1	1	1	1	2	2	8
65 LIGHT WATER REACTOR (LWR) (900 MWE)	0	0	0	0	0	0	0	0	0	0	0
66 LIGHT WATER REACTOR (LWR) (600 MWE)	0	0	0	0	0	0	0	0	0	0	0
67 DAM & HYDROELECTRIC POWER PLANT (200 MWE)	0	0	0	0	0	0	0	0	0	0	0
68 PUMPED STORAGE (500 MWE)	0	0	0	0	0	1	0	1	1	1	4
69 GEOTHERMAL POWER COMPLEX (200 MWE)	0	0	0	0	0	0	0	0	0	0	0

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 37 (Continued)

SCHEDULE OF ANNUAL TRANSPORTATION ADDITIONS TO SUPPLY FUEL MIX; EGYPT - NUCLEAR Capacity 1976-2010

FACILITY NAME	Variations								TOTAL ADDED (1978- 1982)
	1975 TOTALS	1976	1977	1978	1979	1980	1981	1982	
1 CRUDE OIL PIPELINE (800 MB/D, 241.4 KM)	0.1	0	0	0	0	0	0	0	0
3 OIL TANKER (90,000 DWT; 620,000 B)	0.0	0	0	0	0	0	0	0	0
4 OIL BARGES (90,000 BBL)	3.0	1*	2*	1*	1	0	1	1	4
5 OIL TANK TRUCK (226 BBL)	290.3	128*	130*	131*	130	129	136	149	675
6 PRODUCTS PIPELINE (70 MB/D, 160.9 KM)	0.5	0	0	0	0	0	0	0	0
7. HOT OIL PIPELINE (40 MB/D, 80.5 KM)	2.4	0	0	1*	0	0	0	0	1
8 REFINED PRODUCTS HULK STATION (69 MB/D)	1.6	0	0	0	1*	0	0	0	1
9 RAIL LINE (64.4 KM, SINGLE TRACK)	0.0	0	0	0	0	0	0	0	0
10 MIXED TRAIN (6556 TONNES)	2.3	0	0	1*	0	0	0	1	2
11 COAL UNIT TRAIN (9,528 TONNES)	0.0	0	0	0	0	0	0	0	0
12 COAL SLURRY PIPELINE (22.69 MM TONNES/Y, 241.4 KM)	0.0	0	0	0	0	0	0	0	0
13 COAL SLURRY PREPARATION (22.69 MM TONNES/Y)	0.0	0	0	0	0	0	0	0	0
14 COAL SLURRY DEWATERING (22.69 MM TONNES/Y)	0.0	0	0	0	0	0	0	0	0
15 COAL BARGES (19,048 TONNES)	0.2	0	0	0	0	0	0	0	0
16 COAL TRUCK (22.7 TONNES)	4.8	1*	1*	1*	1	1	1	1	5
17 GAS PIPELINE (.87 BSCF/D, 241.4 KM)	0.1	0	0	0	0	0	0	0	0
18 GAS DISTRIBUTION FACILITIES (50 MMSCF/D)	0.7	1*	1*	0	0	0	0	0	0
20 LNG TANKER (2.6 BCF)	0.0	0	0	0	0	0	0	0	0
21 230 KVAC TRANSMISSION LINE (250 MWE, 805 KM)	0.5	0	0	0	0	1	0	0	1
22 345 KVAC TRANSMISSION LINE (600 MWE, 805 KM)	0.0	0	0	0	0	0	0	0	0
23 500 KVAC TRANSMISSION LINE (1200 MWE, 805 KM)	0.2	0	0	0	0	0	0	0	0
24 765 KVAC TRANSMISSION LINE (2500 MWE, 805 KM)	0.0	0	0	0	0	0	0	0	0
25 +-400 KVDC TRANSMISSION LINE (1500 MWE, 1287 KM)	0.0	0	0	0	0	0	0	0	0
26 ELECTRICITY DISTRIBUTION-AERIAL LINES (131.6 MWE)	9.0	1*	2*	1*	2*	2*	2	2	9

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 37 (Continued)

SCHEDULE OF ANNUAL ENERGY FACILITIES ADDITIONS TO SUPPLY FUEL MIX: EGYPT - NUCLEAR Capacity
Variations 1976-2010

FACILITY NAME	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	TOTAL ADDED (1978- 1993)
1 ONSHORE PRIMARY OIL RECOVERY-(1,000 MBPD)	17	16	16	14	13	14	13	13	14	13	14	244
2 ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	0	0	0	0	0	0	0	0	0	0	0	0
3 ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	0	0	0	0	0	0	0	0	0	0	0	0
4 OFFSHORE OIL RECOVERY (12.5 MBPD)	3	3	3	3	2	3	2	3	2	3	2	45
6 HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	0	0	0	0	0	0	0	0	0	0	0	0
7 LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	0	0	0	1	0	0	0	1	0	0	0	3
19 ONSHORE CONVENTIONAL GAS RECOVERY (100 MMCF/D)	1	0	0	0	0	1	0	0	0	0	1	4
20 ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0	0
21 OFFSHORE GAS RECOVERY (25 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0	0
24 LNG EXPORT (3030 MMCF/D)	0	0	0	0	0	0	0	0	0	0	0	0
27 UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0	0
37 SURFACE URANIUM MINE (275.4 M TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0	0
38 UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0	0
39 URANIUM MILL (275.4 M TONNES/Y)	0	0	0	0	0	0	0	0	0	0	0	0
42 LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	0	0	0	0	0	0	0	0	0	0	0	0
43 LWR FUEL FABRICATION - PU RECYCLE (150 MTU/Y)	0	0	0	0	0	0	0	0	0	0	0	0
49 HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	0	0	0	0	0	0	0	0	0	0	0	0
50 OIL-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0	0	1	1	2
51 OIL-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	0	0	0	0	2
52 OIL-FIRED POWER PLANT (450 MWE)	0	0	0	0	0	0	0	0	1	0	0	2
53 COAL FIRED POWER PLANT-LOW BTU (800 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
54 COAL FIRED POWER PLANT-HIGH BTU (800 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
55 COAL FIRED POWER PLANT-LOW BTU (600 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
56 COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
59 HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
60 HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
61 COMBINED CYCLE POWER PLANT (400 MWE)	0	1	1	0	0	0	0	0	0	0	0	3
62 GAS TURBINE POWER PLANT (133 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
63 FUEL CELLS (26 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
64 LIGHT WATER REACTOR (LWR) (1200 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
65 LIGHT WATER REACTOR (LWR) (900 MWE)	0	0	0	0	0	0	0	0	0	0	0	0
66 LIGHT WATER REACTOR (LWR) (600 MWE)	0	0	0	1*	0	1	0	1	0	0	0	0
67 DAM & HYDROELECTRIC POWER PLANT (200 MWE)	0	0	0	0	0	1	0	0	0	0	0	0
68 PUMPED STORAGE (500 MWE)	0	0	0	0	0	0	0	1	0	0	1	1
69 GEOTHERMAL POWER COMPLEX (200 MWE)	0	0	0	0	0	0	0	0	0	0	0	0

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

BECHTEL ENERGY SUPPLY PLANNING MODEL

Table 37 (Continued)

SCHEDULE OF ANNUAL ENERGY FACILITIES ADDITIONS TO SUPPLY FUEL MIX: EGYPT - NUCLEAR Capacity Variations 1976-2010

FACILITY NAME	1994	1995	1996	1997	1998	1999	2000	TOTAL ADDED (1978- 2000)
1 ONSHORE PRIMARY OIL RECOVERY-(1,000 MBPD)	13	14	14	14	14	15	14	342
2 ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	0	0	0	0	0	0	0	0
3 ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	0	0	0	0	0	0	0	0
4 OFFSHORE OIL RECOVERY (12.5 MBPD)	3	2	3	3	2	3	3	64
6 HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	0	0	0	0	0	0	0	0
7 LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	1	0	0	0	1	0	0	5
19 ONSHORE CONVENTIONAL GAS RECOVERY (100 MMCF/D)	0	0	0	0	1	0	0	5
20 ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	0	0	0	0	0	0	0	0
21 OFFSHORE GAS RECOVERY (25 MMCF/D)	0	0	0	0	0	0	0	0
24 LNG EXPORT (3030 MMCF/D)	0	0	0	0	0	0	0	0
27 UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	0	0	0	0	0	0	0	0
37 SURFACE URANIUM MINE (275.4 M TONNES/Y)	0	0	0	1	0	0	0	1
38 UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	0	0	0	0	0	0	0	0
39 URANIUM MILL (275.4 M TONNES/Y)	0	0	0	1	0	0	0	1
42 LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	0	0	0	0	0	0	0	0
43 LWR FUEL FABRICATION - PU RECYCLE (150 MTH/Y)	0	0	0	0	0	0	0	0
49 HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	0	0	0	0	0	0	0	0
50 OIL-FIRED POWER PLANT (800 MWE)	0	0	0	1	2	2	1	8
51 OIL-FIRED POWER PLANT (600 MWE)	1	2	2	0	0	0	0	7
52 OIL-FIRED POWER PLANT (450 MWE)	0	0	0	0	0	0	0	2
53 COAL FIRED POWER PLANT-LOW BTU (800 MWE)	0	0	0	0	0	0	0	0
54 COAL FIRED POWER PLANT-HIGH BTU (800 MWE)	0	0	0	0	0	0	0	0
55 COAL FIRED POWER PLANT-LOW BTU (600 MWE)	0	0	0	0	0	0	0	0
56 COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	0	0	0	0	0	0	0	0
59 HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	0	0	0	0	0	0	0	0
60 HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	0	0	0	0	0	0	0	0
61 COMBINED CYCLE POWER PLANT (400 MWE)	0	0	0	0	0	0	0	3
62 GAS TURBINE POWER PLANT (133 MWE)	0	0	0	0	0	0	0	0
63 FUEL CELLS (26 MWE)	0	0	0	0	0	0	0	0
64 LIGHT WATER REACTOR (LWR) (1200 MWE)	0	0	0	0	0	0	0	0
65 LIGHT WATER REACTOR (LWR) (900 MWE)	0	0	0	0	0	0	0	0
66 LIGHT WATER REACTOR (LWR) (600 MWE)	0	0	0	0	0	0	0	0
67 DAM & HYDROELECTRIC POWER PLANT (200 MWE)	0	0	0	0	0	0	0	0
68 PUMPED STORAGE (500 MWE)	0	0	0	1	0	0	0	0
69 GEOTHERMAL POWER COMPLEX (200 MWE)	0	0	0	0	0	0	0	0

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ELECTRIC GENERATING CAPACITY (MWE)

EGYPT - NUCLEAR Capacity Variations

	1975	1982	1985	2000	AVERAGE ANNUAL GROWTH
COAL AND COAL/WASTE PLANTS	0.0	0.0	0.0	0.0	-----
OIL-STEAM PLANTS	1420.0	2904.0	2868.0	11367.0	8.68%
GAS-STEAM PLANTS	0.0	0.0	0.0	0.0	-----
LOW-BTU GAS-STEAM PLANTS	0.0	0.0	0.0	0.0	-----
GAS TURBINE PLANTS	137.0	107.0	107.0	0.0	-----
COMBINED CYCLE PLANTS	0.0	330.0	1230.0	1418.0	-----
FUEL CELLS	0.0	0.0	0.0	0.0	-----
NUCLEAR POWER PLANTS	0.0	0.0	0.0	1900.0	-----
CONVENTIONAL HYDRO PLANTS	2445.0	2445.0	2445.0	2603.0	0.25%
PUMPED STORAGE PLANTS	0.0	0.0	0.0	1350.0	-----
GEO THERMAL PLANTS	0.0	0.0	0.0	20.0	-----
TOTAL CAPACITY	4002.0	5786.0	6650.0	18658.0	6.35%

MECHTEL ENERGY SUPPLY PLANNING MODEL

Table 37 (Continued)

SCHEDULE OF ANNUAL ENERGY FACILITIES ADDITIONS TO SUPPLY FUEL MIX: EGYPT - NUCLEAR Capacity Variations 1976-2010

FACILITY NAME	1975 TOTALS	1976	1977	1978	1979	1980	1981	1982	TOTAL ADDED (1978- 1982)
1 ONSHORE PRIMARY OIL RECOVERY-(1,000 MBPD)	66.0	17*	17*	17*	18*	17	18	17	87
2 ONSHORE SECONDARY OIL RECOVERY (.913 MBPD)	0.0	0	0	0	0	0	0	0	0
3 ONSHORE ENHANCED OIL RECOVERY (3.51 MBPD)	0.0	0	0	0	0	0	0	0	0
4 OFFSHORE OIL RECOVERY (12.5 MBPD)	11.8	3*	3*	3*	3*	4*	3	3	16
6 HIGH-GASOLINE REFINERY (200 MB/D EFFECTIVE)	0.0	0	0	0	0	0	0	0	0
7 LOW-GASOLINE REFINERY (100 MB/D EFFECTIVE)	2.0	0	0	0	0	0	0	1	1
19 ONSHORE CONVENTIONAL GAS RECOVERY (100 MMCF/D)	0.4	1*	0	0	1*	0	0	0	1
20 ONSHORE ENHANCED GAS RECOVERY (208 MMCF/D)	0.0	0	0	0	0	0	0	0	0
21 OFFSHORE GAS RECOVERY (25 MMCF/D)	-0.0	0	0	0	0	0	0	0	0
24 LNG EXPORT (3030 MMCF/D)	0.0	0	0	0	0	0	0	0	0
27 UNDERGROUND EGYPTIAN COAL MINE (2.1 MM TONNES/Y)	0.0	0	0	0	0	0	0	0	0
37 SURFACE URANIUM MINE (275.4 M TONNES/Y)	0.0	0	0	0	0	0	0	0	0
38 UNDERGROUND URANIUM MINE (114.8 M TONNES/Y)	0.0	0	0	0	0	0	0	0	0
39 URANIUM MILL (275.4 M TONNES/Y)	0.0	0	0	0	0	0	0	0	0
42 LWR FUEL FABRICATION-NO PU RECYCLE(600MTU/Y)	0.0	0	0	0	0	0	0	0	0
43 LWR FUEL FABRICATION - PU RECYCLE (150 MTH/Y)	0.0	0	0	0	0	0	0	0	0
49 HIGH-LEVEL WASTE DISPOSAL (3100 CANISTERS/YR)	0.0	0	0	0	0	0	0	0	0
50 OIL-FIRED POWER PLANT (800 MWE)	0.0	0	0	0	0	0	0	0	0
51 OIL-FIRED POWER PLANT (600 MWE)	0.0	0	0	0	0	1*	1*	0	2
52 OIL-FIRED POWER PLANT (450 MWE)	3.2	0	0	0	1*	0	0	0	1
53 COAL FIRED POWER PLANT-LOW BTU (800 MWE)	0.0	0	0	0	0	0	0	0	0
54 COAL FIRED POWER PLANT-HIGH BTU (800 MWE)	0.0	0	0	0	0	0	0	0	0
55 COAL FIRED POWER PLANT-LOW BTU (600 MWE)	0.0	0	0	0	0	0	0	0	0
56 COAL FIRED POWER PLANT-HIGH BTU (600 MWE)	0.0	0	0	0	0	0	0	0	0
59 HIGH BTU GAS-FIRED POWER PLANT (800 MWE)	0.0	0	0	0	0	0	0	0	0
60 HIGH BTU GAS-FIRED POWER PLANT (600 MWE)	0.0	0	0	0	0	0	0	0	0
61 COMBINED CYCLE POWER PLANT (400 MWE)	0.0	0	0	0	1*	0	0	0	1
62 GAS TURBINE POWER PLANT (133 MWE)	1.0	0	0	0	0	0	0	0	0
63 FUEL CELLS (26 MWE)	0.0	0	0	0	0	0	0	0	0
64 LIGHT WATER REACTOR (LWR) (1200 MWE)	0.0	0	0	0	0	0	0	0	0
65 LIGHT WATER REACTOR (LWR) (900 MWE)	0.0	0	0	0	0	0	0	0	0
66 LIGHT WATER REACTOR (LWR) (600 MWE)	0.0	0	0	0	0	0	0	0	0
67 DAM & HYDROELECTRIC POWER PLANT (200 MWE)	12.2	0	0	0	0	0	0	0	0
68 PUMPED STORAGE (500 MWE)	0.0	0	0	0	0	0	0	0	0
69 GEOTHERMAL POWER COMPLEX (200 MWE)	0.0	0	0	0	0	0	0	0	0

* - THE CONSTRUCTION SCHEDULE FOR THIS FACILITY IS LONGER THAN THE NUMBER OF YEARS BETWEEN 1977 AND THE ON-LINE DATE.

Table 38

CUMULATIVE CAPITAL COSTS 1978-2000

(Billion Egyptian Pounds, 1978)

	Traditional (1) Technologies	Renewable (2) Sources	Increase (3) Efficiency
Comparison	16.2	1.6	0
Maximum Gas Use	14.7	1.6	0
Increased Efficiency	14.5	1.6	>0
Accelerated Renewables Resources	15.0	3.9	0
Nuclear Capacity Variations	10.6	3.9	>0

Notes: (1) Computed by the ESPM
 (2) Derived from estimates by A.D. Little, Inc.
 (3) Relative to the Comparison Case; no numerical estimates were made.

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