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U.S. Department of Energy
Assistant Secretary, Conservation
and Renewable Energy
Office of Renewable Technology
Washington, D.C. 20585
Under Contract No. DE-FG01-80RA50296

October 1982

ALTERNATIVE FUEL PRODUCTION FACILITY
FOR CITY OF HUNTSVILLE ALABAMA
VOLUME I EXECUTIVE SUMMARY

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October 1982

Prepared for:

U.S. Department of Energy
 Assistant Secretary, Conservation
 and Renewable Energy
 Office of Renewable Technology
 Washington, D.C. 20585

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ALTERNATIVE-FUEL PRODUCTION FACILITY
 FOR CITY OF HUNTSVILLE, ALABAMA.
 VOLUME I, EXECUTIVE SUMMARY

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MASTER

Prepared by:
 City of Huntsville, Alabama
 and Leonard S. Wegman Co. Inc.
 Under Contract No. DE-FG01-80RA50296

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FINAL REPORT

ALTERNATIVE FUEL PRODUCTION FACILITY
FEASIBILITY STUDY

DEPARTMENT OF ENERGY
DE - FG01 - 80RA50296

DEPARTMENT OF PUBLIC WORKS
HUNTSVILLE, ALABAMA

PREAMBLE

This volume, one of five, describes work performed and findings of the AFPP feasibility study which was intended to identify and resolve technical, economic, environmental, and institutional problems in implementing a solid waste-to-energy project.

Volume I, the Executive Summary capsulizes the contents of the four other volumes, and provides an overview on the work performed. The complete listing of the five Volumes is as follows:

Volume I	Executive Summary
Volume II	Feasibility Study
Volume III	Technology Development Summary
Volume IV	Preliminary Design and Outline Specifications
Volume V	Environmental Assessment and Permit Workbook

HUNTSVILLE
EXECUTIVE SUMMARY
SUMMARY

The feasibility of a Municipal Solid Waste (MSW)-to-energy project in the Huntsville area was investigated and found to be an environmentally attractive and cost effective method of MSW disposal. Of nine likely alternatives, that were developed for detailed evaluation and analysis, Alternative 1M surfaced as best for the City. It is described as follows:

A MSW-To-Energy Plant, consisting of two 300 TPD Mass Burning Waterwall Furnace/Boiler Systems at Lowe Industrial Park to provide low pressure steam to industries in the park. A MSW Transfer Station at the existing landfill and MSW as well as residue transport rolling stock equipment is included to facilitate movement of the waste materials between the two locations that are some twelve miles apart.

The practice of energy recovery from waste materials, rather than mere discard, provides a means of conserving the nation's energy resources and offers potential savings and revenues that can stabilize the future cost of MSW management. The cost would otherwise be expected to escalate rapidly due to the compounding of general inflation, increased expense of added environmental safeguards in the landfill operation and ultimately the longer haul distances to remote landfills when the existing City landfill has reached its final fill capacity.

The basis for the Huntsville MSW-to-energy project is established in the feasibility and preliminary design work accomplished and documented in this report. It serves to preface the sustained effort, fully described in the report's implementation section, needed to advance the project to commercial operability projected for year 1985.

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1. INTRODUCTION

In August of 1980, the City of Huntsville was awarded a Department of Energy (DOE) grant (DE-FG01-80RA50296) to investigate the feasibility of using Huntsville's municipal solid waste (MSW) as an alternative fuel source. Work was initiated in September of 1980 on the first segment of investigation and evaluation of producing energy from Huntsville's MSW. This first segment of work which consisted of identification of existing solid waste composition and generation, evaluation as a fuel source, energy and recovered materials market analysis, technology development and evaluation, site selection, and evaluation of various MSW-to-energy alternatives, was documented through a series of seven monthly progress reports. These monthly progress reports were submitted to a Citizens Advisory Committee and the Huntsville Public Works Department for review and input.

Monthly Progress Report number 7, dated July 15, 1981, summarized the findings of the work completed up to that date. Conclusions and recommendations of Progress Report number 7 indicated that a MSW-to-energy project for the Huntsville area was a viable alternative to sanitary landfilling of Huntsville's solid waste, and preliminary design of the recommended facility and additional implementation steps was recommended.

The work completed to date has been documented in the final report consisting of five (5) volumes. These five volumes are as follows:

Volume I	Executive Summary
Volume II	Feasibility Study
Volume III	Technology Development Summary
Volume IV	Preliminary Design and Outline Specifications
Volume V	Environmental Assessment and Permit Workbook

The Executive Summary, Volume I, capsulizes the contents of the four (4) other volumes and provides an overview perspective of the work performed.

2. SOLID WASTE GENERATION AND COMPOSITION

An initial step in the evaluation of MSW-to-energy is to identify accurately the existing solid waste stream quantity and quality. A review of current and past records of solid waste quantities disposed of at the landfill was done during the course of the study. Based upon this review and a review of present and past population figures for the City of Huntsville and Madison County, projection of future waste quantities were made.

Historical solid waste quantities disposed of at the sanitary landfill since the scale house was built and record keeping was initiated in 1975 are summarized in Table 2.1. Figure 2.1 illustrates these past or recorded solid waste quantities disposed of at the City landfill, and also projects future generation and collection rates.

Future solid waste quantities are based upon population projections provided by the Chamber of Commerce, and the assumption that per the capita waste generation rate will increase at a rate of one (1) percent per year. Past and projected population figures for the City of Huntsville and Madison County are as follows:

	<u>1950</u>	<u>1960</u>	<u>1970</u>	<u>1980</u>	<u>1990</u>	<u>2000</u>
Within Huntsville City Limits	16,437	72,365	137,802	142,513	153,139	160,236
<u>Outside Hunts-</u> <u>ville City Limits</u>	<u>56,466</u>	<u>44,984</u>	<u>48,738</u>	<u>54,453</u>	<u>55,630</u>	<u>60,820</u>
Total in Madison County	72,903	117,349	186,540	196,966	208,769	221,056

Solid waste quantities and projections for the Huntsville area are summarized in Table 2.2 for 1980, 1990, and the year 2000. These quantities which represent an increase of approximately 35 percent from 1980 to year 2000 (561 TPD to 758 TPD based on 5.5 days per week), support the analyses and evaluation of various technologies and alternatives developed during the study.

TABLE 2.1

Historical Total Solid Waste Landfill Disposal
(FY '75 - FY '81)
HUNTSVILLE, ALABAMA

<u>YEAR</u>	<u>TOTAL NET LBS COLLECTED</u>	<u>TONS</u>	<u>TONS/DAY *</u>
FY 75	369,947,300	184,974	650
FY 76	277,246,990	138,623	487
FY 77	289,042,600	144,521	508
FY 78	320,376,460	160,188	563
FY 79	334,480,960	167,240	588
FY 80	318,972,540	159,486	561
FY 81	<u>319,820,880</u>	<u>159,910</u>	562
Total	2,229,884,880	1,114,942	

* Based on 23.7 days/month

**AVERAGE REFUSE COLLECTION
RATES IN HUNTSVILLE**

FIG. 2.1

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TABLE 2.2

PROJECTED QUANTITIES OF SOLID WASTE
(tons per day)

Huntsville, Alabama

	<u>5.5 days/week</u>			<u>7.0 days/week</u>		
	<u>1980</u>	<u>1990</u>	<u>2000</u>	<u>1980</u>	<u>1990</u>	<u>2000</u>
Average ¹	561	661	758	441	520	595
Minimum ²	281	331	379	221	260	298
Peak ³	842	992	1137	662	780	893

1) Based on weekly averages

2) Minimum = 0.5 x average

3) Peak = 1.5 x average

A waste composition study was also conducted on Huntsville's MSW by collecting samples directly from sanitation trucks upon disposal at the City's landfill. These samples were then separated into individual components (paper, food wastes, metal, etc.), weighed, and logged. The results of the waste composition study are shown in Table 2.3, and are compared with the national average. Since many factors, such as sample size, season of the year, and sampling methodology can affect results of a composition study, the results were slightly modified for use in this study. The moisture content was raised and the heat value was lowered to reflect a conservative design approach.

TABLE 2.3
SOLID WASTE COMPOSITION
for
HUNTSVILLE, ALABAMA
(% of Composition by Weight)
January 1981

	<u>Commerical</u>	<u>Residential</u>	<u>Residential</u>	<u>Total Commerical and Residential</u>	<u>Industrial</u> ¹	<u>Average</u> ² <u>MSW</u>	<u>National</u> ³ <u>Average</u>
<u>Combustibles:</u>	<u>94.3 %</u>	<u>73.6 %</u>	<u>72.1 %</u>	<u>76.3 %</u>	<u>80.2 %</u>	<u>77.6 %</u>	<u>79.4 %</u>
1. Food waste	4.7	8.4	20.6	11.9	NR	8.3	17.0
2. Garden waste	NR	0.5	NR	0.2	25.1	7.8	17.5
3. Paper products	75.1	53.2	40.4	52.3	23.8	43.8	33.5
4. Plastic, rubber, leather	14.5	4.8	8.1	7.8	11.9	9.0	6.2
5. Textiles	NR	6.2	3.0	3.9	1.9	3.3	2.0
6. Wood	NR	0.5	NR	0.2	17.5	5.4	3.2
	—	—	—	—	—	—	—
<u>Non-combustibles:</u>	<u>5.7 %</u>	<u>26.4 %</u>	<u>27.9 %</u>	<u>23.7 %</u>	<u>19.8 %</u>	<u>22.4 %</u>	<u>20.6 %</u>
7. Metals	5.7	7.6	6.2	6.7	4.1	5.9	9.2
8. Glass & Ceramics	NR	18.3	21.7	16.4	4.4	12.8	9.9
9. Ash, dirt, rocks	NR	0.5	NR	0.6	11.3	3.8	1.5
	—	—	—	—	—	—	—
Total	100 %	100 %	100 %	100 %	100 %	100 %	100 %

NR = None Recorded or insignificant.

¹ Industrial composition includes waste disposed by City street vehicles that include tree limbs, leaves, etc. plus demolition material collected by the City.

² Average MSW in Huntsville is 49% Residential, 21% Commerical and 30% Industrial.

³ "Resource Recovery Facts and Figures", NCRR Briefs, National Center of Resource Recovery, Inc., Washington, D.C. (July 1980).

3. ENERGY MARKETS

In order to assist in the site selection process and identification of potential energy markets, "Preliminary Questionnaires" were sent to approximately 40 industries located in the Huntsville area. The questionnaires were used to determine interest by industries in using energy commodities (steam, chilled water, electricity, RDF, gas, etc.) that could be derived from Huntsville's MSW stream.

Based on the results of the energy market survey, and a review of existing land use and zoning regulations, essentially four areas of concentrated major industrial activity in the Huntsville area can be defined. These areas are noted on the map shown by Figure 3.1. While there are other industrial areas scattered throughout the City, these four areas appear to offer the best potential of continued and expanded growth. The four potential market areas are:

- (1) Lowe Industrial Park located in southwest Huntsville just northeast of the Madison County Airport.
- (2) Research Park located approximately four miles west of downtown Huntsville and bounded by University Drive (U.S. Highway 72) on the north and Governor's Drive (State Highway 20, U.S. Highway 72 - Alternate) on the south.
- (3) Madison County Industrial District located in the northeast part of the City near the city limits and just north of U.S. Highway 72.
- (4) Memorial Parkway-Green Cove Road located in the southeast part of the City.

Analysis of the results of the preliminary questionnaires and industrial zoning and growth patterns resulted in the identification of three of the four industrial areas shown by Figure 3.1 as being potential sites for a MSW-to-energy facility. Due to a lack of expressed interest on the part of industries located in the Madison County Industrial District, it was eliminated as a potential area for marketing an energy source derived from MSW. It was also desired that

LEGEND:

CONCENTRATED INDUSTRIAL AREAS

1. LOWE INDUSTRIAL PARK
 2. RESEARCH PARK
 3. MADISON COUNTY INDUSTRIAL DISTRICT
 4. MEMORIAL PARKWAY - GREEN COVE ROAD
- △ POTENTIAL FACILITY SITES

INDUSTRIAL AREAS AND POTENTIAL MARKET AREAS

FIG. 3.1

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the existing sanitary landfill site be evaluated as a potential site and therefore the energy market area near the landfill was evaluated.

Four areas were, therefore, selected for consideration and evaluation as potential sites for the construction of an AFPP. The energy consumption history (natural gas and electricity) for the major energy consumers within each of the four areas was investigated, using consumption records obtained from Huntsville Utilities.

The Lowe Industrial Park was found to have the highest energy consumption of the four areas surveyed. Of the nine industries located in or near the Lowe Industrial Park, Dunlop Tire and Rubber Corporation was found to be the largest energy user in the area.

Review and analysis of the "Preliminary Questionnaires" sent to Huntsville industries, coupled with followup telephone conversations with industry representatives and plant visits to several of the industries, allowed Table 3.1 to be prepared, summarizing the potential steam market demand for the four geographical areas investigated.

While various energy commodities can be derived from MSW, steam is usually the commodity that can offer the greatest overall conversion efficiency, and therefore can be very attractive and cost effective, provided a steam market can be matched with existing and projected solid waste quantities.

Of the four areas surveyed, the Lowe Industrial Park area exhibits the highest potential for steam market demand. A breakdown of approximate winter and summer steam demand curves is presented by Figures 3.2 and 3.3. As noted by the figures, Dunlop Tire and Rubber Corporation comprises approximately 75% of the total steam demand for the area.

TABLE 3.1

POTENTIAL STEAM MARKET DEMAND
FROM AN
ALTERNATIVE FUEL PRODUCTION FACILITY
PLANT

Geographical Area	Steam Usage (#/hr)		Remarks
	Summer	Winter	
LOWE INDUSTRIAL PARK	85,000	116,000	See Note 1
RESEARCH PARK	-0-	-0-	See Note 2
CITY LANDFILL AREA	8,000	13,500	See Note 3
MEMORIAL PARKWAY-GREEN COVE ROAD AREA	13,400	20,600	See Note 4

NOTES:

1. List of potential steam customers as noted in Progress Report Number 5.
2. No significant steam demand exist in this area.
3. Based on Huntsville Manufacturing's interest of 90,000,000 lbs. of steam per year. Distribution of summer and winter loads shown are assumed.
4. Based on GTE Automatic being the only potential steam customer with summer and winter demand so noted.

WINTER STEAM DEMAND CURVE
LOWE INDUSTRIAL PARK AREA

FIG. 3.2

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**SUMMER STEAM DEMAND CURVE
LOWE INDUSTRIAL PARK AREA**

FIG. 3.3

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4. ENERGY VALUES

During the past decade, profound changes in both the supply and economics of energy in the United States and the world have occurred. Dramatic increases in the prices of petroleum, coupled with energy supply interruptions, have become more frequent. These events, in turn, have adversely affected the balance of payments, inflation, unemployment, and economic growth.

Current as well as future price levels for energy supplies (crude oil, No. 6 fuel oil, and natural gas) will greatly affect the economics of all technologies and alternatives in which MSW is used as an energy source. Prediction and projection of future energy values, while not an exact science, can be done on the basis of past price increases and knowledge of existing energy supplies. Figure 4.1 notes the historical pricing levels for electricity and natural gas in the Huntsville area. Natural gas has shown an average increase of approximately 29 percent per year from late 1976 to early 1981 while electricity has increased an average of 25 percent per year over the last four (4) years.

Increases in the price of energy can be very closely tied to the increase in the price of crude oil. Since the price of crude oil is projected to continue to increase, it can be assumed that petroleum derivatives, such as gasoline and fuel oil, will at least parallel the increase of crude oil. It is also assumed that the price of natural gas and steam will parallel the increases of crude oil.

Using published government projections in the price of crude oil, Figure 4.2 has been developed to project future price levels for crude oil and natural gas. These prices, which reflect an average increase of 8.2 percent per year (in 1980 dollars) until the year 2000, do not include increases due to annual inflation which may range from 8 to 12 percent or more.

HISTORICAL ELECTRICAL AND NATURAL GAS PRICES
FOR
HUNTSVILLE, ALABAMA

FIG. 4.1
Leonard S.Wegman Co.Inc. Engineers

**PROJECTED PRICE FOR CRUDE OIL
AND
NATURAL GAS**

(1980 Dollars)

FIG. 4.2

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Several years ago the Federal Energy Regulatory Commission (FERC) issued Regulations known as the Natural Gas Policy Act of 1978 that requires utilities to charge some large industrial customers higher rates for the natural gas they use as a boiler fuel. The law is designed to discourage the use of gas as boiler fuel, and it sets the price that must be charged at the level of the cost of No. 6 fuel oil.

These set natural gas prices vary from state to state and are usually listed on or around the 20th of each month in the Federal Register. For the month of April, 1981 the price for natural gas in the State of Alabama per million Btu's was \$3.90. So if it is assumed that the Natural Gas Policy Act of 1978 remains in force, a prediction of future natural gas prices can be made based on the projected price increases of No. 6 fuel oil.

The pricing methodology used in developing the future price levels of steam, the most efficient energy commodity that can be derived from a MSW-to-energy facility, has been based on the assumption that natural gas will at least parallel the cost of No. 6 fuel oil. To arrive at an equivalent price between natural gas and steam some basic items must be presented: (1) every cubic foot of natural gas is equivalent to approximately 1000 Btu's; (2) one thousand (1,000) cubic feet of gas can produce approximately 800 lbs of steam (80% efficiency); (3) one (1) pound of steam (saturated) is approximately 970 Btu's at atmospheric pressure and a temperature of 212°F. Therefore the conversion from natural gas to steam can be done by dividing the natural gas prices by 80% to arrive at the steam prices.

Projected steam prices are displayed by Figure 4.3. This can serve as the basis for pricing of steam sold to local industries. If the steam is to be an interruptible steam the City may want to discount it to make the commodity inviting to the industries. If the steam is to be a non-interruptible steam then the price may be equivalent to or higher than the energy value. The actual price of the steam, whether it is interruptible or non-interruptible, and the basis for price increases will have to be negotiated with the individual industries in the market area.

**PROJECTED FUTURE PRICE
FOR
STEAM**

(1980 Dollars)

FIG. 4.3

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5. ALTERNATIVES ANALYSIS

A survey and review of the available technologies that reclaim and/or recover materials from MSW was conducted during the study period. The results of this review are summarized in Volume III, Technology Development Summary. The discussions presented were directed toward providing the necessary insights for selection of the recommended technology which best suits the specific requirements of an Alternative Fuel Production Facility (AFPF) in the Huntsville area. The following technologies for recovery of energy and materials were investigated:

- ° Spreader stoker or suspension fired units for Refuse Derived Fuel (RDF)
- ° Mass Burning Incineration (Refractory Lined or Waterwall Units)
- ° Modular Incinerators
- ° Pyrolysis
- ° Methane Recovery from Landfills

Upon completion of the technology review and in conjunction with the energy market survey, a total of nine (9) alternatives were developed which were deemed worthy of further evaluation. Upon completion of the energy market survey and determination of the potential steam market demand for each of the four (4) areas considered as potential sites a modified version of each alternative was developed (designated the M-Series). Economic analysis of the M-Series of alternatives was then completed in which revenues derived from steam sales were matched with the potential steam market demand for each site. (This is designated as Phase 1 analysis). Table 5.1 summarizes and compares the costs for each of the alternatives considered.

Two (2) alternatives, 1M (2 - 300 TPD mass burning waterwall furnaces) and 2M (5 - 100 TPD modular combustion units), surfaced as best for the City. Both are located at Lowe Industrial Park. Upon further analysis of alternatives 1M and 2M (designated as Phase 2 analysis) it was concluded that Alternative 1M is more attractive and is therefore the recommended alternative for implementation.

ALTERNATIVE FUEL PRODUCTION FACILITY FEASIBILITY STUDY
CITY OF HUNTSVILLE, ALABAMA

TABLE 5.1
COMPARATIVE COSTS OF ALTERNATIVES - PHASE 1 ANALYSIS

	Description		Avg. Energy Export		Cost in 1981 Dollars Based on 182,500 Tons per Year					
	MSW Energy Plant	MSW Transfer Station	Stm.(lb/hr)	Elect(kw)	Capital	LDS(\$/T)	O&M(\$/T)	TE(\$/T)	REV.(\$/T)	NTF(\$/T)
1	2-300 TPD MBWW @ Lowe Ind'l Park	None	97,800 @ 1203 Btu	-	\$42,100,000	25.30	14.20	39.50	24.96	14.54
1M	-DO-	3 Pushpit/Compactor Units @ Landfill	97,800 @ 1203 Btu	-	\$44,840,000	26.92	16.76	43.68	25.17	18.51
2	5-100 TPD MCU @ Lowe Ind'l Park	None	70,900 @ 1203 Btu	-	\$26,550,000	18.00	14.40	32.40	19.21	13.19
2M	-DO-	3 Pushpit/Compactor Units @ Landfill	70,900 @ 1203 Btu	-	\$28,948,000	19.68	16.50	36.18	19.41	16.77
3	2-300 TPD MBWW/TG @ Research Park *	None	75,000 @ 1326 Btu	2970	\$57,600,000	34.60	16.80	51.40	27.14	24.26
3M	2-300 TPD MBWW/TG @ Research Park	None	-	9310	\$54,160,000	32.51	16.30	48.81	17.89	30.92
4	2-300 TPD MBWW/TG & LFG Firing @ Landfill	None	75,000 @ 1326 Btu	5020	\$61,200,000	36.70	17.00	53.70	30.48	23.22
4M	-DO-	None	10,750 @ 1326 Btu	10410	\$58,832,000	35.30	17.00	52.30	22.53	29.77
5	2-300 TPD MBWW/TG & LFG&E Gen. @ Landfill	None	75,000 @ 1326 Btu	4400	\$61,900,000	37.20	17.50	54.70	29.21	25.49
5M	-DO-	None	10,750 @ 1326 Btu	9800	\$59,532,000	35.75	17.50	53.25	21.69	31.56
6	2-300 TPD MBWW/TG & LFG&E Gen./WHB@LF	None	75,000 @ 1326 Btu	5630	\$62,800,000	37.70	17.80	55.50	31.52	23.98
6M	-DO-	None	10,750 @ 1326 Btu	11070	\$60,432,000	36.26	17.80	54.06	23.64	30.42
7	2-300 TPD MBWW/TG @ Memorial Pkw'y	None	75,000 @ 1326 Btu	2970	\$57,600,000	34.60	16.80	51.40	27.14	24.26
7M	-DO-	None	17,000 @ 1326 Btu	7670	\$55,880,000	33.56	16.80	50.36	20.06	30.30
8	Union Carbide Purox System Not Comm'l	None	-	-	-	-	-	-	-	-
9	500 TPD MSW/RDF Mfg. 2-SS/TG @ Landfill	None	75,000 @ 1326 Btu	4360	\$58,100,000	34.80	20.70	55.50	30.24	25.26
9M	500 TPD MSW/RDF Mfg. 2-SS/TG @ Landfill	None	-	10,900	\$47,780,000	28.68	19.70	48.38	19.82	28.56

Notes & Abbreviations

*Stm pipeline to Research Pk

\$/T = Dollars per Ton

MSW = Municipal Solid Waste

TPD = Tons Per Day

TG = Turbine Generator

TE = Total Expenses = LDS + O&M

WHB = Waste Heat Boiler

LF = Landfill

LFG = Landfill Gas

LFG&E = Landfill Gas Electric

REV = Revenues = Steam & Elect. Sales + Interest on

Operating Reserve

RDF = Refuse Derived Fuel

SS = Spreader Stoker

MBWW = Mass Burning Waterwall

MCU = Modular Combustion Unit

LDS = Level Debt Service Expense

O&M = Operating & Maintenance Expenses

NTF = Net Tipping Fee = TE - REV

6. PROJECT DESCRIPTION

The Huntsville MSW-to-energy facility, as developed through the preliminary design stage, consists of constructing two 300 tons per day (TPD) mass burning waterwall furnace/boiler systems at the Lowe Industrial Park. The facility is to provide low pressure steam to industries located in or near the industrial park with the major steam customer being Dunlop Tire and Rubber Corporation. The project also includes the construction of a MSW transfer station to be located at the existing sanitary landfill. Transfer trailers and trucks as well as residue transport rolling stock equipment are included to facilitate movement of the waste materials between the sanitary landfill and the MSW to energy facility at the Lowe Industrial Park. Figure 6.1 notes the overall location map of the two sites.

The proposed facility, as currently designed, will be capable of producing 97,800 lb/hr of 300 psi steam based on an average solid waste feed stream of 500 TPD of MSW. Peaking loads up to 600 TPD can also be handled by the facility. Figure 6.2 shows the energy and mass balances of the proposed facility. The energy mass flow diagram is based upon an input of 500 TPD of MSW at an average BTU content of 4,500 BTU/lb of MSW. The energy that can be produced by the MSW to energy facility is equivalent to the energy produced by more than 575 barrels of oil per day. This is equivalent to a savings of more than 200,000 barrels of oil per year.

A capsule plant description of the proposed facility is summarized in Table 6.1.

HUNTSVILLE

ALABAMA

ALTERNATIVE FUEL PRODUCTION SYSTEM

- [A]** ALTERNATIVE FUEL PRODUCTION FACILITY (PROPOSED)
- [T]** TRANSFER STATION (PROPOSED)
- [L]** LANDFILL (EXISTING)
- [P]** LOWE INDUSTRIAL PARK (EXISTING)

FIG. 6.1
LOCATION MAP

HUNTSVILLE ALTERNATIVE FUEL FEASIBILITY

FIGURE 6.2

ALTERNATIVE 1M
SITE = LOWE INDUSTRIAL PARK
ENERGY AND MASS BALANCES

TABLE 6.1
CAPSULE PLANT DESCRIPTION
ALTERNATIVE 1M

A. Transfer Station

Enclose tipping area, 3 push pits, 3 stationary compactors in basement, scale, scale house and employee facilities.

B. Refuse Receiving Facility includes:

Enclosed tipping area, 1500 tons refuse storage bins and 2-300 tpd overhead crane and grapple systems.

C. Grate Waterwall Furnace System includes:

2-300 tpd waterwall furnaces each with its own integral boiler without superheater, stoker grate system, combustion air system, feed hopper and chute system, auxiliary burners flue system, and residue conveyors. Also steam plant auxiliaries, piping systems, instrumentation and controls for furnace and steam systems, building enclosure, and chimneys.

D. Pollution Abatement System includes:

Gas conditioning flues, electrostatic precipitators, induced draft fans, and fly ash conveyors. All equipment is installed outdoors.

E. Steam Transmission Line and Miscellaneous Facility

Steam transmission line-1 mile, site work, scale, scale house and employee facilities.

7. PRELIMINARY DESIGN AND OUTLINE SPECIFICATIONS

The preliminary design and outline specifications for the proposed alternative was completed during the course of this study. The work is presented in Volume IV for the recommended MSW to energy scenario. Preliminary design and outline specifications were prepared for the following:

- A) MSW-to-energy facility at Lowe Industrial Park consisting of two 300 TPD mass burning waterwall furnace/boiler system, air pollution controls, MSW receipt and storage, weigh scale, tipping floor, residue/sifting/fly ash handling, cranes, maintenance and personnel facilities, buildings and building services.
- B) Three-position push-pit/compactor transfer station on site of existing Huntsville landfill.

Pre-design engineering has been provided for the following:

- ° Site and utilities
- ° Material handling
- ° Combustion process
- ° Air pollution controls
- ° Wastewater treatment
- ° Instrumentation and controls
- ° Heating, ventilation, air conditioning, dust and odor control
- ° Electrical
- ° Plumbing & fire protection
- ° Rolling stock specifications

Site and utilities work at the transfer station will encompass the City's existing scale house and scale, presently being used to weigh in refuse for the City's current sanitary landfill operation.

The MSW-to-energy facility at Lowe Industrial Park will include:

- ° Scale house and scales
- ° Receiving area, refuse pit, and cranes
- ° Furnace/boiler systems
- ° Tire shredder system
- ° Stacks
- ° Air pollution controls
- ° Boiler feedwater treatment system
- ° Residue storage and handling
- ° Siftings and fly-ash handling
- ° Wastewater treatment system
- ° Steam and condensate piping systems
- ° Natural gas supply and distribution system
- ° Instrument, control, and security systems
- ° Control, conference and locker rooms, offices, and equipment rooms
- ° Storage facilities, shops and maintenance areas
- ° Electrical substation
- ° Waste oil receipt and storage area

The site layout of the proposed MSW-to-energy facility is shown by drawing PF-1. Approximately ten (10) acres of land will be required for siting of the facility. The proposed location of the facility is at the eastern end and just north of Dunlop Boulevard. This location is adjacent to the Dunlop Tire and Rubber Corporation plant and offers the advantages of good access and a closeness to the steam customers. Drawing PF-3 depicts a longitudinal section of the proposed facility and notes the major components making up the plant. Drawing PF-8 notes the proposed steam pipe routing to the various industries at the Lowe Industrial Park.

NOTE
DATUM 0 = EL. 579.00' (MSL)

NO.	DATE	REVISION	BY

LEONARD S. WEGMAN CO. INC.
ENGINEERS
NEW YORK
ATLANTA · BOSTON · BUFFALO
EAST HARTFORD · FORT LAUDERDALE · MEMPHIS

AFPF FEASIBILITY STUDY
CITY OF HUNTSVILLE, AL
AFPF - PROCESS
STATION-LONGITUDINAL SECTION

DATE: 1-8-82	PROJECT NO. 8016	DRAWING NO. PF-3
SCALE: 3/8" = 1'-0"	DESIGNED BY: EGB	CHECKED BY: GCB
APPROVED BY: GCB	DATE: 1-8-82	BY: EGB

NO.	DATE	REVISIONS

LEONARD S. WEGMAN CO. INC.
ENGINEERS
NEW YORK
ATLANTA BOSTON BUFFALO
EAST HARTFORD FORT LAUDERDALE MEMPHIS

AFPP FEASIBILITY STUDY
CITY OF HUNTSVILLE, AL
AFPP
SITE LAYOUT

DATE: EGS	BY: EGS
DATE: W. NAVARRO	BY: W. NAVARRO
DATE: EGS	BY: EGS
DATE: 1-30-81	BY: 1-30-81
8016	PF-1

LEGEND

- MH DENOTES MANHOLE
- SIO DENOTES 10" STEAM PIPELINE
- CG DENOTES 6" CONDENSATE PIPELINE
- MIN. DENOTES MINIMUM

				LEONARD S. WEGMAN Co. INC.		AFPP FEASIBILITY STUDY		SHEET 263	
				ENGINEERS				DESIGN FL	
								DESIGN H.T.	
				NEW YORK		CITY OF HUNTSVILLE, AL		263	
				ATLANTA BOSTON BUFFALO				SCALE 1" = 400'	
				EAST HARTFORD FORT LAUDERDALE MEMPHIS		AFPP PROCESS		PROJECT NO.	
						STEAM DISTRIBUTION LINE		8018	
NO.		DATE		DESCRIPTION		BY		DATE	
				REVISIONS				PF- 8	

8. ENVIRONMENTAL CONSIDERATIONS AND PERMIT REQUIREMENTS

The implementation of any solid waste to energy facility requires that adequate attention be given to the various environmental factors of the project. Environmental review of a project generally runs parallel with the permit application process. Volume V of the study titled, Environmental Assessment and Permit Workbook, contains an environmental evaluation of the proposed facility and identifies permit requirements and recommended methodology to secure environmental review and permits from agencies and organizations having jurisdiction.

The Environmental Assessment concludes that adverse impacts on the land, water, or air environments due to the proposed project should be minimal. The area of highest probable impact is the atmosphere. The implementation of best available control technology (BACT) for control of air emissions should make the impact on existing air quality minimal.

Air pollution control aspects have been given prime consideration in project development and will continue to be emphasized as the project proceeds through detailed design, construction and startup. A Prevention of Significant Deterioration (PSD) Review will be required. Energy to be sold as steam will allow purchasers to reduce emissions of pollutants from their boilers that would otherwise burn more fossil fuels. This reduction in existing emissions may offset the new emissions and the net result would be environmentally advantageous.

The purpose of the Permit Workbook is to serve as a guide, reference document, and summary document of what types of regulations must be met, what types of permits are required, and how to go about securing these various permits. This Workbook can be continuously modified and added to as the project progresses and more specific information about the project and specific permitting requirements become known or is developed.

9. PROJECT COSTS AND ECONOMICS

Project costs for the recommended alternative are summarized in Table 9.1, given in 1981 dollars. As noted in the table the total estimated construction cost for the facility, including the transfer station and rolling stock is \$26,070,000. Interest during construction and reserve funds are estimated to add another \$18,770,000 bringing the total capital cost to \$44,840,000. Amortization of the total capital cost at 9 percent over 20 years results in an annual capital cost (levelized) of \$4,912,000. Total annual operating costs are estimated at \$3,058,000. Therefore, the total equivalent annual cost is \$7,970,000.

Project economics may be developed by adding debt service to operations and maintenance costs and then subtracting revenues from this sum. Revenues consist of energy sales, interest from reserve funds and tipping fees. While some revenues may be realized from the sale of secondary materials (i.e. ferrous metals) from the ash residue, it is considered minimal and is not reflected in project economics. The resultant net cost is either positive or negative. A positive cost would indicate that some added source of funds would be needed to subsidize the project. The negative cost signifies the project to be profitable and the profits may be distributed or placed in a reserve fund.

An alternate economic analysis is not to include a stipulated tipping fee, in the calculation of net cost, but rather to allow the other project cost factors to determine what tipping fee is required to "break even." Thus, depending on the pricing and quantity of steam to be sold to the local industries, the resulting tipping fee per ton of MSW disposed of can be calculated.

Project economics have been based on a pricing structure that is tied to the equivalent energy value of the MSW and the cost of producing that steam using natural gas or fuel oil. As an incentive to the local industries to enter into a steam market agreement to purchase

TABLE 9.1

PROJECT COSTS
 ALTERNATIVE 1M
 2-300 TPD MASS BURNING WATERWALL FURNACE/BOILERS

PLANT OUTPUT: STEAM
 PLANT SITE: LOWE INDUSTRIAL PARK
 6(1981 DOLLARS)

CAPITAL COST

A. Transfer Station	\$1,800,000
B. Refuse Receiving Facility	4,000,000
C. Grate Waterwall Furnace System	14,500,000
D. Pollution Abatement System	4,000,000
E. Steam Transmission Line & Misc. Facility	1,000,000
F. Rolling Stock	770,000
7 Tractor-trailers @ \$90,000 ea.	
2 Residue trucks @ \$70,000 ea	
G. Total Construction Cost	\$26,070,000
H. Interest during construction and reserve fund	<u>18,770,000</u>
I. Total Capital Cost	\$44,840,000
J. Annual Capital Cost (9%, 20 yr.) CRF = 0.10955	\$4,912,000

ANNUAL OPERATING COST

K. Operating Personnel	\$ 1,228,000
L. Electricity	310,000
M. Chemicals	10,000
N. Water and miscellaneous	71,000
O. Maintenance and repairs	253,000
P. MSW haul	292,000
Q. Residue haul	100,000
R. Residue tipping fee @ landfill	<u>394,000</u>
Direct Operating Cost	\$ 2,658,000
S. Management	<u>400,000</u>
T. Total Annual Operating Cost	\$ 3,058,000

steam from an MSW-to-energy facility, the pricing structure has been discounted. The amount of discount that can be offered and the quantity of steam sold to the local industries will greatly affect the overall project economics.

A tipping fee analysis (Phase 2 Analysis) was conducted for both a level debt service (LDS) and graduated debt service (GDS) type financing of the project. (See Figures 9.1 and 9.2)

These projected tipping fees are based on capital and operating costs and revenues at the respective times they are incurred, using appropriate inflation factors displayed in Table 9.2.

LDS financing is conventional, accepted financing. In the early years of operation, before the impact of escalating energy costs begin to dominate, MSW-to-energy project tipping fees would be higher than Sanitary Landfilling; ultimately, the converse would be true; the cross-over year would be a function of the steam sales percent discount.

GDS is innovative financing but, at a slightly higher interest rate (10% compared to 9%), can be an attractive investment to the bond market. The low debt service payments in the early years, when needed most, makes for a more viable project. Debt service payments increase in subsequent years, but at a time when revenues have escalated to a level where they offset these payments.

In the Phase 2 Analysis, an availability factor of 0.85 was taken as representative of the availability of facilities to perform at nominal design levels. Loss of availability may be due to forced or planned equipment outages, waste quantities and heat values being less than predicted, or moisture content being greater than anticipated, loss in revenues due to excessive fouling of boiler tubes, market upsets, loss in efficiency in order to operate in a mode other than planned for reasons of environmental compliance and the like. This is a catch-all factor that integrates a multitude of impacts that may cause revenues

FIGURE 9.1 TIPPING FEE VS YEAR
HUNTSVILLE
MSW ALTERNATIVE
FUEL FEASIBILITY

ALTERNATIVE 1M

2-300 TPD MASS BURNING WATERWALL BOILERS
STEAM TO LOWE INDUSTRIAL PARK

FINANCING SCENARIO #1
LEVELIZED DEBT SERVICE ($i=8\%$, $n=20$)

AVAILABILITY FACTOR = 0.85

FIGURE 9.2 TIPPING FEE VS YEAR

HUNTSVILLE

MSW ALTERNATIVE

FUEL FEASIBILITY

ALTERNATIVE 1M

2-300 TPD MASS BURNING WATERWALL BOILERS
STEAM TO LOWE INDUSTRIAL PARK

FINANCING SCENARIO #2
GRADUATED DEBT SERVICE ($i = 10\%$, $n = 20$)

AVAILABILITY FACTOR = 0.85

TABLE 9.2

INFLATION FACTORS

(Used for Phase 2 and 3 Economic Analysis)

Construction	:	10% compounded to mid-point of construction, projected to be 1983.
Operation & Maintenance (exclusive of energy costs, figured same basis as Revenues)	:	10% compounded annually to year incurred. Initial year of operation is projected to be 1985
Revenues		
Steam	:	Based on \$5.00 per 10 ⁶ BTU with annual compounded inflation rate as follows: 17% (1981 to 1985) 14% (1985 to 1995) 14.5% (1995 to 2004) Steam revenues are developed for alternative discounts: 10, 20, 30 and 40%.
Oil & Natural Gas	:	Based on \$4.00 per 10 ⁶ BTU with annual compound inflation rate same as steam.
Electricity	:	Based on \$0.0313* per KWH with annual compound inflation rate as follows: 19% (1981 to 1985) 16% (1985 to 1990) 14% (1990 to 1995) 14.7% (1995 to 2004)
Earnings on Reserve	:	Constant at 12% of Annual Level Debt Service to repay Capital Cost.

* \$0.0313 per KWH is current rate of TVA purchase of electricity.
\$0.0343 per KWH is current rate for City purchase of electricity.

from energy sales to be only 85% of output capacity, while debt service remains unaffected with operating costs somewhere in between (depending on ratio of fixed to variable elements of operating costs). The 0.85 factor was used to compute the net annual cost of the alternative as it would be reduced from its 100% availability value.

In order to model this computation, operating costs were divided into fixed and variable elements. Labor, management, elements of maintenance and miscellaneous office costs are essentially fixed whereas electricity, chemicals, fuel, operating supplies and other costs are considered variable. Thus the 0.85 factor was applied to energy sales revenues at the same time it was applied to the variable element of operating cost. The fixed element of operating cost is not affected. As modeled, 15% of the MSW was assumed to by-pass the MSW-to-energy facility and go directly to landfill, with the MSW landfilling cost charged against the MSW-to-energy project.

Based upon the Phase 2 Analysis it is recommended that a graduated debt service (GDS) type of financing methodology be used for financing the MSW-to-energy project in the Huntsville area. The details of how a graduated debt service may be structured for market acceptance is presented in paragraph 10, Implementation, and is further discussed in Volume II of the Feasibility Study Report.

A series of analysis designated as Phase 3 Analysis was conducted in order to focus on the recommended Alternative 1M under a GDS type of financing and to examine the sensitivity of the tipping fee on variations of interest rates, availability factor and corresponding steam sales discounts.

In order to advance the Phase 3 Analysis expeditiously, a computer assisted approach was used. Specifically the following variations were analysed:

*	Variation 1,	i = 10%,	AF = 0.85,	STM DISC = 10%
*	Variation 2,	i = 10%	AF = 0.85,	" " = 20%
*	Variation 3,	i = 10%	AF = 0.85,	" " = 30%
*	Variation 4,	i = 10%	AF = 0.85,	" " = 40%
	Variation 5,	i = 12%	AF = 0.85,	" " = 10%
	Variation 6,	i = 12%	AF = 0.85,	" " = 20%
	Variation 7,	i = 12%	AF = 0.85,	" " = 30%
	Variation 8,	i = 12%	AF = 0.85,	" " = 40%
	Variation 9,	i = 10%,	AF = 0.70,	" " = 10%
	Variation 10,	i = 10%,	AF = 0.70,	" " = 20%
	Variation 11,	i = 10%,	AF = 0.70,	" " = 30%
	Variation 12,	i = 10%,	AF = 0.70,	" " = 40%
	Variation 13,	i = 12%,	AF = 0.70,	" " = 10%
	Variation 14,	i = 12%,	AF = 0.70,	" " = 20%
	Variation 15,	i = 12%,	AF = 0.70,	" " = 30%
	Variation 16,	i = 12%,	AF = 0.70,	" " = 40%

* The asterisked variations were evaluated under Phase 2, but were replaced under the Phase 3 computer-assisted approach to maintain a consistency in all of the variations examined under Phase 3.

The phase 3 compendium of variations would then become a useful reference in the negotiations that would subsequently be required to firm steam sales agreements with the industries who may desire to subscribe to the service. Figures 9.3 through 9.6 note the effect on the tipping fee for the sixteen (16) variations noted above. The Phase 3 data was assembled and included in the Appendix of Progress Report Number 7.

HUNTSVILLE MSW ALTERNATIVE FUEL FEASIBILITY
 ALTERNATIVE 1M - 2 300 TPD MASS BURNING WATERWALL BOILERS
 AF=.85. GRADUATED DEBT SERVICE - BOND I=10%

FIG. 9.3
TIPPING FEE vs. YEAR
(VARIATIONS 1-4)

- 1 = 10% STEAM DISCOUNT
- 2 = 20% STEAM DISCOUNT
- 3 = 30% STEAM DISCOUNT
- 4 = 40% STEAM DISCOUNT

5 = LANDFILLING ONLY

PREPARED BY LEONARD S. HEGMAN CO., INC.

HUNTSVILLE MSW ALTERNATIVE FUEL FEASIBILITY
 ALTERNATIVE 1M - 2 300 TPD MASS BURNING WATERWALL BOILERS
 AF=.85. GRADUATED DEBT SERVICE - BOND I=12%

FIG. 9.4
 TIPPING FEE vs. YEAR
 (VARIATIONS 5-8)

- 1 = 10% STEAM DISCOUNT
- 2 = 20% STEAM DISCOUNT
- 3 = 30% STEAM DISCOUNT
- 4 = 40% STEAM DISCOUNT

5 = LANDFILLING ONLY

PREPARED BY LEONARD S. WEGMAN CO., INC.

HUNTSVILLE MSW ALTERNATIVE FUEL FEASIBILITY
 ALTERNATIVE 1M - 2 300 TPD MASS BURNING WATERWALL BOILERS
 AF=.70. GRADUATED DEBT SERVICE - BOND 1=10%.

FIG. 9.5
TIPPING FEE vs. YEAR
(VARIATIONS 9-12)

PREPARED BY LEONARD S. WEGMAN CO., INC.

HUNTSVILLE MSW ALTERNATIVE FUEL FEASIBILITY
 ALTERNATIVE 1M - 2 300 TPD MASS BURNING WATERWALL BOILERS
 AF=.70. GRADUATED DEBT SERVICE - BOND I=12%

FIG. 9.6
 TIPPING FEE vs. YEAR
 (VARIATIONS 13-16)

- 1 = 10% STEAM DISCOUNT
- 2 = 20% STEAM DISCOUNT
- 3 = 30% STEAM DISCOUNT
- 4 = 40% STEAM DISCOUNT

5 = LANDFILLING ONLY

PREPARED BY LEONARD S. WEGMAN CO., INC.

10. IMPLEMENTATION AND PROJECT SCHEDULE

10.1 General

The Feasibility Study has found that a MSW-to-energy project in the Huntsville area is a viable alternative to sanitary landfilling of the City's solid waste. Final financial analysis and overall project economics, however, will be based upon the financing method employed, revenue received from steam sales, capital costs for construction, and operational costs of the facility. The type of procurement process used for the construction and operation of a MSW to energy facility can also affect the overall project costs. Basically three (3) procurement options are available for the construction of a MSW to energy facility. They are conventional, turnkey, and full service. The recommended method for implementation of the Huntsville project is a "full service" Design-Construct-Operate (DCO) procurement approach.

The implementation of any solid waste-to-energy project must undergo essentially four (4) stages or time segments of work from the planning and study stage until commercial operation is obtained. The project schedule shown by Figure 10.1 notes the four (4) time segments of work to be performed. Segment 1, the feasibility study stage, has been completed and is summarized in Volume II of the final report on Alternative Fuel Production Facility Feasibility Study for the City of Huntsville, Alabama. Segment 2, Preliminary Design, has also been completed and is summarized in Volume IV of the Alternative Fuel Production Facility Feasibility Study.

Segment 3, Project Authorization and Bid Award Process, is scheduled to take approximately 12 months. Segment 3 work includes City authorization to prepare a "Request for Bids" (RFB), preparation of the RFB, continuation of steam market negotiations and agreements, preparation of bids by prospective DCO's, review of bids and selection of DCO, and finalize financing and award of contract to DCO. Following award of contract to successful DCO candidate, Segment 4, Detailed Design and

PROJECT SCHEDULE

Commercial
Operation

Construction, will be initiated. This segment provides for a 27 month period for the detailed design, construction, startup and testing leading to commencement of commercial operations scheduled for April, 1985.

The procurement strategy employed will affect the ease of financing the facilities. Turnkey and full service procurements are viewed favorably by the capital markets. The allocation of completion and operation risks to the turnkey or full service contractor place these risks with the entity that is best equipped to manage these risks and reduces exposure to the bond holders and the City.

A detailed description of the tasks to be performed under the implementation plan (Segments 3 and 4) is described in the following paragraphs.

10.2 Segment 3 - Project Authorization and Bid Award Process

Following the completion of preliminary design, the major effort will be to advance the project into a detailed design/construction mode. Several tasks that were initiated in the preliminary design stage, steam market agreements and financing analysis, will be continued. Tasks identified under this segment of work are as follows:

10.2.1 Steam Market Agreements (Task 4)

While a significant steam market exists in the Lowe Industrial Park continued negotiations with Dunlop Tire and Rubber Corporation, the major steam user in the area, will be required. A draft steam market agreement, prepared under the preliminary design segment, has been presented to Dunlop Tire and Rubber Corporation for review. This is the initial step in negotiation of an equitable steam market agreement where steam demand and pricing are established which in turn reflects on the overall economics of the solid waste to energy project. Initiation and development of steam market agreements with smaller steam users in the area will also be required. Negotiation of steam market agreements can be a long and tedious process therefore it

should be done concurrently with other tasks noted by the project schedule.

10.2.2. Financing Analyses (Task 5)

Continuation of the financing analyses will also be required under Segment 3 work. The work should run concurrent with and used to support negotiations on the steam market agreements.

Since the successful DCO contractor will not be selected until the last quarter of 1982, at which time construction and operating/maintenance costs will become definitive, followed shortly thereafter by actual financing costs, the steam market agreements must necessarily allow an "escape clause". This would permit either party to the agreement (e.g. the City or the steam customer) the option of cancellation should project economics differ substantially from the projections. Notwithstanding the "escape clause", it is intended that negotiations between the City and the steam customers be conducted on as realistic a basis as possible. In pursuance of this goal, the following procedures are to be instituted:

- (a) The City is to select a Financial Advisor, a Bond Counsel and Underwriter to provide necessary inputs to the process of financial analyses.
- (b) The Financial Advisor will estimate interest rates, underwriters discounts, call provisions, distribution of maturities, and other pertinent matters needed to develop the cost basis for negotiations.
- (c) The sizing, timing and structure of bond issues will be accessed after:
 - 1) The Preliminary Design Engineers and the City's Financial Advisor review a tentative estimate of construction cash flow.
 - 2) The Financial Advisor projects capital market conditions at the estimated time of sales.

- 3) Bond counsel reviews the legal ramifications of the bond issue.
- (d) Based on tentative agreements with steam customers, the consultants for the Preliminary Design, in coordination with the Financial Advisor, Bond Counsel and Underwriters, will prepare projections of cash flows, statements of financial position, net income statements, and statements of changes in financial position for the project. Then a normal utility investment analysis will be conducted to evaluate:
- ° The operating ratio (i.e., operating and maintenance expenses divided by total operating revenues),
 - ° The net take-down ratio (i.e., debt operating income and other income divided by gross revenues),
 - ° The debt service coverage ratio (i.e., debt service divided by revenues available for debt service),
 - ° The debt service safety margin (i.e., revenues remaining after payment of debt service divided by gross revenues), and
 - ° The debt ratio (i.e., net funded debt divided by net working capital and net fixed assets).
- (e) The results of the analysis will then be compared with similar projects in other parts of the country made available to the City through the offices of the Department of Energy or other sources.
- (f) A reiterative analytical process will then follow, wherein it is expected that terms and conditions for steam sales will evolve which can be mutually agreed upon between the City and the various steam customers, subject only to the "escape clause".
- (g) The analysis will be made on the assumption that the impact of revenues from ferrous metal sales is negligible. Based on the record of performance on recovery of post-combustion ferrous metal at existing waste-to-energy plants, this is a reasonable assumption.

10.2.3 Department of Energy (DOE) Review and Approval (Task 2)

The feasibility study and preliminary design of the Alternative Fuel Production Facility study was funded by a grant from the DOE to the City of Huntsville. The scope of work to be performed included only segments 1 and 2 which has culminated in this final report on the findings. This final report, consisting of five (5) volumes, is to be reviewed by Argonne National Laboratories (ANL) which serves as a technical monitor to DOE. Approximately four (4) to six (6) weeks have been allocated for this effort.

10.2.4 City Authorizes Request for Bid (RFB) and Initiate PSDA Review (Task 3)

Approximately six (6) weeks are allowed in the Segment 3 work for City authorization of the preparation of a Request for Bid. This six-week period allows for receipt of comments from DOE and ANL and any necessary revisions to the Feasibility Study and Preliminary Design before final issuance of these documents.

This period will also be used to initiate the Prevention of Significant Deterioration Analysis (PSDA) Review Process. Meetings will be held with the State of Alabama Air Pollution Control Commission to establish detailed requirements and scope of work for the PSDA permit process. (For further discussion of PSD requirements see Volume V - Environmental Assessment and Permit Workbook).

10.2.5 Resolve Legal and Administrative Issues (Task 6)

These issues consist of evaluation and formation of a Solid Waste Authority and enactment of a Flow Control Ordinance for the waste stream. Legal and administrative issues can be resolved concurrently with the preparation of the RFB and should be resolved prior to advertising for RFB's. For further discussion see Volume II of the Feasibility Study Report, paragraphs 13 and 14.

10.2.6 Prepare RFB (Task 7)

The Request For Bid is a document designed to select a qualified Design-Construct-Operate (DCO) contractor to supply, construct and

operate the essential elements of the most cost-effective, best state-of-art, optimally configured Waste-to-Energy Plant, compatible with the energy market, redundancy and site specific requirements. The RFB document allows the bidder freedom to exercise expertise and proprietary skills under City surveillance and control, to assure appropriate technology, attention to engineering details, scope of systems supply, and quality of components, and to elicit substantive and adequate performance guarantees of systems and components supplied, all within the framework of an equitably structured, competitive bidding procedure.

The requirement that the DCO assume a 25% equity role in financing the project is intended to cushion City and bond holders against financial losses due to the project risks (completion, operation and/or others) that are inherent in implementing a MSW-to-energy project. Equity funds would include a tipping fee stabilization reserve fund. This reserve fund would be drawn upon in the early years of project operation to improve cash flow and avoid tipping fees in excess of what they may have been in the City had landfilling of solid waste been continued.

This period will also be used to further define and/or perform PSD permit requirements as established by the Alabama Air Pollution Control Commission.

Two months are allowed for the preparation of the Request for Bid (RFB). Much of the information developed in the Segment 2 Preliminary Design will be integrated into the RFB, generally in the Appendix section. The RFB will in addition include the following:

- (1) Preamble & Definition of Terms
- (2) Instruction to Bidders
- (3) Form of Bid
- (4) Service Contract
- (5) Form of Surety Bonds
- (6) General Conditions

- (7) Criteria for System Design and Construction
- (8) Financing Methodology
- (9) Procedural Matters

10.2.7 Prospective DCO's Prepare Bid (Task 8)

The project schedule allows DCO's three months for preparation of their bids.

10.2.8 Review Bids and Select DCO (Task 9)

The project schedule provides two months for review of bids and selection of a successful DCO.

10.2.9 City Authorizes Award to DCO & Finalizes Financing (Task 10)

The project schedule provides two months for City authorization of award to the DCO. This time will also be used to finalize the revenue bond issue. This process will complete Task 5. This allows time for completing the Official Statement for the bond issue(s). The Statement will be prepared jointly by the City, the Financial Advisor, bond counsel, and a third party engineering firm. The Official Statements will then be printed for circulation.

If the bond sales are negotiated, the City and the Financial Advisor will negotiate interest rates, underwriters discounts, call provisions, distribution of maturities, and other pertinent matters with the underwriting investment banks.

Presentations to the rating agencies will be made to secure investment grade ratings for the issues.

Immediately prior to sale, an investor relations program will be undertaken to create institutional interest in the bond issues.

The bond will be sold to the underwriting syndicate, and a closing paper will be signed.

It is intended that the revenue bond be settled and sold on the same day that the Notice to Proceed is issued to the DCO.

10.3 Segment 4 - Detailed Design and Construction.

10.3.1 Detailed Design, Procurement and Shop Drawings (Tasks 11 & 12)

Item 10, Detailed Design of Facilities is scheduled to be accomplished over a 12 month period through 1983. Item 12 Procurement and Shop Drawings can be initiated almost immediately upon Notice to Proceed in January, 1983 since the DCO will have selected major equipment suppliers and subcontractors in the course of preparing his bid in third quarter, 1982.

10.3.2 Construction (Tasks 13, 14, 15 & 16)

The project schedule Figure 10.1, details the major elements of construction as follows:

Task 13 - Preparation of Sites

Task 14 - Foundations

Item 15 - Buildings

Task 16 - Equipment Installation & Connection

Task 16 includes all required piping, wiring and connections for an operable installation. Construction is to be fast-tracked for completion in a 21-month time span.

10.3.3 Testing & Trial Operation (Task 17)

Following the construction, a 4-month period is allowed in the project schedule for Testing and Trial Operation, to bring all facilities into commercial operation by April, 1985.

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