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DOE/CS/20071-1 (Vol. 7, App. C)
(DE84006862)

Energy

CONSERVATION

DISTRICT HEATING AND COOLING SYSTEMS FOR COMMUNITIES
THROUGH POWER PLANT RETROFIT DISTRIBUTION NETWORK

Phase 2, Final Report for the Period March 1, 1980—January 31, 1984

January 31, 1984

Work Performed Under Contract No. AC02-78CS20071

Public Service Electric & Gas Company
Newark, New Jersey

Technical Information Center
Office of Scientific and Technical Information
United States Department of Energy

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DISTRICT HEATING AND COOLING SYSTEMS FOR
COMMUNITIES THROUGH POWER PLANT
RETROFIT DISTRIBUTION NETWORK
PHASE 2

FINAL REPORT
FOR THE PERIOD
1 MARCH 1980 - 31 JANUARY 1984

VOLUME VII
APPENDIX C

REPORT DATE: 31 JANUARY 1984

WORK PERFORMED UNDER CONTRACT
DE-AC022-78CS20071

PUBLIC SERVICE ELECTRIC & GAS COMPANY
80 PARK PLAZA
NEWARK, NEW JERSEY 07101

PREFACE

This volume contains:

- Hudson No. 2 Limited Retrofit Cost Estimates provided by
Stone & Webster Engineering Corp. (SWEC)
- Backup data and basis of estimate for SWEC Heater Plant and
Gas Turbine Plant (Kearny No. 12) cost estimates
- "Appendices - Analysis of Relevant Tax Laws" - Coopers &
Lybrand. (Overlaps somewhat with Vol. VI, Appendix B, but
contains additional data, as well.)

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Topics of other volumes of this report:

VOLUME I

Detailed Summary

VOLUME II

1. Introduction
2. Load & Service Area Assessment
3. Institutional Questions
4. Rates
5. Financial Considerations

VOLUME III

6. Technical Considerations

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VOLUME IV

7. Cost Estimates
8. Staged Development Scenarios
9. Economic Evaluation
10. Impact on Fuel and on the Environment
11. Alternates to Conventional Heating Systems
12. Conclusions
13. Recommendations

VOLUME V

Appendix A - Attachments to Section 2

VOLUME VI

Appendix B - Attachments to Section 6

ORIGINAL ESTIMATE

SUMMARY & BASIS OF ESTIMATE

EST./J.O. NO.

13222.02

PAGE

DATE 5/26/82

ELIENS**LOCATION**

10

12/28/82

SUMMARY

PSE & G

HUDSON #2

ACCOUNT NO.	DESCRIPTION	QUANTITIES	UNIT COST		MATERIAL	SUBCONTRACT	S/C LABOR	TOTAL	MAN-HOURS
			MATL.	MM/RATE					
	SUBSTRUCTURE			/	309000		323000	632000	11000
	SUPERSTRUCTURE			/	393000		257000	650000	7860
	MECHANICAL EQUIPMENT			/	1052000		165000	1217000	5070
	PIPING & VALVES			/	515000		503000	1018000	15450
	INSULATION			/	57000		86000	143000	2800
	MISCELLANEOUS MECHANICAL			/	28000		43000	71000	1320
	ELECTRICAL			/	299000		380000	679000	11830
	INSTRUMENTATION			/	73000		135000	208000	4430
	TOTAL DIRECT COST			/	2726000		1892000	4618000	59760
	HEADQUARTERS			/				646000	
	CONSTRUCTION MANAGEMENT + DISTRIBUTABLES			/				369000	
	SUBTOTAL			/				5633000	
H	CONTINGENCY			/				563000	
	TOTAL			/				6196000

Issue
No.J.O. No. 13222.02Page 1/3

Item _____

Client PSE & G Date Noted MAY 28 1982 J. ARDARYLocation HUDSON #2 Checked _____ By _____Subject LIMITED DISTRICT HEATING PLANT Revised _____ By _____

Basis of Estimate

Overview

This estimate was prepared using the previous (Oct. 1981) Hudson station district heating plant estimate as the basis and modifying it for the reduced scope of the limited facility. All material costs taken from the base estimate were updated for escalation to present day. All subcontract labor rates were brought to present day using Means 1982 craft rates. No allowance for escalation into the future was included as no construction schedule was furnished.

Civil / Structural

The estimates for the building & its foundation were priced using $\$/\text{FT}^2$ for the foundation and $\$/\text{FT}^3$ for the building. These units were taken from the base estimate and escalated. Adjustments were made to the base estimate prior to the calculation for omitting the T.G. pedestals.

Mechanical Equipment

The equipment costs were taken from the base estimate and adjusted for escalation (heaters, pumps & strainers). The water treatment system cost was supplied by engineering for a previous district heating study and adjusted for escalation. All labor was estimated.

Issue
No.J.O. No. 13222.0Page 2/3

Item _____

Client PSE & GDate Noted MAY 28 1982 J. ARDASLocation HUDSON #2

Checked _____ By _____

Subject LIMITED-DISTRICT HEATING PLANT

Revised _____ By _____

Basis of Estimate (contd).Piping & Valves

Piping layout drawings were furnished by engineering. A complete takeoff made and material was priced using current unit prices and applicable discounts (GUYON).

Valve prices were taken from the base estimate and escalated to present day.

Piping labor manhours were taken from the piping manhour manual.

Insulation

Insulation prices were obtained from a NY/NJ area contractor (KEASBY Co.) and are reflective of current material and labor prices.

Electrical & Insulation

Electrical & instrumentation allowance were made using the same relationship to Total Direct Cost as was developed in the base estimate.

Headquarters Office

Engineering & Design & support service were allowed for by calculating 14% of Total Direct Cost.

Construction Mgmt & Distributables

Const. mgmt & distrib. were estd. as 8% of Total Direct Cost.

Issue
No.J.O. No. 13222.02Page 3/3Item
By MAY 28 1982 J. ARDARYClient PSE & G Date NotedLocation HUDSON #2 Checked _____ By _____Subject LIMITED DISTRICT HEATING PLANT Revised _____ By _____Basis of Estimate (Cont'd.)Contingency

A 10% contingency was added to cover undefined items, design changes, etc.

LIST OF OMISSIONS

- 1- Clearing, grubbing & stripping of topsoil from building site.
2. Dewatering
3. Demolition or relocation of existing facilities
4. Exterior lighting (street)
- 5- Oil breakers or other equipment which may be required in the switchyard.
- 6- Loss of productivity due to security in an existing plant
- 7- Client costs.

SUMMARY

ALTERNATES 1 & 2

CALCULATION SHEET

Item _____

Client	Location	Est. No.	J.O. No.
Subject		Date	By
PRICE S		Checked	By
Based on		Revised	By

DISTR SERV TRANSF

26 - 4.16 KV

2000 KVA OA/FUT FA

SEE PRICE LIST GE SEC. 5532

GO-150A = DISC MULT = 2.6

BASE PRICE \$ 12,620

H.V. RATING 26KV 1% 126

PRESS RELIEF DEVICE 120

LIQUID FIL DISC SW 5120

LTNG ARR CINTERM 685

FAULT PRESS RELAY 391

REC. CONT CBT REL 320

TESTS: TEMP 1000

IMPULS TEST 1000

GROUND LEVEL 133

INSUL PWR FACTOR 133

TOTAL \$ 22,652

X MULT 2.6

TOTAL PRICE \$ 58,900.00

ACCOUNT NO.	DESCRIPTION	QUANTITIES	UNIT COST		MATERIAL	SUBCONTRACT	S/C LABOR	TOTAL	MAN-HOURS
			MATL.	MB/RATE					
				/					
	SUBSTRUCTURE			/	309000		323000	632000	11,000
	SUPERSTRUCTURE			/	393000		257000	650000	7,860
	MECHANICAL EQUIPMENT			/	1122000		170000	1292000	5,220
	PIPING & VALVES			/	696000		561000	1257000	17,250
	INSULATION			/	63000		97000	160000	3,170
	MISCELLAN. MECHANICAL			/	28000		43000	71000	1,320
	ELECTRICAL			/	507000		320000	827000	9,960
	INSTRUMENTATION			/	73000		135000	208000	4,440
	TOTAL DIRECT COST			/	3191000		1906000	5097000	60,220
	HEADQUARTERS			/				713000	
	CONSTRUCT. MGMT & DISTRIB.			/				407000	
	SUBTOTAL			/				6217000	
	CONTINGENCY			/				228000	
	TOTAL			/				6445000	

EST./J.O. NO.

13222.02

ALTERNATE II

TYPE OF UNIT DISTRICT HEATING

PAGE

of

DATE 6/21/82

CLIENT

• PSE d G

LOCATION

HUDSON #2

By

DATE Rvw'd

SUMMARY

ACCOUNT NO.	DESCRIPTION	QUANTITIES	UNIT COST		MATERIAL	SUBCONTRACT	S/C LABOR	TOTAL	MAN-HOURS
			MATL.	MH/RATE					
	SUBSTRUCTURE			/	179000		226000	105000	7,700
	SUPERSTRUCTURE			/	290000		127000	417000	3,900
	MECHANICAL EQUIPMENT			/	1122000		170000	1292000	5,220
	Piping & VALVES			/	696000		561000	1257000	17,250
	INSULATION			/	63000		97000	160000	3,170
	MISCELLAN. MECHANICAL			/	-		-	-	-
	ELECTRICAL			/	507000		320000	827000	9,960
	INSTRUMENTATION			/	73000		135000	208000	4,440
	TOTAL DIRECT COST			/	2930000		1636000	4566000	51,640
	HEADQUARTERS			/				230000	
	CONSTRUCT. MGMT & DISTRIB.			/				365000	
	SUBTOTAL			/				5370000	
	CONTINGENCY			/				657000	
00	TOTAL			/				6027000	

DETAIL

ALTERNATES 1 & 2

ONE & WEBSTER ENGINEERING CORPORATION				TYPE OF BID		EST./J.O. NO.			
SUBSTRUCTURE				TYPE OF UNIT		PAGE			
				DISTRICT HEATING LIMITED RETROFIT SCHEME		OF			
				CLIENT		DATE			
				PSE #G		5/21/82			
				LOCATION		BY			
				HUDSON #2		JAA			
COUNT NO.	DESCRIPTION	QUANTITIES	UNIT COST		MATERIAL	SUBCONTRACT	LABOR	TOTAL	MAN-HOURS
			MATL.	MH/RATE					
	TUNNEL (SAME AS BEFORE)				165800				7684
	BUILDING (SEE CALC.)	PELETE (ALT. 2)			120000				3316
	SUBTOTAL				285800				11000
	ESCALATE TO MID '82	{			22900				
	Material x .08				13200				
	TOTAL			2932	308700		322500	631200	11000
	6/18/82 REVISED (ALT. 2)				179000		226000	405000	87,700
	(ALT. 1)				309000		323000	632000	11,000

Issue
No.

J.O. No. 13222.02

Page

Item

Client PSE & G Date Noted MAY 21 1982 J. ARDARY
Location Hudson #2 Checked _____ By _____
Subject Building Substructure Revised _____ By _____

Ref. R. Sharon est dtd. 8/81

Building area - 31,241 $\square$

New Building 71' x 167' = 11,857 $\square$

$$\frac{11857 \square}{31241 \square} = .3795 \text{ use } .38$$

R. Sharon estimate -

MATL	LABOR MH.
\$272,200	7539 MH.

x .38

\$103,400 2865 MH.

VOID

Rev. increase bldg / Geo. Kan 5/26/82

Add 36' x 52' extn to house water treatment equip.

11857 $\square$

1872 $\square$

$$13729 \square \div 31241 \square = .44 \times \$272,200 = \$120,000 \text{ MATL}$$

$$.44 \times 7539 \text{ MH} = 3317 \text{ MH.}$$

COUNT NO.	DESCRIPTION	QUANTITIES	UNIT COST		MATERIAL	SUBCONTRACT	LABOR	TOTAL	MAN-HOURS
			MATL.	MH/RATE					
	BUILDING (SEE CALC.)				364300-				7857
	ESCAL. TO MID '82	}			29100-				-
	Material x 108								
	TOTAL			3263	393400-		256300	649700	7857
L.T.Z.	BUTLER TYPE BLDG W/SLAB ON GROUND				290000		1127000	4170000	3,900
	ALTERNATE 1 - NO CHANGE								?
ST

J.O. No. 13222.02

Page _____

Item _____

Client PSE & G Date Noted MAY 21 1982 J. ARDARYLocation HUDSON #2 Checked _____ By _____Subject Building Superstructure Revised _____ By _____

Ref. R. Sharon est. dtd. 8/81.

Building Volume = $1,713,826 \text{ FT}^3$ New Building - $71' \times 167' \times 32'$ High
(no second level / G. KAN.) $= 379,424 \text{ FT}^3$
$$\frac{379,424 \text{ FT}^3}{1,713,826 \text{ FT}^3} = .2214 \text{ use } .25$$
$$8/81 \text{ Est.} = \begin{array}{r} \text{M} \\ \$1,448,200 \end{array} \quad \begin{array}{r} \text{MH} \\ 33,630 \end{array}$$
$$\times .25 \longrightarrow$$
$$\begin{array}{r} \$362,100 \quad 8408 \text{ MH.} \end{array}$$
VOIDRev. Increase Bldg to enclose water treating equipment. Addition = $36' \times 52' \times 32'$ High
$$\begin{array}{r} 59904 \text{ FT}^3 \\ 379,424 \text{ FT}^3 \\ \hline 439,328 \text{ FT}^3 \div 1,713,826 \text{ FT}^3 = .256 \text{ use } .26 \end{array}$$
$$\begin{array}{r} \text{MATERIAL} \\ \$1,401,200 \\ \times .26 \\ \hline \$364,300 \end{array} \quad \begin{array}{r} \text{MHRS} \\ 30219 \\ \times .26 \\ \hline 7857 \end{array}$$

BUTLER TYPE BUILDING

APPROXIMATE SIZE REQ'D. 75'W X 100'L X 30'H

STEEL FRAME, CORRUGATED & INSULATED SIDING, SLOPE
ROOF, LIGHTING, HEATING, VENTILATION REQUIRED.
THREE ROLL-UP DOORS FOR ACCESS TO EXCHANGER
TUBE BUNDLES. STRUCTURAL SLAB AT GRADE SUPPORTED
BY PILES. EXCHANGERS REQUIRE STRUCTURAL STEEL
FRAME AROUND EQUIPMENT FOR PIPE SUPPORTS. ASSUME
STEEL FRAME OUTER DIMENSIONS TO BE 60' X 50' X 15'.

BLDG - ALLOW *35/SF ; 75 X 100 X 35 = *263,000
ALLOW *275,000 TOTAL

	MATERIAL	MH.
BLDG.	*200,000	2,500

FLING. - PER 8/21/81 EST.

$\frac{75 \times 100}{142 \text{ SF./PILE}} = 55 \text{ PILES}$

55 X 70 LF EACH. = 3,850 LF *
 $3,850 \times 13.10 \times 1.08 = 55,000$
 $3,850 \times .123 = 475$

PIPE SUPPORT STEEL

$60 \times 50 \times 15 \times 1.5 \text{ */CF} = 68,000 \text{ *}$

34 TONS @ 900 X 1.08 = *33,000

34 TNS @ 25 MH/TN. = 850

ROLL-UP DOORS 3 @ 12' X 12' EACH.

3 @ 17 MH. EACH *

3 @ *670 = 2,010

50

SUBTOTAL

290,010

3,875

ROUND TO

*290,000

3,900

ONE & WEBSTER ENGINEERING CORPORATION

TYPE OF BID	_____
--------------------	-------

EST./J.O. NO.

13222.02

TYPE OF UNIT DISTRICT HEATING
LIMITED RETROFIT SCHEME

PAGE **OF**

DATE
5/19/82

CLIENT
PSE & G

LOCATION HUDSON #2

101

[illegible]

Issue
No.J.O. No. 13222.02

Page _____

Item _____

Client PSE & G Date Noted MAY 19 1982 J. ARDARYLocation Hudson #2 Dist. Htg. Checked _____ By _____Subject Equipment Installation Revised _____ By _____Heaters - use same as 8/81 estimate

	<u>WT</u>	<u>MH</u>
3A. 4'-2" ϕ x 40' L.	- 13 TN.	50 MH.
4A. 4'-4" ϕ x 52' L.	- 18 TN.	65 MH.
DRAIN COOLER. 5'-4" ϕ x 50' L.	- 30 TN.	100 MH.

Pumps

2300 GPM, 450 TDH w/ 350 HP motors

Manual - $158 + 88 = 246$ use 250 MH/EA.Strainers

Allow - 50 MH. per strainer

Issue
No.J.O. No. 13222

Page _____

Item _____

Client PSE & G Date Noted MAY 19 1982 I.A.Location Hudson #2 Checked _____ By _____Subject Equip Pricing Revised _____ By _____District Heating Water Pumps -

2300 GPM, 450 TDH w/ 350 HP Motor.

use Horiz. Centrif. Type TC pumps -
use 6 x 13 TC pump

Base price = 7135 (10/78)

Escalation (5%) = 3565
10700Add motor - TECC = 25500 (3/81)
(4160 V, 1200 RPM)Escalation (10%) = 2500
28000

Total = \$38,700 say \$40,000

Geo. Kan supplied interpolated price of
\$50,000 based on vendor prices =use \$50,000 ea. + escal
= \$54,000 ea.* Strainers - use price from Geo. Kan\$13,000 ea. + escal.
= \$14,000 ea.

* INCREASE SIZE OF STRAINERS FROM 12" TO 20"

ALLOW \$22,000 EACH

ALLOW 75 MANHOUSES EACH

Issue
No.J.O. No. 13222.02

Page _____

Item _____

Client PSE & G Date Noted MAY 27 1982 J. ARDARYLocation HUDSON #2 Checked _____ By _____Subject LIMITED RETROFIT - Revised _____ By _____WATER TREATMENT PLANT

include a 100 GPM water treatment plant
per Geo Kan 5/26/82

Original Hudson #2 water treating plant
was 800 GPM $\left(\frac{100 \text{ GPM}}{800 \text{ GPM}} \right)^{.6} = 0.287$

	MATL \$	MHRS
800 GPM PLANT =	1082,300	10,987 MH

	$\times .287$	$\rightarrow$
ESTD. 100 GPM -	310,600	3153 MH ($\times 32^{SS} = 102,600$)

NOTE: Boston supplied quotes for a 100 GPM
Water treatment plant for the Fried
Water plant study done in Dec. 1981

Matl \$ = \$330,000
Labor \$ = \$119,000

Use Boston Supplied Matl & Labor \$

Matl = \$330,000 $\times 1.08$ ESCAL = \$356,400

Labor = \$119,000 $\times 1.08$ = 39,50 MH
32 SS

Issue
No.J.O. No. 13222.02

Page _____

Item _____

Client PSE & GDate Noted MAY 19 1982 J. ARDARYLocation HUDSON #2 DIST HTG.

Checked _____ By _____

Subject ESCALATION

Revised _____ By _____

Equipment & Valve prices furnished by
Engineering are from July/August 1981

Escalate to 6/82

use PPI-1013 & SIC 34 for escalation
(STL. MILL PRODUCTS) (FAB. MFL. PRODUCTS)

Say M/I split = 50/50

PPI 1013 - MID '81 = 337.6
MID '82 = 363 (projected) = 7.5 % increa.

SIC 34 - MID '81 = 8.20
MID '82 = 8.86 (projected) = 8.0 % increa.

Average increase = 7.8 %

use 8.0 %

PUMPS

WERE.

3 EACH

2300 GPM
450' DIFF. HD.
350 HP MOTOR
\$54,000 EACH

NOTED JUN 17 1982 R. HICKY

REVISED TO.

3 EACH

3500 GPM
450' DIFF. HD.
500 HP MOTOR.

1982 - 1983

RICHARDSON'S - SECTION 100-284 PAGE 3 SHOWS

1100 GPM 500' ΔH 200 HP REQ'D \$10,485
(CENTRIFUGAL, TWO STAGE, HORIZONTAL SPLIT CASE)
SCALE UP

$$\left(\frac{3500}{1100}\right)^{.6} = 2.00$$

$$2.00 (\cancel{10,485}) = \cancel{*} 20,970 \text{ EACH}$$

MECHAN. SEAL 950 "

WITNESS PERFORM. TEST 680 "

300 HP. ELECT. MOTOR 27,000 " (ALLOW)

SUBTOTAL 49,600

FREIGHT 4% 2,400

TOTAL (EACH) 52,000

$$\cancel{*} 36,000 \times 3 = \cancel{*} 108,000$$

$$\left(\frac{3500}{2300}\right)^{.6} \times \cancel{*} 54,000 \times 3 = \cancel{*} 208,000 \text{ TOTAL.}$$

LABOR MANHOURS.

$$\text{LABOR FOR EACH} = 255 + 22(\text{HP} - 400) = 275 \text{ EACH}$$

$$275 \times 3 = 825 \text{ MH.}$$

ONE & WEBSTER ENGINEERING CORPORATION

TYPE OF BID

EST./J.O. NO.

13222.02

TYPE OF UNIT DISTRICT HEATING
LIMITED RETROFIT SCHEME

PAGE

OF

DATE

5/20/82

CLIENT
PSE #GLOCATION
HUDSON #2

BY

JAA

PIPING

COUNT NO.	DESCRIPTION	QUANTITIES	UNIT COST		MATERIAL	SUBCONTRACT	LABOR	TOTAL	MAN-HOURS
			MATL.	MI/RATE					
	Pipe, Carbon Steel, A-106 GR. B Std. wall Seamless.								
1177	16" L.S. 7' 5"	240'	55.40	2.5	13300				600
1176	14" 7' 0"	160'	51.90	2.25	8300				360
	12" 6' 11" 123 (1850')	44.60	2.0	82500	54860			2460	3700
	10" 5' 5"	960'	38.20	1.75	36670				1680
	8" 3' 4"	1990'	25.70	1.50	51140				2985
11	6" 2' 6"	530'	19.60	1.00	10390				530
	20" 9' 4" - 46%	620	69.30	2.75	42770				1,705
14	90° L.R. EUS, STD, 16"	13	307	-	3990				W/PIPE
39	14"	14	220	-	3080				
10	12"	39.67	155	-	40380	6050			
217	10"	23	110	-	2530				
2030	8"	62	60	-	3720				
550	6"	21	33	-	690				
	109A-50% 20"	28	547	-	15320				
54	45° EUS, STD, 16"	1	177	-	180				
7920	12"	5.44	90	-	490	450			
7640	8"	1	38	-	40				
20	633-50% 20"	6	317	-	1900				
	TEES, STD, 12"	0.4	220	-	220				
	2045-50% 20"	1	1000	-	1000				
	TOTAL				228130				9855

10320

ONE & WEBSTER ENGINEERING CORPORATION

TYPE OF BID

EST./J.O. NO.

13222.02

TYPE OF UNIT DISTRICT HEATING
LIMITED RETROFIT SCHEME

PAGE

OF

DATE

5/20/82

CLIENT
PSE & GLOCATION
HUDSON #2

BY

JSA

PIPING

COUNT NO.	DESCRIPTION	QUANTITIES	UNIT COST		MATERIAL	SUBCONTRACT	LABOR	TOTAL	MAN-HOURS
			MATL.	MI/RATE					
	BROUGHT FORWARD				228130				9855
ST X.S					256580				10,320
34	RED. TEES, STD. - 16" x 16" x 10"	2	442		880				w/PIPE
87	CONC. REDUCERS - 16" x 12"	2	144		290				
157	(STD) 14" x 12"	2	130		260				
257	L 14" x 10"	2	130		260				
152	12" x 8"	2	76		150				
79	WELDOLETS - 16" (OLET WELD CUT)	2	820	36	1640				72
5%									
	FLANGES, W.N., C.S., STD.								w/PIPE
517	150# - 16"	8	260		2080				
82	14"	8	200		1600				
15	10"	10	93		930				
1320	8"	20	47		940				
1720	6"	10	29		290				
89	300# - 12"	0 AC	245		1120				
171	8"	4	85		340				
	1497 - 57% 20"	46	650		29900				
20	SUBTOTAL				249060	296,140		10,392	9927
40	ALLOW 45%				112,080	133,260			

ONE & WEBSTER ENGINEERING CORPORATION

TYPE OF BID

EST./J.O. NO.

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TYPE OF UNIT DISTRICT HEATING
LIMITED RETROFIT SCHEMEPAGE
OFDATE
5/20/82CLIENT
PSE #GLOCATION
HUDSON #2BY
JAA

PIPING

COUNT NO.	DESCRIPTION	QUANTITIES	UNIT COST		MATERIAL	SUBCONTRACT	LABOR	TOTAL	MAN-HOURS
			MATL.	MI/RATE					
	BROUGHT FORWARD				361140				9927
					429400				10,392
	FIELD WELDS, STD WALL								
	C.S. 16"	12	-	12					144
	14"	8	-	11					88
	12"	62.93	-	10				620	930
	10"	48	-	10					480
	8"	100	-	9					900
	6"	27	-	7					189
	20"	31	-	15					465
	BOLT UPS, 16"	8	50	3.25	400				26
	14"	8	40	3.0	320				24
	12"	0.46	30	2.5	1380				115
	10"	10	25	2.0	250				20
	8"	24	15	1.5	360				36
	6"	10	10	1.25	100				13
	20"	46	70	4.0	3220				184
	SUBTOTAL				363950	434,050		13,581	12812
TO CO	HANGERS & SUPPORTS	10%			36400	43,400		1,353	1281
					110000	177,450		14,940	14181

ONE & WEBSTER ENGINEERING CORPORATION

TYPE OF BID

EST./J.O. NO.

13222.02

TYPE OF UNIT DISTRICT HEATING
LIMITED RETROFIT SCHEME

PAGE OF

DATE
5/21/82CLIENT
PSE #GLOCATION
HUDSON #2BY
JAA

PIPING

COUNT NO.	DESCRIPTION	QUANTITIES	UNIT COST		MATERIAL	SUBCONTRACT	LABOR	TOTAL	MAN-HOURS
			MATL.	MH/RATE					
	BROUGHT FORWARD				400350	477,450		149,150	14187
	MISC. ERECTION MAT'L. + 5%				20050	73,850		750	-
	TOTAL PIPE & FITTINGS				420400	501,300		156,900	14187
	VALVES (SEE BREAKDOWN SHEET ATTACHED)				95000	194,400		1553	1268
	TOTAL PIPE, FITTINGS & VALVES			32 ⁵³	515400		562600	1618400	15447
	SUB TOTAL				695700				17,243
	ROUND - OFF				696000				17,250
	TOTAL (ALTERNATES 1 & 2)				696000		561000	1257000	17,250

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ONE & WEBSTER ENGINEERING CORPORATION						TYPE OF BID .		EST./J.O. NO.	
						TYPE OF UNIT		PAGE OF	
						DISTRICT HEATING LIMITED RETROFIT SCHEME		DATE	
						CLIENT		LOCATION	
						PSE #G		HUDSON #2	
VALVES								BY JAA	
COUNT NO.	DESCRIPTION	QUANTITIES	UNIT COST		MATERIAL	SUBCONTRACT	LABOR	TOTAL	MAN-HOURS
			MATL.	NH/RATE					
	150# CARBON STEEL VALVES			/					
	16" NON RETURN	2	10000	72	20000				144
	16" M.D. GATE	2	12000	54	24000				108
	14" A.O. BUTTERFLY	2	3800	50	7600				100
	10" BUTTERFLY	2	2200	24	4400				48
	10" A.O. BUTTERFLY	2	2800	36	5600				72
	8" A.O. "	2	2100	32	4200				64
	8" BUTTERFLY	5	1500	21	7500				105
	6" "	2	1100	18	2200				36
	6" A.O. BUTTERFLY	2	1300	27	2600				54
	300# CARBON STL. VALVES			/					
	12" BUTTERFLY	0 12	3700	33	7400				9-396
	12" CHECK	0 3	3200	33	9600				99
	8" BUTTERFLY	2	2500	21	5000				42
	20" BUTTERFLY	12	7,000	52	84000				624
	20" CHECK	3	10,600	52	31800				156
	TOTAL VALVES.			/	95600				1268
				/	194400				1,553
25				/					
				/					
				/					

Noted MAY 13 1932
 Dwg. No. 13222.01-EP.1A-1 DTD. 1

NOTE: IF ELEVATIONS WERE NOT IDENTIFIED, 5 LF OF PIPE WAS ALLOWED FOR EA CHANGE.

26

Project Hudson Sta. District Htg. Date 1/
 Company PSE & G By JFA
 System Piping Summary Fig. No.

PIPE SIZE		16"	14"	12"	10"
Spec. - - - - -	PIPE	240	160	823 86 319 <u>620</u> DEDUCT 1848	780 180 <u>960</u>
Size.					
Flanges					
Spec. - - - - -					
Flanges					
Valves		240	160	1230 <u>1350</u>	
90 ELLS - L.R.		13	14	20.6.13.28 <u>67</u> <u>39</u>	19.4. <u>2</u>
90 ELLS - S.R.					
45 ELLS		13		5.6 <u>11</u> <u>5</u>	
TEES				<u>1</u> - 0 -	
RED - TEES		16x10-2 <u>2</u>			
CONC. REDUCER		16x12-2 <u>2</u>	14x12- <u>2</u> 14x10- <u>2</u>	12x8- <u>2</u>	
ECC. REDUCER					
CAPS					
WELDOLETS ETC.		16" outlet <u>2</u>			
WELD NECK FLGS.		150# <u>8</u>	150# <u>8</u>	300# <u>46</u> - 0 -	150# - 4.6
SLIP-ON FLGS.					
NON RETURN VALVES		150# <u>2</u>			
VALVES - GATE		150# <u>2 M.O.Y</u>			
BUTTERFLY VALVES		150#		<u>12</u> - 0 -	<u>2</u>
VALVES - CHECK		150#		<u>2</u> - 0 -	
VALVES - M.O.		150#			
BUTTERFLY A.O. VALVES		150#	<u>2</u>		<u>2</u>
NOZZLE WELDS (SHOP)		2 TAPS			
STRAINERS				<u>3</u> - 0 -	
ALLOW 1 EVERY 20 LF BUTT WELDS (FIELD)		<u>12</u>	<u>8</u>	<u>93</u> 62	<u>48</u>
BOLT-UPS (1 BOLT PER FLANGE)		<u>8</u>	<u>8</u>	<u>46</u> - 0 -	<u>10</u>

ALTERNATE I CHANGES MADE AND REVISED QUANTITIES ARE NOTED IN RED.

ONE & WEBSTER ENGINEERING CORPORATION

TYPE OF BID

EST./J.O. NO.

ALTERNATES 1 & 2

TYPE OF UNIT DISTRICT HEATING
LIMITED RETROFIT SCHEMEPAGE
OFDATE
5/21/82

INSULATION

CLIENT
PSE & GLOCATION
HUDSON #2BY
JAA

COUNT NO.	DESCRIPTION	QUANTITIES	UNIT COST		MATERIAL	SUBCONTRACT	LABOR	TOTAL	MAN-HOURS
			MATL.	MM/RATE					
	Piping Insulation								
	Calcium Silicate 7/								
	.016 Aluminum jacket								
	16" - 1 1/2" tk.	240	8.00	.4	1920				96
	14" - 1 1/2" tk.	160	7.20	.36	1152				58
	12" - 1 1/2" tk. 1230	1850	6.40	.32	11840	7870		394	542
	10" - 1 1/2" tk.	960	5.60	.28	5376				269
	8" - 1 1/2" tk.	1990	4.80	.24	9552				478
	6" - 1" tk.	530	3.60	.18	1908				95
	20" - 2" TK.	620	13.00	.65	8060				403
	Fittings - 16"	20	8.00	4.0	1600				80
	14"	18	6.00	3.0	1080				54
	12" 46	81	5.00	2.5	4050	2300		115	203
	10"	23	4.00	2.0	920				46
	8"	63	3.00	1.5	1890				95
	6"	21	1.60	.8	336				17
	20"	35	11.00	7.0	3850				245
	Valves -	36	12.00	5	4320				180
	Header 3A - 4" TK.	763	5.60	.28	4270				213
	4A - 4" TK.	550	5.60	.28	3080				154
28	Drain Cooler - 2" TK.	864	4.00	.20	3456				173
	USE - ROUNDED OFF				63000		97000	160000	3170
					11750		85910	147660	2803

Issue
No.J.O. No. 13222.02

Page _____

Noted MAY 21 1982 J. MOODYClient PSE & G

Date _____

By _____

Location Hudson #2

Checked _____

By _____

Subject Insulation

Revised _____

By _____

"Budget" prices for insulation from
KEASBY Co. for northern New Jersey
area -

Piping insulation - Calcium Silicate w/
.016" O.K. aluminum jacket.

O.D.	TR.	#/LF M & I	#/FITTING	#/VALVE
16"	1 1/2"	\$20 (8 ⁰⁰ /12 ⁰⁰)	200 (80/120)	AVERAGE
14"		\$18 (7 ⁵⁰ /10 ⁰⁰)	150 (60/90)	\$300/EA.
12"		\$16 (6 ⁵⁰ /9 ⁰⁰)	125 (50/75)	(120/180)
10"		\$14 (5 ⁵⁰ /8 ⁰⁰)	100 (40/60)	
8"		\$12 (4 ⁵⁰ /7 ⁰⁰)	75 (30/45)	
6"	1"	\$9 (3 ⁵⁰ /5 ⁰⁰)	40 (16/24)	

Equipment insulation - 4" thick (2 layers of 2" ea)
Calcium silicate
\$14⁰⁰ / lb (5⁵⁰/8⁰⁰)

For 2" thick use \$10/lb (4⁰⁰/6⁰⁰)

Split M & I prices 40% materials
60% labor.

use \$30 labor rate as per G. Co.
(\$30 rate was recommended by PSE & G)

[illegible]

30

J.O. No. 13222.02

Page _____

Item _____

Client PSE & G Date Noted MAY 25 1982 J. ARDAYLocation HUDSON #2 Checked _____ By _____Subject MISC. MECHANICAL - Revised _____ By _____

Use same allowances as were included in the 8/81 estimate - Floor plan = 11,857 sq

Plumbing - (roof & floor drains, sanitary)

Means \$/SF for factories - 1982 edition
Median = \$1.44/SF, high = \$2.11/SF use #2:

Assume Split of 40 Matl / 60 labor
Matl Labor
\$.80/SF \$1.20/SF

Mech. Contractor s/c rate

= 32.53

\$1.20
32.53 = .03689 MH/SF

use .037 MH/SF.

Sprinkler System (Fire Protection) - Richardson
1982

Wet pipe system - up to 5000 sq = 1.35/sq
over 5000 sq = 1.15/sq

use \$1.35/sq SPLIT 50 M / 50 L

MATL

\$1.68/sq

LABOR

\$1.68/sq

x 1.73

\$1.18/sq

use \$1.70/sq

(RICHARDSONS RATE = 18.55

S&W ESTD RATE = 32.53

32.53
18.55 = 1.73

\$1.18
32.53 = .036 MH/sq

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Issue
No.J.O. No. 13222.02

Page _____

Item _____

Client PSE & G Date _____ Noted By MAY 26 1982 I.A.B.Location Hudson #2 Checked _____ By _____Subject Misc Mechanical Revised _____ By _____

HVAC - use same approach as was estimated
for Hudson #2 in 1981
Mostly heating req'd.

Means 1982 = median value \$/h for
heating & ventilating = 1.00/h high is
\$1.95/h use \$1.25/h Split 40% matl.
60% labor.

Matl = \$.50/h

Labor = $\frac{.75}{32.53} = .023$ MH/h

ONE & WEBSTER ENGINEERING CORPORATION

TYPE OF BID	
-------------	--

EST./J.O. NO.

13222.02

TYPE OF UNIT	DISTRICT HEATING LIMITED RETROFIT SCHEME
--------------	---

PAGE **OF**

DATE 5/26/82

CLIENT
PSE #G

LOCATION
HUDSON #2

By

ELECTRICAL

[illegible]

EST./J.O. NO.

13222.02

PAGE **OF**

DATE 5/26/82

LOCATION
HUDSON #2

BY gda

INSTRUMENTATION

[illegible]

Issue
No.J.O. No. 13222.02

Page _____

Item _____

Client PSE & G Date Noted MAY 26 1982 J. ARDARYLocation HUDSON #2 Checked _____ By _____Subject ALLOWANCES FOR ELECTRICAL Revised _____ By _____AND INSTRUMENTATION

Reference Summary Sht. dtd. 10/5/81 from Hudson #2 estimate

	<u>MATL \$</u>	<u>MANHOURES</u>
ELECTRICAL	- 2,708,000	53,160
INSTRUMENTS	- 663,000	19,890
TOTAL DIRECTS	- 24,630,000	268,300
	(2,708,000)	(53,160)
	(663,000)	(19,890)
SUBTOTAL w/o } #	21,259,000	195,250 MH.
ELECT & INSTR.		

$$\text{ELECT} - \frac{2,708,000}{21,259,000} = .127 \quad \frac{53,160}{195,250} = .272$$

$$\text{INSTR} - \frac{663,000}{21,259,000} = .031 \quad \frac{19,890}{195,250} = .102$$

	<u>MATL \$</u>	<u>MHRS</u>
SUBTOTAL THIS ESTIMATE } #	2,353,800	43,492
EXCLUDING ELECT & INSTR.		

			<u>RATE</u>
ELECTRICAL (M = .127 L = .272)	\$	298,900	11,830 32 ¹⁵ / ₁₀₀

INSTRUMENTATION (M = .031 L = .102)	\$	73,000	4436 30 ⁵⁰ / ₁₀₀
--	----	--------	--

	\$	2,725,700	59,758
--	----	-----------	--------

ELECTRICAL

NOTED JUN 18 1982 R. HICKET

FROM R.A.S. ESTIMATE OF 8/21/81

ELECTRICAL EQUIPMENT = 2,181,000

TOTAL ELECTRICAL MAT'L. = 2,707,000

TOTAL ELECTRICAL MANHOURS = 53,150

CURRENT ELECT. EQUIP. ESTIMATE FROM I. MOKRIWSKYJ
= \$408,700

$$\frac{2,707,000}{2,181,000} \times \$408,700 = \$507,300$$

$$\frac{53,150}{2,707,000} \times \$507,300 = 9,960 \text{ MH.}$$

$$9960 \text{ MH} \times \$32.15 = \$320,200$$

USE FOLLOWING AMOUNTS

MATERIAL	\$507,000
S/C LABOR	320,000
TOTAL	827,000
S/C MANHOURS	9,960

FOR INFORMATION ONLY

ONE & WEBSTER ENGINEERING CORPORATION
 (INCESS INDUSTRIES GROUP)

TYPE OF BID

EST./J.O. NO.

13222.01

TYPE OF UNIT

DISTR. HTG. WATER HTG. PLANT

PAGE

DATE

1 OF 11

8-21-81

CLIENT

LOCATION

PSEE & CO

HUDSON UNIT #2

BY

WJMM

ELECTRICAL SUMMARY

COUNT NO.	DESCRIPTION	QUANTITIES	UNIT COST		MATERIAL	SUBCONTRACT	LABOR	TOTAL	MAN-HOURS
			MATL.	MI/RATE					
	MAJOR ELEC EQUIPT				2181000				17650
	MAIN XFR FEEDERS				61150				2215
	STA. PWR XFR FEEDERS				35200				1830
	SWGR/LD/CNTR/MCC FEEDERS				93550				2250
	460V MOTOR FEEDERS				23450				2110
	480V MOTOR FEEDERS				87210				14860
	LIGHTING				141550				1375
	GROUNDING				75000				2000
	SUB-TOTAL ELECTRICAL				2698600				52370
	CIVIL - XFR PLATFORMS				8700				780
	TOTAL - ELECTRICAL			26.59 510	2707300	1413300		4120600	53150
	USE				2707000	1413000		4120000	53150
23	DOES NOT INCLUDE ANY PRODUCTIVITY FACTOR								

ESTIMATE

REV. 6/17/82

CLIENT PSE & G	STATION HUDSON # 2	ESTIMATE NO.	JO. NO. 13222.01	SHEET NO. 1 of 2
DESCRIPTION OF WORK PRICES FOR MAJOR ELEC EQUIP.		QUANTITIES BY I. M.	CHECKED BY	PRICES BY I. M.
		DATE 7/30/81	APPROVED	

ACCOUNT NO	DESCRIPTION	QUANTITIES	UNIT COST		MATERIAL	LABOR	TOTAL	MAN-HR
			MAT'L	MIN/RATE				
	MAIN TRANSF	0.1	220,000		220,000			
	26-13.8 KV							
	24/32/40 MVA							
	OA/FA/FOA							
	MAIN TRANSF	0.1	200,000		200,000			
	26-10.8 KV.							
	20/26.7/33.33 MVA							
	OA/FA/FOA							
	STA 2WR TRANSF	1	58,900		58,900 ✓			
	10/12.5 MVA 2000 KVA	2	121,000		200,000			
	26/3.8-4.16 KV							
	OA/FA/FOA							
	13.8 KV SWGR	2.0	327,120		654,240			
	4.16 KV SWGR	2	95,000		171,000 ✓			
			214,776		429,552			
	480V LOAD CENTER (DOUBLE ENDED)	1	122,000		122,000 ✓			
			89,970		89,970			
	1 TRANSFORMER SWGR				108,285			

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STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

Preliminary

Item

Client **PSES G** Location **HUDSON** Est. No. J.O. No.

Subject **ONE LINE** Date **6/17/62** By **L.F.**

Checked By

Based on Revised By

TO 26 KV MARION
 SWITCH STA

SEE MCL FRONT VIEW FOR TYP. MCL

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

Page No. 1
 Preliminary
 Item 13222-E-

1 Client PSE & G/DOE Location HUDSON #2 Est. No. J.O. No. 13222.C
 2 Subject LOAD ANALYSIS Date 6/16/82 By IM
 3 Checked _____ By _____
 4 Based on _____ Revised _____ By _____

4KV LOADS

	CONNECTED LOAD KVA	OPERATING LOAD KVA
(3) DISTR HTG WTR PP	1500	1000
	1500	1000

480V MCC

			START KVA
(4) DEAR WTR FORU PP (30HP)	60	30	3
(2) WASTE TRANSF PP (10HP)	20	10	1
(2) RECIRC PP (5HP)	10	5	1
(2) SOFT WTR FORW PP (5HP)	10	5	1
(3) ACID TRANSF PP (5HP)	10	5	1
(4) CAUSTIC TRANSF PP (5)	20	10	1
(4) MISC PP	6	3	1
(2) VALVE MTR OPER	6	6	1 RE
(2) DEAR VAL PP	20	10	1
(4) VENT FANS* (3HP)	12	6	1
(4) EXH FANS* (3HP)	12	6	1
LTG (ASSUMED)*	35	35	BLK
MISC*	15	15	BLK

45 TOTAL 236 146
 46
 47 173C 41 114
 48
 49
 50

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

Preliminary _____
Item _____

Client PSE & G Location HUDSON #2 Est. No. _____ J.O. No. 13222
Subject MOTOR CONTROL CENTER Date 6/17/82 By I.M
Checked _____ By _____
Based on _____ Revised _____ By _____

INC	S-1	S-1	100AF	S-1
FDR	FVNR	FVNR	BKIL	
SIZE 1	S-1	S-1	100AF	S-1
FVNR	FVNR	FVNR	BKIL	
			6P	
SIZE 1	S-1	S-1	2-50A	100A
FVNR	FVNR	FVNR	SP	BKIL
SIZE 1	S-1	S-1	S-1	FUT
FVNR	FVNR	FVNR	FVNR	
			SP	
SIZE 3	S-1	S-1	S-1	FUT
FVNR	FVNR	FVNR	FVNR	
			6P	
	S-1	FVNR	S-1	FUT
	FVNR		FVNR	

EACH MCC

COMB STARTERS - CKT BKIL TYPE

FVNR NEMA SIZE B - 1
L ↓ L 1 - 17

FVNR NEMA SIZE 1 - 2

CKT BKILS

100AF - 5

SPACES FOR FUT USE

FVNR SIZE 1 - 2

CKT BKILS - 100AF - 1

Client PSE & G Location HUDSON #2 Est. No. J.O. No. 13222.0Subject Date 6/17/82 By IMSubject PRICING Checked By Based on Revised By

MOTOR Control Center (TYPICAL)
(2 R/L'D)
SEE GEP-800

INC TERM. BD	\$ 490
1 - SIZE 3 FVNR	\$ 1,767
17 - SIZE 1 FVNR	\$ 15,997
2 - SIZE 1 FVR	\$ 2,744
5 - 100A F. Ckt BKL	\$ 3,767
3 - SPACES	600
19 - CONT Ckt TRANS. SIZE 1 @ \$92	1,748
1 SIZE 3 @ 171	171
20 - CONT TRANS FUSES @ \$66	1,320
40 - INDIC LIGHTS @ \$92	3,680
20 DB STA'S @ 79	1,580

TOTAL \$ 33,864

G.O. 100 MULTIPLIER = $0.753 \times 0.3 = 0.2259$

PRICE PER MCL = \$ 7,650.00

2 R/L = \$ 15,300.00

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

Page No. _____
Preliminary _____
Item _____

1 Client PSE & G Location Hudson #2 Est. No. _____ J.O. No. 13222
2 Subject PRICING Date 6/17/82 By L.M.
3 _____ Checked _____ By _____
4 Based on _____ Revised _____ By _____

480V LOAD CTR (DOUBLE ENDED)

SEE GET-6691

DISC SW (LVD) \$ 3,720

SURG ARRESTERS 1,620

TRANS BODIES/AA 13,480

THERM LOAD SIMULATOR 1,616

2 - THERM. COMPARTMENTS @ 920 1,840

TOTAL

26,270

2 of each imp'd = 52,540

G.O. 150B DISC MULTIPLIER = 0.99

PRICE = \$52,015.00

LV SWGR

SEE BEC.7541

3 - 22" sections 13W @ \$ 1000 = \$ 3,000.

1 - TRANSITION 3430

3 - COMPRESSION LUGS 950

1 - MAIN BRK 800A 9,320

1 - FDR BRK (MAIN) 7,450

1 - VUMA TRIP 710

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STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

Page No. 2
 Preliminary _____
 Item _____

Client	Location	Est. No.	J.O. No.
Subject		Date	By
	PRICES	Checked	By
Based on		Revised	By

3 - PT @ 960 2880

3 - CT'S @ 800 2400

1 - Volt m 1,300

1 - Ammeter 1,300

2 - Amm & Vm SW @ 540 1,080

3 - o/c Relays @ 1540 4,620

3 BKR TRANSFER 14,050

Delayed Return 2,320

1 - Space 1,740

TOTAL \$ 43,950

2 Ref d = 87900

+ TIE BKR = 9,320

1 Vm & trip 710

1 Space 1,740

99,670

G.O. 127A amt = .7

Price L.V. SINGLE = \$69,769

+ TRANSFER 52,015

TOTAL Double ended 121,784 45

480V 5W55A

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

Preliminary _____
 Item _____

Client	Location	Est. No.	J.O. No.
Subject		Date	By
		Checked	By
Based on		Revised	By

4KV SWGR (2 Reg'd)

SINGLE SOURCE INC (SSIL-1200A) 48,140

INDUC LTR FOR (IMF-2) 48,210

GEN PWR FOR GPF-3 40,005

TOTAL 1-UNIT 136,355

2 UNITS 272,710

+ BUS TIE (BT) 37,165

- OPTIONS (BUS TRANSF) 25,100
 et

TEST CAB

1265-

\$ 336,140

G.O - 225 MULTIPLIER = 0.53

PRICE FOR 2 UNITS = \$ 188,250

ADD PRICE & INSTALLATION TO ADD

1- 1200A 350MVA BRK' ENL AT
 HUDSON 2 4KV SWGR FOR BACK-UP
 FOR \$ 40,005 x 0.53 = \$22,410

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

Preliminary _____

Item _____

1 Client	Location	Est. No.	J.O. No.
2 Subject		Date	By
3 PRICE S		Checked	By
4 Based on		Revised	By

DISTR SERV TRANSF

26 - 4.16 KV

2000 KVA OA/FUT FA

SEE PRICE LIST GE SEC. 5532

90-150A = DISC MULT = 2.6

BASE PRICE \$ 12,620

H.V. RATING 26KV 1% 126

PRESS Relief device 120

LIQUID FILL DISC SW 5120

LTKG PER CINTER 685

FAULT PRESS RELAY 395

REC. CONT CBT REL 320

TESTS: TEMP 1000

IMPULSIE TEST 1000

BURN LEVEL 133

INSUL PWR FACTOR 133

TOTAL \$ 22,652

X MULT 2.6

TOTAL PRICE \$ 58,900.00

A 023 27A
COPY

STONE & WEBSTER ENGINEERING CORPORATION

cc: P. A. Bender
G. Kan
J. Ardary/R. Hickey
General Files
Job Book #2
D. Samela

Dr. Melvin Zwillenberg
Public Service Electric
and Gas Company
80 Park Plaza
Newark, N.J. 07101

August 9, 1982
J.O. No. 13222.02
DH2-SP-41

PUBLIC SERVICE ELECTRIC AND GAS
DOE DISTRICT HEATING STUDY-PHASE 2
ALTERNATE #3. COST ESTIMATE

Dear Dr. Zwillenberg:

Attached is a Cost Estimate for Alternate #3 (District Heating Plant within the Hudson Station). This estimate was prepared, per your direction, to assess the approximate costs for the "minimum cost" alternative. The estimate is based on the assumptions noted in your memo to Dr. C. R. Guerra (dated June 10, 1982) and the additional assumptions listed in the attachment.

If you have any questions, please let me know.

Very truly yours,

D. Samela
Study Manager

DS:sg
Enclosure

Assumptions for Alternate #3

1. This alternate (#3) was based on previous alternates (#1, and #2).
2. There is no change from alternate #1 in the following estimated items -- mechanical equipment, piping and valves, insulation, electrical and instrumentation.
3. All required equipment can be located on the elevated floor slab of the existing turbine-generator building. This permits the elimination of the building (and building services) and the pipe tunnel.
4. All equipment could be placed on concrete pads which would be dowelled and concreted into the existing floor, and patched as necessary.
5. It would be necessary to remove a section of a wall to allow entry of new equipment into the existing building. This wall section would have to be replaced.
6. The existing overhead crane could be used to place new equipment at required locations.
7. Headquarters, construction management and distribution costs have been prorated from total direct cost.

STONE & WEBSTER ENGINEERING CORPORATION

ALTERNATE III

1.14 OF MID

BUDGET.

EST./J.O. NO.

13222.02

	TYPE OF UNIT
()	Individual
()	Group
()	Family
()	School
()	Community
()	Nation
()	Other _____

DISTRICT HEATING

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100	100

or

DAZE

8/2/82

CLIENT

PSE & G

LOCATION

HUDSON #2

69 4

R.W.H.

SUMMARY

ACCOUNT NO.	DESCRIPTION	QUANTITIES	UNIT COST		MATERIAL	SUBCONTRACT	^{S/C}	TOTAL	MAN-HOUR
			MATL.	MM/RATE			LABOR		
	SUBSTRUCTURE, FNDTNS.			/	111000		66000	77000	2,25
	SUPERSTRUCTURE			/	-		-	-	-
	MECHANICAL EQUIPMENT			/	1122000		170000	1292000	5,22
	PIPING & VALVES			/	696000		561000	1257000	17,25
	INSULATION			/	63000		97000	160000	3,17
	MISCELLANEOUS MECHANIC.			/	-		-	-	-
	ELECTRICAL			/	507000		320000	827000	9,96
	INSTRUMENTATION			/	73000		135000	208000	4,44
	TOTAL DIRECT COST			/	2472000		1349000	3821000	42,29
	HEADQUARTERS			/				536000	
	CONSTRUCT. MGMT. & DIST.			/				305000	
	SUBTOTAL			/				4662000	
	CONTINGENCY			/				466000	
50	TOTAL			/				5128000	

SUBSTRUCTURE, FOUNDATIONS

CONCRETE PADS FOR 3 EXCH., 3 PUMPS, 3 STRAINERS AND WATER TREATMENT SYSTEM

ALLOW AN AVERAGE SIZE CONCRETE PAD OF 6' x 8' x 3' EACH PIECE OF EQUIPMENT

EXCHANG. PUMPS, STRAIN.	—	9	CONCRETE PADS
WTR TRTMT. SYSTEM	—	ALLOW 6	"
TOTAL		15	"

$15 \times 6 \times 8 \times 3 \div 27 + 10\% \text{ OVERPOUR} = 88 \text{ C.Y.}$

$88 \text{ C.Y. @ } \$100/\text{C.Y. MTL.} = \$8,800 \text{ M}$

$* 88 \text{ C.Y. @ } 20 \text{ MH/C.Y. LABOR} = 1,760 \text{ M}$

* INCLUDES LABOR TO BREAK FLOOR, BUR REINFORCED CON PAD AND PATCH FLOOR FOR EACH PAD. AND DOWEL INTO FLOOR.

	MTL.	LAB. MH
CONCRETE PADS	8,800	1,760
DEMOLISH AND REBUILD PORTION OF WALL TO BRING IN EQUIP. ALLOW	2,200	490
TOTAL	<u>\$ 11,000</u>	<u>2,250</u>
LABOR COST: 2250 MH @ \$2932	<u>66,000</u>	
	<u>\$ 77,000</u>	

514

STONE & WEBSTER ENGINEERING CORPORATION
STONE & WEBSTER ENGINEERING CORPORATION - NEW YORK
ONE PENN PLAZA, 250 WEST 34TH STREET
NEW YORK, NEW YORK 10001

DATE	Jan. 20, 1982
J O NO	13222.01
P O NO	
LTR NO	
REF	District Heating

VIA

TO

Dr. Melvin L. Zwillenberg
Public Service Electric and
Gas Company
80 Park Plaza
Newark, New Jersey 07102

DEAR SIRs:

THE FOLLOWING ARE ☒ ATTACHED ☐ SENT SEPARATELY

<u>1</u> COPIES	PRINTS	REPRODUCIBLES	MICROFILM APERTURE CARD
EACH OF			
☐ DRAWINGS	☐ SPECIFICATIONS		
☒ DOCUMENTS	☐ NOTES OF CONFERENCE		

STATUS		PLEASE NOTE	SENT FOR YOUR	
☐ FINAL	☐ APPROVED	☐ REVISIONS	☐ OMISSIONS	☐ APPROVAL ☒ COMMENT
☐ PRELIMINARY	☐ APPROVED AS REVISED AS DEFINED IN SPECIFICATION	☐ ADDITIONS	☐ CORRECTIONS	☒ USE ☐ INFORMATION
☐ NO COMMENT	☐ UNACCEPTABLE	☐ COMMENTS	☐	☐ FILES ☐ CONCURRENCE
☐ SUGGESTIONS AS NOTED	☐			

YOUR ATTENTION IS DIRECTED TO THE FOLLOWING:

RELEASED FOR: ☐ FABRICATION ☐ PURCHASE OF NECESSARY MATERIALS

☐ PLEASE REVISE AND SUBMIT PRINTS REPRODUCIBLES MICROFILM APERTURE CARDS

☐ PLEASE SUBMIT PRINTS REPRODUCIBLES MICROFILM APERTURE CARDS OF ☐ DOCUMENTS ☐ DRAWINGS ☐ SHOP DETAILS

☐ PLEASE RETURN ONE COPY EACH OF THIS MATERIAL BEARING YOUR APPROVAL OR COMMENTS.

☐ PLEASE ACKNOWLEDGE RECEIPT OF THIS MATERIAL BY SIGNING AND RETURNING THE ENCLOSED COPY OF THIS FORM

☐ WE TRUST THAT THESE NOTES ARE IN ACCORDANCE WITH YOUR UNDERSTANDING IF NOT, PLEASE ADVISE US

IMPORTANT

SHOULD ANY REVISION TO DOCUMENTS OR DRAWINGS RETURNED HERewith INVOLVE A PRICE INCREASE, THE SUPPLIER MUST NOTIFY STONE & WEBSTER PURCHASING DEPARTMENT WITHIN TEN (10) DAYS EVEN THOUGH A DEFINITE ESTIMATE CANNOT BE GIVEN AT THE TIME OTHERWISE THE PURCHASER WILL CONSIDER THE REVISIONS MADE WITHOUT COST.

HEATER PLANT AND GAS TURBINE PLANT

COST ESTIMATES

The following information is attached:

1. Heater Plant Summary and Basis of Estimate
2. Gas Turbine Plant Summary and Basis of Estimate

Very truly yours,

D. Samela
Study Manager

cc: PABender
TPiaseik - PSE&G-Enc.
~~MGKurzy-Transflux-Enc.~~
GKan
Job Book 2-Enc.

STONE & WEBSTER ENGINEERING CORPORATION

TYPE OF BID

EST./J.O. NO.

13222.01

TYPE OF UNIT

PAGE

OF

DATE
12/31/81

CLIENT

P.S.E & G

LOCATION

BY

JTA / JFC 11/18

HEATER PLANT SUMMARY

ACCOUNT NO.	DESCRIPTION	QUANTITIES	UNIT COST		MATERIAL	SUBCONTRACT	LABOR	TOTAL	MAN-HOURS
			MATL.	MH/RATE					
	CIVIL / STRUCTURAL				28779.00		2636.00	5535.00	9555
	MECHANICAL				13712.00		2439.00	16151.00	8981
	PIPING & INSULATION				1693.00		1724.00	3417.00	5977
	ELECTRICAL				2053.00		1259.00	3312.00	4735
	INSTRUMENTATION				1000.00		784.00	1784.00	3025
	TOTAL DIRECT COST				21357.00		8842.00	30199.00	32273
	CONSTR. MGMT. & DISTRIBUTABLES							2416.00	
	HEADQUARTERS							4228.00	
	SUBTOTAL							36843.00	
CA CA	CONTINGENCY	~ 10%						3687.00

Issue
No.J.O. No. 13222.01

Page _____

Item _____

Client PSE & GDate 1/15/82By JtaLocation Berrip Creek (various stations)

Checked _____

By _____

Subject Fired Heaters

Revised _____

By _____

Basis of Estimate

This estimate is for the installation of (4) fired heaters (50×10^6 BTU/HR each) with associated pumps, tanks, etc. for district heating purposes. General specifications, equipment layout, flowsheet & prices for the heaters were supplied by Transflux Int'l. Ltd.

Since no schedule for completing the work was furnished, all costs are present day with no allowance for escalation. All work is estimated to be subcontracted and the labor rates used are the same rates which were developed for the Hudson #2 estimate prepared in August 1981.

Direct Costs

Civil/Structural - Based on the written description of the building required furnished by Transflux Int'l. Ltd., ab est'd. cost was developed. Slabs, equip. fdn's, etc. were included as judgement estimates. Piling was included based on the requirements for piling at the Essex Station (Essex Sta. Dist. Htg. estimate 9/81)

Mechanical - Vendors quote was supplied for the htr's. & economizer. Catalog cuts were supplied for tanks & pumps supplying weights &/or capacities for estimating purposes. Waste & Water treatment system costs were supplied lump sum by environmental div'n.

Issue
No.J.O. No. 13222.01

Page _____

Item _____

Client PSE & GDate 1/15/82 By JHLocation Berry Creek (various stations)

Checked _____ By _____

Subject Fired Heaters

Revised _____ By _____

Basis of Estimate (cont'd.)

Mechanical (cont'd) - All other costs for equip. were estimated using in house data. Labor for all items was estimated.

Piping & Insulation - piping takeoff was made using the flow diagram & equipment layout sketches (furnished by Transflux Int'l.) and allowing quantities to cover each service. Valve types & quantities were furnished by Transflux Int'l. Pricing for piping was taken from current McTunkin price list (except control valves priced from Richardson's). Labor for piping was taken from the piping manhour manual. Insulation prices were estimated using 1980 \$ from B & B Insulation Inc. and adjusting the prices for escalation & location.

Electrical & Instrumentation - allowances were included for Elect. & controls based on the relationship to the T.D.C. - Referenced the Essex Station District Heating estimate prepared 9/81.

Distributables & F.N.M. - allowance was made of 8% of T.D.C. (consistent w/ other district heating estimates).

Headquarters - allowance was made of 14% of T.D.C. (consistent w/ other district heating est's.)

Issue
No.J.O. No. 13222.01

Page _____

Item _____

Client PSE & G Date 1/14/82 By JJA
Location Berry's Creek (various stations) Checked _____ By _____
Subject Fried Heaters Revised _____ By _____

Basis of Estimate (cont'd.)

Escalation - no escalation was included, all \$ are present day 12/81.

Contingency - a 10% contingency was included

Qualifications

- 1- all costs are order of magnitude, present day 12/81 with no allowance for escalation
- 2- Estimate scope was furnished by Transflu Int'l. Ltd. & modified to include additional items per Mr. Kury.
- 3- In areas where certain materials were specified (example: manufacturer & model of pumps) and prices were not available, prices for equivalent materials were included.

Issue
No.J.O. No. 13222.01

Page _____

Item _____

Client PSE & GDate 1/14/82By JSRLocation Kearny #12

Checked _____

By _____

Subject Heat Recovery Exchangers

Revised _____

By _____

Basis of Estimate

This estimate is for the installation of (4) heat recovery heat exchangers on the exhaust side of existing gas turbines. General specifications, equipment layout, flowsheet and some equipment prices were furnished by TRANSFLUX INTL. LTD. (consultant to PSE & G). No schedule for accomplishing the work was provided so the estimated costs are all present day. All work is subcontracted and the labor rates used were developed for Hudson #2.

Direct Costs

Civil/Structural - no details were furnished for these requirements so judgement estimates were prepared for structural steel, foundation & a building to enclose the pump station. Piling was included based on the requirements for piling at the Essex Station (Essex Station Dist. Htg. estimate 9/81).

Mechanical - vendor quotations were supplied for the heat recovery exchangers. Phone quotes were obtained for the circ. pumps, dampers expansion jts. & duct insulation. The waste and water treatment system costs were supplied lump sum by environmental divn in Boston. The balance of mechanical equipment, ductwork, etc. was estimated using in house data. Labor for all items was estimated.

Issue
No.J.O. No. 13222.01

Page _____

Item _____

Client PSE & GDate 1/14/82By JTaLocation Kearny #12

Checked _____

By _____

Subject Heat Recovery Exchangers

Revised _____

By _____

Basis of Estimate (cont'd.)

Piping & Insulation - piping takeoff was made using the flow diagram & equip. layout sketches (furnished by Transflux Intl & allowing quantities to cover each service. Valve types & quantity were also furnished by Transflux Intl. Pricing for piping & valves was taken either from current McJunkin price lists or from the district heating estimate prepared in Sept 1981. Insulation prices were estimated using 1980 \$ from B & B Insulation Inc. and adjusting the prices for escalation & location. Manhours for installing the piping, etc. were taken from the piping manhour manual.

Electrical & Instrumentation - allowances were included for electrical & controls based on the relationship to the T.D.C. - Referenced an estimate where details were available and a complete elect./I & C estimate was prepared. Ref: Essex Station District Heating est. dated 9/81.

Distributables & F&M - allowance was made of 8% of T.D.C. (consistent w/ other district heating estimates)

Headquarters - allowance was made of 14% of T.D.C. (consistent w/ other district heating estimates)

Issue
No.J.O. No. 13222.01

Page _____

Item _____

Client

PSE & G

Date

1/14/82

By

JTA

Location

Kearny #12

Checked _____

By _____

Subject

Heat Recovery Exchangers

Revised _____

By _____

Basis of Estimate (contd.)

Escalation - no escalation was included
all \$ are present day 12/81.

Contingency - a 10% contingency was added

Qualifications

- 1- all costs are order of magnitude, present day 12/81 with no allowance for escalation
- 2- Estimate scope was furnished by Transflux Int'l. Ltd. & modified to include additional items per MR George Kan.
- 3- In areas where certain materials were specified (example: type of insulation & lagging on piping) and prices were not available, prices for equivalent materials were included.

STONE & WEBSTER ENGINEERING CORPORATION
250 WEST 34TH STREET, NEW YORK, N.Y. 10001

DATE	Feb. 2, 1982
J O NO	13222.01
P O NO	
LTR NO	
REF	District Heatin

VIA

TO

Dr. Melvin L. Zwillenberg
Public Service Electric and
Gas Company
80 Park Plaza
Newark, NJ 07102

DEAR SIR:

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1	COPIES	PRINTS	REPRODUCIBLES	MICROFILM APERTURE CARDS
			EACH OF	
	☐ DRAWINGS	☐ SPECIFICATIONS		
	☒ DOCUMENTS	☐ NOTES OF CONFERENCE		

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☐ PRELIMINARY	☐ APPROVED AS REVISED AS DEFINED IN SPECIFICATION	☐ ADDITIONS	☒ USE ☐ INFORMATION
☐ NO COMMENT	☐ UNACCEPTABLE	☐ COMMENTS	☐ FILES ☐ CONCURRENCE
☐ SUGGESTIONS AS NOTED			

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HEATER PLANT AND GAS TURBINE PLANT
COST ESTIMATES

The following information is attached:

1. Back up Information for Heater Plant Cost Estimate
2. Back up Information for Gas Turbine Plant Cost Estimate

Very truly yours,

D. Samela
Study Manager

DS:pcw
cc: P.A. Bender
G. Kan
Job Book 2 (enc)

STONE & WEBSTER ENGINEERING CORPORATION

TYPE OF BID

EST./J.O. NO.

13222.01

TYPE OF UNIT

PAGE

OF

DATE
1/4/82

CLIENT

PSE & G

LOCATION

BY

JAN

HEATER PLANT

ACCOUNT NO.	DESCRIPTION	QUANTITIES	UNIT COST		MATERIAL	SUBCONTRACT	LABOR	TOTAL	MAN-HOURS
			MATL.	MH/RATE					
	CIVIL / STRUCTURAL SUMMARY								
	SUPERSTRUCTURE				140360		149252	289612	5456
	SUBSTRUCTURE (CIVIL) (INCLUDING PILING)				149525		114367	263892	4099
	TOTAL				289885		263619	553504	9555
		USE			289900		263600	553500	9555

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EST./J.O. NO.

13222

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OF

DATE

12-31-81

CLIENT

LOCATION

By

RAS

2. fahen an der
 11.11.2011
 mit 11.11.2011
 für 11.11.2011 - 11.11.2011 (11)

STONE & WEBSTER ENGINEERING CORPORATION

TYPE OF BID

EST./J.O. NO.

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TYPE OF UNIT

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DATE

OF

12-31-81

CLIENT

LOCATION

BY

PSE?G

RAS

ACCOUNT NO.	DESCRIPTION	QUANTITIES	UNIT COST		MATERIAL	SUBCONTRACT	LABOR	TOTAL	MAN-HOURS
			MATL.	MH/RATE					
	<u>SUBSTRUCTURE</u>								
	EXCAVATION	1600 cu	-	.08 33.77	-		4261	4261	128
	BACKFILL	820 cu	-	.067 51.60	-		2838	2838	55
	PILING	8050 LF	13.10	.123 35.57	105455		35234	140689	970
	FOUNDATIONS - CONC	485 cu	50	1.2 19.53	24250		11366	35616	582
	- CONC OVERBUR	49 cu	50	-	2450		-	2450	-
	- FORMS	6720 SF	0.60	.20 22.32	4032		29998	34030	1344
	- REBAR	53,350 LB	0.25	.015 274	13338		23552	36890	800
	MOBILIZE? DEMOB. Pile Rig	ALLOW		35.57	-		7118	7118	200
	TOTAL →				149525		114367	263892	4099

STONE & WEBSTER ENGINEERING CORPORATION

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OFDATE
12/28/81

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PSE & G

LOCATION

BY

JTA

HEATER PLANT SUMMARY

ACCOUNT NO.	DESCRIPTION	QUANTITIES	UNIT COST		MATERIAL	SUBCONTRACT	LABOR	TOTAL	MAN-HOURS
			MATL.	MM/RATE					
	MECHANICAL SUMMARY								
	Fired Heaters	4	175000	500 26 ⁷⁰	700000		53400	753400	2000
	Pressurization tank	1	1700	32 26 ⁷⁰	1700		900	2600	32
	Make up Water Storage tank	1	8000	96 26 ⁷⁰	8000		2600	10600	96
	Economizers	1	30000	100 26 ⁷⁰	30000		2700	32700	100
	Ductwork	19 TM	2000	30 26 ⁷⁰	38000		15200	53200	570
	Stack	1	76000	375 26 ⁷⁰	76000		10000	86000	375
	Dampers - 4' x 4', M.O.	4	6000	24 26 ⁷⁰	24000		2600	26600	96
	4' x 6.5', M.O.	2	7000	24 26 ⁷⁰	14000		1300	15300	48
	Water Treatment & Waste Treatment Sys.	L.S.	330000	4220 28 ²⁰	330000		119000	449000	4220
	Heater Circ. Pumps	4	6000	48 26 ⁷⁰	24000		5100	29100	192

TYPE OF BID:

EST./J.P. NO.

13222.01

TYPE OF UNIT

PAGE

DATE: 12/29/81

CLIENT**LOCATION**

5

HEATER PLANT SUMMARY

PSE & G

ACCOUNT NO.	DESCRIPTION	QUANTITIES	UNIT COST		MATERIAL	SUBCONTRACT	LABOR	TOTAL	MAN-HOURS
			MATL.	MH/RATE					
	MECHANICAL SUMMARY (CONT'D.)								
	System Circ Pumps	4	13000	64 2670	52000		6800	58800	256
	Makeup Pumps	2	2000	32 2670	4000		1700	5700	64
	Instrument Air Compressor	2	30000	96 2670	60000		5100	65100	192
	Insulation of ducts 3" thk. fiberglass	3000 lb	3 15	.248 2363	9500		17500	27000	740
	Subtotal this page				125500		31100	156600	1252
	Subtotal page 1				1245700		212800	1458500	7729
	Total				1371200		243900	1615100	8981

STONE & WEBSTER ENGINEERING CORPORATION

TYPE OF BID

EST./J.O. NO.

13222.01

TYPE OF UNIT

PAGE

OF

DATE

12/31/81

CLIENT

PSE & G

LOCATION

BY

JAA

HEATER PLANT

ACCOUNT NO	DESCRIPTION	QUANTITIES	UNIT COST		MATERIAL	SUBCONTRACT	LABOR	TOTAL	MAN-HOURS
			MATL.	MH/RATE					
	PIPING & INSULATION								
	SUMMARY								
	PIPE & FITTINGS				69370				3543
	HANGERS & SUPPORTS				6940				354
	MISC. ERECT. MATLS				3690				-
	VALVES				77500				1254
	TOTAL PIPING			2942	157500		152900	310400	5151
	PIPE INSULATION			2567	11800		19500	31300	826
	TOTAL PIPING & INSULATION				169300		172400	341700	5977

TONE & WEBSTER ENGINEERING CORPORATION

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12/29/81

CLIENT

PSE & G

LOCATION

BY

JTA

HEATER PLANT

ACCOUNT NO.	DESCRIPTION	QUANTITIES	UNIT COST		MATERIAL	SUBCONTRACT	LABOR	TOTAL	MAN-HOURS
			MATL.	MH/RATE					
	Piping - A-106 GR.B								
	Carbon Steel, seamless								
	Mc Junkin Prices dtd. 4/28/81								
	14" ϕ Std. wall	350'	37 ⁷⁰	2.25	13200				788
	12" ϕ	315'	32 ⁵⁰	2.0	10170				630
	10" ϕ	320'	27 ⁷⁰	1.75	8860				560
	8" ϕ	160'	18 ⁶⁰	1.5	2780				240
	6" ϕ	200'	14 ³⁰	1.0	2860				200
	4" ϕ	200'	7 ⁴⁰	.80	1480				160
	Subtotal				39550				2578
	Allow for fittings & flanges	25%			10000				w/PIPE
	Subtotal				49550				2578
	Allow for Shop Fabrication	40%			19820				-
	Subtotal				69370				2578

STONE & WEBSTER ENGINEERING CORPORATION

TYPE OF BID

EST./J.O. NO.

13222.01

TYPE OF UNIT

PAGE
OF

DATE
12/30/81

CLIENT

PSE & G

LOCATION

BY

JSA

HEATER PLANT

ACCOUNT NO.	DESCRIPTION	QUANTITIES	UNIT COST		MATERIAL	SUBCONTRACT	LABOR	TOTAL	MAN-HOURS
			MATL.	MH/RATE					
	Piping - Continued								
	Brought forward				69370				2578
	Field welds - Allow 1 weld every 15 LF.								
	14" std wall	24	-	11	-				264
	12"	21	-	10	-				210
	10"	21	-	10	-				210
	8"	11	-	9	-				99
	6"	14	-	7	-				98
	4"	14	-	6	-				84
	NOTE: Boltups for valves are w/ valves.								
	Subtotal				69370				3543
	Allow for Hangers & Supports	10%			6940				354
	allow for Misc. Erection Materials	~ 5%			3690				-

HEATER PLANT

ENT PSE & G

Ja

ACCOUNT NO.	DESCRIPTION	QUANTITIES	UNIT COST		MATERIAL	SUBCONTRACT	LABOR	TOTAL	MAN-HOURS
			MATL.	MH/RATE					
	VALVES - Ref. tabulation of valves supplied w/equipment list from Transflux Ltd.								
VAG FORGED STEEL	300# C.S. S.W. ENDS								
	1 1/2" GATE, OS & Y	2	80-	4.5	160				9
	1 1/2" CHECK (PISTON)	2	80-	4.5	160				9
	MISC. DRAIN & VENT USE AVG. OF 1" GATE	25	60-	3.0	1500				75
WALWORTH CAST STEEL	150# C.S. FLANGED								
	3" GATE, OS & Y	2	420-	10	840				20
	6" " "	2	780-	18	1560				36
	10" " "	4	1920-	24	7680				96
	12" " "	14	2560-	28	35840				392
	14" " "	5	4350-	33	21750				165
	10" CHECK (SWING)	4	2000-	24	8000				96
WALWORTH	4" CONTROL VALVES (NATURAL GAS)	4	2400-	22	9600				88
	6" CONTROL VALVES (LANDFILL GAS)	4	3700-	30	14800				120

STONE & WEBSTER ENGINEERING CORPORATION

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OF

DATE

12/28/81

CLIENT

P.S.E & G

LOCATION

BY

JJA

HEATER PLANT

ACCOUNT NO.	DESCRIPTION	QUANTITIES	UNIT COST		MATERIAL	SUBCONTRACT	LABOR	TOTAL	MAN-HOURS
			MATL.	MB/RATE					
	<u>VALVES (CONTD.)</u>								
	Boltnuts for flanged valves								
	3" 150#	4		.75					3
	4" }	4	-	.75					3
	6" }	8	-	1.25					10
	10" }	16	-	2.00					32
	12" }	28	-	2.50					70
	14" }	10	-	3.0					30
	Subtotal this page								148
	Subtotal pg. 1				10187.0				1106
	TOTAL				7749.0				1254
	USE				7750.0				1254
72	NOTE: Socket welds for welded valves are								

STONE & WEBSTER ENGINEERING CORPORATION

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PSE & G

LOCATION

BY

JPA

HEATER PLANT

ACCOUNT NO.	DESCRIPTION	QUANTITIES	UNIT COST		MATERIAL	SUBCONTRACT	LABOR	TOTAL	MAN-HOURS
			MATL.	MM/RATE					
	PIPE INSULATION								
	Prices are for mineral wool insulation w/ .016 aluminum jacket								
	PIPE INSUL. TK.								
	14" - 3" tk.	350'	7 ⁶⁹	.54	2670				189
	12" - 3" tk.	315'	6 ⁶³	.47	2090				148
	10" - 3" tk.	320'	6 ²⁵	.44	2000				141
	8" - 2" tk.	160'	5 ⁴⁵	.38	870				61
	6" - 2" tk.	200'	4 ⁷⁰	.33	740				66
	4" - 2" tk.	200'	4 ⁰⁴	.28	810				56
	Subtotal			23 ⁶⁵	9400		15600	25000	661
	Allow 25% for flanges, fittings & valves (ref. Essex details for insul. valves & fittings)			23 ⁶⁵	2400		3900	6300	165
27	Total				11800		19500	31300	826

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EST./J.D. NO.

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DATE 1/11/82

CLIENT**LOCATION**

By

^{NT} PSE & G

HEATER PLANT

[illegible]

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

Preliminary _____
Item _____

Client PSE & G. Location _____ Est. No. _____ I.O. No. 13222.01
Subject Allowances for Electrical & Instrumentation Noted JAN 11 1982 By J. ARDARY
Checked _____ By _____
Based on Heater Plant Revised _____ By _____

The percentages of electrical & instrumentation and controls are as follows (based on PSE & G. ESSEX STA. DISTRICT HTG. estimate - see attached worksheets.

ELECTRICAL - 11.3% of TDC } 17.4% { 65% ELEC
I & C - 6.1% of TDC } { 35% I & C

	M \$	L \$	T \$
TOTAL - Civil/Struct. -	254,700	207,800	462,500
Mech. -	137,120	243,900	161,510
Piping -	169,300	172,400	341,700
	1,795,200	624,100	2,419,300

If 17.4% of TDC is elect. & I & C, then 82.6% of TDC equals the Civil/Struct., Mech. & Piping

$$\frac{\$2,419,300}{.826} = \$2,928,900$$

$$\begin{aligned} \$509,600 &= \$2,928,900 - \$2,419,300 \\ &= \$509,600 \end{aligned}$$

$$\begin{aligned} \$509,600 \times .65 &= \$331,200 \text{ Elect.} \\ \$509,600 \times .35 &= \$178,400 \text{ I \& C.} \end{aligned}$$

$$\text{ELECT.} = 62\% \text{ M} / 38\% \text{ L} = \begin{aligned} &\$205,300 \text{ Materials} \\ &\$125,900 \text{ Labor} \\ &\$331,200 \checkmark \end{aligned}$$

$$\text{I \& C} = 56\% \text{ M} / 44\% \text{ L} = \begin{aligned} &\$100,000 \text{ Materials} \\ &\$78,400 \text{ Labor} \\ &\$178,400 \checkmark \end{aligned}$$

Issue
No.J.O. No. 13222.01

Page _____

Item JAN 7 1982 J. ARDARY

By _____

Client PSE & G Date Noted

Location _____ Checked _____ By _____

Subject Heater Plant Revised _____ By _____INSTRUMENTATION & CONTROLS

Allow \$ based on % of I & C to T.D.C.
using Essex Station District Heating
estimate dated 9/81 as the basis

<u>DESCRIPTION</u>	<u>MATL. \$</u>	<u>LABOR \$</u>	<u>TOTAL \$</u>
I & C	426,000	331,000	757,000
TOTAL DIRECT COST.	9321000	3152000	12473000

$$\frac{757000}{12473000} = 6.1\% \text{ of Total Direct Cost}$$

(56% M, 44% L)

Issue
No.J.O. No. 13222.01

Page _____

Item _____

Client PSE & GDate Noted JAN 7 1982 J. ARDARY

Location _____

Checked _____

By _____

Subject

Heater Plant.

Revised _____

By _____

ELECTRICAL

No information was furnished to enable an electrical estimate to be prepared, therefore an allowance to cover electrical requirements is to be made

Ref: Essex Station District Heating estimate dated 9/81.

A complete electrical estimate was made and totaled 1,411,000 for direct material & labor - the relationship to T.D.C. is as follows:

<u>DESCRIPTION</u>	<u>MATL \$</u>	<u>LABOR \$</u>	<u>TOTAL \$</u>
ELECTRICAL	869,000	542,000	1,411,000
TOTAL DIRECT COST	9,321,000	3,152,000	12,473,000

$$\frac{1,411,000}{12,473,000} = 11.3\% \text{ of Total Direct Cost.}$$

(62% M, 38% L)

STONE & WEBSTER ENGINEERING CORPORATION

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DATE

1/11/82

CLIENT

LOCATION

BY

JTA

GAS TURBINE PLANT SUMMARY

PSE #6

ACCOUNT NO.	DESCRIPTION	QUANTITIES	UNIT COST		MATERIAL	SUBCONTRACT	LABOR	TOTAL	MAN-HRS
			MATL.	MH/RATE					
	CIVIL / STRUCTURAL				396000		291000	690000	10.10
	MECHANICAL				2800600		754400	3555000	2923
	PIPING & INSULATION				631200		342900	974100	120.3
	ELECTRICAL				371700		227800	599500	85.
	INSTRUMENTATION				180800		142000	322800	54
	TOTAL DIRECT COST				4380300		1761100	6141400	654
	CONSTR. MGMT & DISTRIBUTABLES							491300	
	HEADQUARTERS							859800	
	SUBTOTAL							7492500	
82	CONTINGENCY	~ 10%						749500	

STONE & WEBSTER ENGINEERING CORPORATION
PROCESS INDUSTRIES GROUP

1.00 50 1912

1211500

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PAGE

1. 3

SAVE

21

WAT

ESTIMATE WORK SHEET

GAS TURBINE PLANT

TYPE OF UNIT

CLIENT

P.S. F+G

LOCATION[illegible]

STONE & WEBSTER ENGINEERING CORPORATION
PROCESS INDUSTRIES GROUP

ESTIMATE WORK SHEET

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HEAT RECOVERY

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2 of 3

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CLIENT

P.S. E. & G

LOCATION	
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7

WAT

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STONE & WEBSTER ENGINEERING CORPORATION

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CLIENT

PSE & G.

LOCATION

BY

JPA

GAS TURBINE PLANT SUMMARY

ACCOUNT NO.	DESCRIPTION	QUANTITIES	UNIT COST		MATERIAL	SUBCONTRACT	LABOR	TOTAL	MAN-HOUR
			MATL.	MH/RATE					
	MECHANICAL SUMMARY								
	Heat Recovery Exchangers	4	155000	440 ²⁶	620000		47000	667000	1760
	Circulating Pumps	5	82000	440 ²⁶	410000		58700	468700	2200
	Ductwork	115.5 TN	2000	30 ²⁶	231000		92500	323500	3460
	Parallel lower dampers	8	35000	150 ²⁶	280000		32000	312000	1200
	Guillotine dampers	8	55000	150 ²⁶	440000		32000	472000	1200
	Expansion joints	8	8000	100 ²⁶	64000		21400	85400	800
	Ductwork Insulation	18100	10 ⁰⁰	.635 ²³⁶³	181000		271600	452600	11490
	Remove & Relocate existing exhaust duct & silencer.	13.	-	26 ⁷⁰	-		51300	51300	1920
	Make up pumps	2	3000	48 ²⁶	6000		2600	8600	96

STONE & WEBSTER ENGINEERING CORPORATION

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1/11/81

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LOCATION

BY

PSE & G

GAS TURBINE PLANT

ACCOUNT NO.	DESCRIPTION	QUANTITIES	UNIT COST		MATERIAL	SUBCONTRACT	LABOR	TOTAL	MAN-HOUR
			MATL.	MH/RATE					
	PIPING & INSULATION SUMMARY								
	PIPE & FITTINGS				205800				734.
	HANGERS & SUPPORTS				20600				73.
	MISC. ERECT. MATL'S.				11300				-
	VALVES				360000				1603
	TOTAL PIPING			2968	597700		287400	885100	9683
	PIPE INSULATION			2353	33500		55500	89000	2350
	TOTAL PIPING & INSULATION				631200		342900	974100	1203

81

STONE & WEBSTER ENGINEERING CORPORATION

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1/6/82

CLIENT

LOCATION

BY

GAS TURBINE PLANT

PSE & G

Jsa.

ACCOUNT NO.	DESCRIPTION	QUANTITIES	UNIT COST		MATERIAL	SUBCONTRACT	LABOR	TOTAL	MAN-HOUR
			MATL.	MH/RATE					
	Piping - Carbon Steel								
	A-106 Gr. B seamless								
	(McJunkin Prices dtd. 6/28/81)								
	24" ϕ std. wall	950'	63 ⁰⁵	3.5	59900				3325
	SA-155 CSS welded								
	(Prices developed from Essex								
	Station ext. dtd. 9/81)								
	36" ϕ .375 wall	200'	143 ⁰⁰	5.25	28600				1050
	48" ϕ .375 wall	150'	190 ⁰⁰	7.0	28500				1050
	Subtotal				117000				5425
	Allow for fittings & flanges	25%			30000				w/PIPE
	Subtotal				147000				5425
	Allow for shop fabrication 10%				58800				-
85	Subtotal				205800				5425

STONE & WEBSTER ENGINEERING CORPORATION						TYPE OF BID		EST./J.O. NO. 13222.01	
GAS TURBINE PLANT						TYPE OF UNIT		PAGE OF	
						CLIENT PSE & G		LOCATION	
BY <i>JTA</i>									

ACCOUNT NO.	DESCRIPTION	QUANTITIES	UNIT COST		MATERIAL	SUBCONTRACT	LABOR	TOTAL	MAN-HOUR
			MATL.	MH/RATE					
	Piping (CONT'D.)								
	Brought Forward				205800				542
	Field Welds - allow								
	1 weld every 15 LF								
	24" std wall	64	-	19	-				1216
	36" " "	14	-	26	-				364
	48" " "	10	-	34	-				340
	NOTE: Boltups for valves								
	are with valves								
	Sub-total				205800				7345
	Allow for Hangers & Supports	10%			20600				735
	Allow for Misc. Erection Material	5%			111300				-
	Total			29 ⁶⁸	2377100		239800	477500	8080

NE & WEBSTER ENGINEERING CORPORATION

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TYPE OF UNIT

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CLIENT

PSE & G

LOCATION

BY

jra

GAS TURBINE PLANT

QUNT IO.	DESCRIPTION	QUANTITIES	UNIT COST		MATERIAL	SUBCONTRACT	LABOR	TOTAL	MAN-HOURS
			MATL.	MH/RATE					
	VALVES - Ref. tabulation of valves supplied w/ equip list from Transfling Unit.								
	150 # C.S., flanged ends								
CAST STEEL STD. TRIM.	36" GATE, OS & Y (ESTD.)	4	43000	86	172000				344
	24" GATE, OS & Y	11	12200	57	134200				627
	16" GATE, OS & Y	5	6000	36	30000				180
	16" CHECK	5	4500	36	22500				180
	Misc. drain & vent use avg. 1" gate	20	60	3.0	1200				60
FORGED STEEL	300# C.S., SW ends (SAME AS HTX PLANT)								
	Boltnps for flanged valves								
	36" 150 #	8	-	6.0	-				48
	24" ↙	22	-	4.5	-				99
	16" ↓	20	-	3.25	-				65
∞ √	TOTAL.				359900				1603
	use				360000				1603
	NOTE: Socket welded valves incl.								

ONE & WEBSTER ENGINEERING CORPORATION

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DATE

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CLIENT

PSE & G.

LOCATION

BY

Jaa

GAS TURBINE PLANT

COUNT NO.	DESCRIPTION	QUANTITIES	UNIT COST		MATERIAL	SUBCONTRACT	LABOR	TOTAL	MAN-HOURS
			MATL.	MH/RATE					
	INSULATION								
	Mineral Wool insulation								
	w/ .016 alum. jacket								
	total 4" thk. applied								
	in two layers								
	PIPE ϕ								
	24" ϕ	950'	17 ³⁶	1.22	16490				1159
	36" ϕ	200'	26 ⁷²	1.84	5240				368
	48" ϕ	150'	33 ⁴¹	2.35	5010				353
	Subtotal			23 ⁶³	26740		44420	71160	1880
	Allow 25% for flanges								
	fittings & valves			23 ⁶³	6690		11110	17800	470
	(ref. Essex details for instal.								
	valves & fittings)								
	Total				33430		55530	88960	2350
∞									
∞		use			33500		55500	89000	2350

ONE & WEBSTER ENGINEERING CORPORATION

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DATE _____

1/11/82

CLIENT

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LOCATION

BY

BY *Joe*

GAS TURBINE PLANT

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STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

Page No. _____
Preliminary _____
Item _____

Client PSE & G. Location _____ Noted No. 13222.01
Subject Allowances for Electrical Date JAN 11 1982 By J. ADARY
Instrumentation Checked _____ By _____
Gas Turbine Plant. Revised _____ By _____

The percentages for elect. & instr. are as follows: (See attached sheets)

ELECT. - 11.3 % of T.D.C. } 17.4 % } 65 % ELECT
INSTR. - 6.1 % of T.D.C. } } 35 % INSTR.

	M	L	T
Total - CIVIL/STRUCT.	\$ 325,000	\$ 218,000	\$ 543,000
MECH.	\$ 2246,600	\$ 614,400	\$ 2,861,000
PIPING	\$ 631,200	\$ 342,900	\$ 974,100
	\$ 3,202,800	\$ 1,175,300	\$ 4,378,100

17.4 % of T.D.C. is for Elect & IDC $\therefore$ 82.6 % of T.D.C. is for Civil/Struct., Mech. & Piping

$\frac{\$ 4,378,100}{.826} = \$ 5,300,400$
 $\frac{\$ 4,378,100}{.826} - \$ 4,378,100 = 922,300$
 $922,300 \times .65 = \$ 599,500$ Elect.
 $922,300 \times .35 = \$ 322,800$ Instr.

ELECT = 62% M / 38% L = $\frac{\$ 371,700}{\$ 227,800}$ Materials Labor
 $\$ 599,500$ ✓

INSTR. = 56% M / 44% L = $\frac{\$ 180,800}{\$ 142,000}$ Materials Labor
 $\$ 322,800$ ✓

Issue
No.J.O. No. 13222.01

Page _____

Item _____

Client PSE & GDate Noted JAN 7 1982 JANUARY

Location _____

Checked _____

By _____

Subject Gas Turbine Plant.

Revised _____

By _____

ELECTRICAL

No information was furnished to enable an electrical estimate to be prepared, therefore an allowance to cover electrical requirements is to be made.

Ref: Essex Station District Heating estimate dated 9/81.

A complete electrical estimate was made and totaled 1,411,000 for direct material & labor - the relationship to T.D.C. is as follows:

<u>DESCRIPTION</u>	<u>MATL \$</u>	<u>LABOR \$</u>	<u>TOTAL \$</u>
ELECTRICAL	869,000	542,000	1,411,000
TOTAL DIRECT COST	9,321,000	3,152,000	12,473,000

$$\frac{1,411,000}{12,473,000} = 11.3\% \text{ of Total Direct Cost.}$$

(62% M, 38% L)

Issue
No.J.O. No. 13222.01

Page _____

Client PSE & G

Date _____ Noted

Item JAN 7 1982 J. ARDIARY

By _____

Location _____ Checked _____ By _____

Subject Gas Turbine Plant Revised _____ By _____INSTRUMENTATION & CONTROLS

Allow \$ based on % of I & C to T.D.C.
using Essex Station District Heating
estimate dated 9/81 as the basis.

DESCRIPTION	MATL. \$	LABOR \$	TOTAL \$
I & C	426,000	331,000	757,000
TOTAL DIRECT COST	9321,000	3152,000	12473,000

$\frac{757000}{12473000} = 6.1\%$ of Total Direct Cost
(56% M, 44% L)

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cc: PABender
GKan
JArday
General Files
Job Book #2/1
DSamela/1

Dr. Melvin Zwillenberg
Public Service Electric
and Gas Company
80 Park Plaza
Newark, New Jersey 07101

June 29, 1982
J.O. No. 13222.02
DH2-SP-38

PUBLIC SERVICE ELECTRIC AND GAS
DOE DISTRICT HEATING STUDY-PHASE 2
REVISED LIMITED RETROFIT COST ESTIMATE

Dear Dr. Zwillenberg:

Attached is a revised Limited Retrofit cost estimate. The basis of this estimate is the Limited Retrofit Cost Estimate transmittal to PSE&G on June 2, 1982 as modified by suggestions from M. G. Kurz to reduce costs at a meeting held at PSE&G on June 9, 1982. Appropriate changes have been made to the original estimate for the following alternatives:

Alternate 1 - DH Plant in a separate building with increased pump and pipe sizes (see attached Basis of Estimate). A detailed electrical estimate was provided in this revision.

Alternate 2 - DH Plant enclosed in a "Butler Building" type of enclosure to minimize costs (see attached Basis of Estimate). This alternative includes the changes made for Alternative 1 as noted above.

The estimated costs are: \$6,839,000 for Alternate 1 and \$6,127,000 for Alternate 2. The cost for Alternate 1 is higher than the original estimate of \$6,196,000 due, in part, to the increased flow requirements. However, there was also an increase in the electrical requirements as determined by the detail estimate (see discussion in Basis of Estimate).

An estimate has not been prepared for the third alternative discussed at our June 9, 1982 meeting (DH Plant located inside the existing Hudson Station). This estimate was not prepared in order to minimize out of scope costs for an alternative with

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STONE & WEBSTER ENGINEERING CORPORATION

Dr. M. Zwillenberg

-2-

June 29, 1982

J.O. No. 13222.02

DH2-SP-38

questionable feasibility (see attached trip report from
G. T. Kan, dated June 28, 1982).

If you have any questions, please let us know.

Very truly yours,

D. Samela
Study Manager

DS:as
attachments

BASIS OF LIMITED RETROFIT ESTIMATE

Alternate I

Pumps - the capacities of the three district heating water pumps have been increased from 2300 gpm to 3500 gpm with a resultant increase in driver horsepower from 350 to 500. The pumps' differential head remained at 450 ft. Additional labor manhours have been allowed due to the larger pump size.

Piping - a 12" line diameter has been increased to 20". Revisions were made in accordance with a material take off of the 12" line, including all fittings, flanges and valves. No change has been made to the materials of construction. The estimated cost of the three strainers have been included with the mechanical equipment, as before. The estimate for these strainers has been increased from \$14,000 to \$22,000 because of the larger size.

Insulation - insulation costs have been increased because of the increase in pipe size.

Electrical - this account has been re-evaluated by the electrical department because the original estimate was presumed to be too high. This reinvestigation determined that these costs should be increased over what was previously estimated. The original figures were factored off a prior estimate for Hudson Unit #2. The qualitative difference between these two estimates are that the turbo-generators and some heat exchangers have been deleted from the original estimate to produce the original figure. Although there is, in fact, a large reduction in equipment and other direct costs, the omitted equipment does not require much associated electrical work. In factoring the original estimate, a larger than necessary cut was made in the electrical account. This has now been revised.

Headquarters costs, construction management and distributable costs and contingency were factored from the original estimate on the basis of total direct costs.

Alternate II

This scheme includes all changes made for Alternate I above and a building substitution. The original estimate included a factored amount for a structural steel building with reinforced concrete arches, insulated metal siding, masonry partitions, acoustical ceilings, and resilient tile floor covering. The pile foundations and plumbing, sprinkler and HVAC systems were also included in the estimate. The revised building is smaller (7,500 SF vs 13,700 SF) and is a "BUTLER" type building with a steel frame, insulated siding, lighting, heating, three roll up doors for access to tube bundles, structural slab at grade

supported by piles and a steel frame around the exchangers to support piping.

Headquarters costs, construction management and distributable costs and contingency were factored from the original estimate on the basis of total direct costs.

SUN. STAR LEDGER
6/27/83

Yesterday's trash may be today's fuel

By TED SHERMAN

A number of New Jersey's utilities are searching for new sources of power in yesterday's trash.

Public Service Electric & Gas Co. (PSE&G) and Jersey Central Power & Light Co. (JCP&L) are both drilling for methane in various landfills across the state to produce electricity or to burn for heat.

When garbage such as food scraps, papers and nonchemical industrial wastes found in standard landfills decomposes, methane and carbon dioxide are produced. After the carbon dioxide is removed, the gas is combustible and rising energy prices have been making that gas too valuable to waste.

Tomorrow, PSE&G will begin drilling a series of test wells on a 25-acre site within the Kingsland Landfill in the Hackensack Meadowlands, as part of the initial phase of a project that could lead to the recovery of enough methane gas to fuel a 300-kilowatt electric generating plant.

The utility is already drawing methane from a landfill in Cinnaminson Township in Burlington County for use in a nearby industrial plant.

Earlier this month, JCP&L began producing electricity by tapping methane from a closed landfill in Dover Township.

(CONTINUED)

(CONTINUED)

James Pardus, senior engineer for PSE&G Research Corp., said the gas in most landfills can last 10 years or more, depending on what is in the disposal site and the age of the garbage. Construction debris and metal, for example, do not decompose and old garbage that has been fully decomposed does not produce much methane.

The drilling that will get under way tomorrow is part of a joint effort with the Wehran Energy Corp. of Middletown, N.Y., which will design and install the gas recovery facilities and construct the generating plant. The costs of the project will be shared.

Wehran also backed the JCP&L project and has developed a number of gas recovery facilities in other parts of the country.

Pardus said six test wells and six pressure probes will be drilled at the now-closed Lyndhurst site to determine how much gas is in the 50-foot deep landfill.

The project was sparked by the Hackensack Meadowlands Development Commission (HMDC), which was simply looking for a way to vent the landfill gas.

James Halsey, assistant chief engineer for the commission, noted that the HMDC plans to turn the landfill area into a park, but methane gas inhibits the growth of grass and trees and must be removed. By recovering the gas instead of allowing it to percolate through the soil, the HMDC will earn a royalty on the unwanted methane while preparing the site for landscaping.

The project is only a small demonstration for what the HMDC hopes will be a large-scale gas recovery program within the entire Meadowlands tract.

"We hope it will be a success so that it will spark other projects," Halsey said.

However, he noted there are many ownership claims to the gas rights in the various landfills because there could be a lot of money involved, and that could further delay future gas recovery.

PSE&G's Pardus said if the test field proves promising, a 300-kilowatt electric generating plant will be installed. The unit will consist of an electric generator driven by an internal combustion engine fueled by the methane extracted from the landfill. The electricity will be fed into PSE&G's grid and the HMDC will be paid a royalty based on the value of the electricity produced.

The project is similar to the one already underway at the Dover Township landfill. The 25-year-old dump alongside the Garden State Parkway closed in August 1980 and township officials sought proposals from JCP&L and Wehran to tap the gas.

A number of wells were sunk into the 100-foot deep landfill and connected to a modified Caterpillar gas engine-driven generator located on a flatbed trailer. The generator produces about 375 kilowatts, or enough electricity to serve 50 homes. JCP&L is paying Wehran about 5.5 cents per kilowatt hour for the electricity, which is being sent directly into the utility's power grid, and Dover Township is getting about \$50-a-day in royalty payments. The municipality will also receive enough methane to heat part of its public works building.

Wehran officials said the landfill should continue to produce methane for the next 10 to 20 years.

PSE&G has been getting methane from its Cinnaminson project since 1979 and Pardus noted the gas there is still in good quantity and will probably last at least another eight to 10 years.

The utility does not generate electricity from the gas being recovered from the landfill at Cinnaminson, but sells it to Hoegenaes Corp., a nearby iron powder plant that uses the gas in its production process.

The utility is now upgrading the Cinnaminson facility. It is also considering another recovery project for an industrial customer at a landfill in Pennsauken, but Pardus said there are still a number of matters to be resolved.

APPENDICES:
ANALYSIS OF RELEVANT
TAX LAWS

APPENDIX A. ACCELERATED DEPRECIATION
UNDER THE ECONOMIC RECOVERY TAX ACT OF 1981

The Economic Recovery Tax Act of 1981 completely changed the rules pertaining to depreciation. For property placed in service after 1980, the rules have been modified to the extent that salvage value and useful life are not longer relevant. Depreciation is determined for qualified property under a series of tables which show the percentage of cost that are to be recovered as expenses in a given year. The percentages shown in the tables become more favorable to taxpayers for property placed in service in later years. The relevant portion of the tables from §168(b)(1)(A) are shown on the following pages.

For property placed in service after December 31, 1980, and before January 1, 1985.

The applicable percentage for the class of property is:

If the recovery year is:	5-year	10-year	15-year Public utility
1	15	8	5
2	22	14	10
3	21	12	9
4	21	10	8
5	21	10	7
6		10	7
7		9	6
8		9	6
9		9	6
10		9	6
11			6
12			6
13			6
14			6
15			6

For property placed in service in 1985.

The applicable percentage for the class of property is:

If the recovery year is:	5-year	10-year	15-year Public utility
1	18	9	6
2	33	19	12
3	25	16	12
4	16	14	11
5	8	12	10
6		10	9
7		8	8
8		6	7
9		4	6
10		2	5
11			4
12			4
13			3
14			2
15			1

For property placed in serviced after December 31, 1985.

The applicable percentage for the class of property is:

If the recovery year is:	5-year	10-year	15-year Public Utility
1	20	10	7
2	32	18	12
3	24	16	12
4	16	14	11
5	8	12	10
6		10	9
7		8	8
8		6	7
9		4	6
10		2	5
11			4
12			3
13			3
14			2
15			1

Classification of Cogeneration Equipment. Under the new rules the method of depreciation for public utility property and its classification under the new ACRS Tables depends on a number of factors.

First, public utility property (which is property owned by a utility whose rates are regulated, §167(1)(3)(A)) is depreciated under the new ACRS Tables only if the utility uses a normalized method of accounting (e.g., uses reserves for deferred taxes to reflect differences between book and tax depreciation). It is our understanding that PSE&G uses a normalized method of accounting.

Second, the ACRS class that a particular asset will fall in (5, 10 or 15 yr) depends primarily on how the asset was classified under the old asset depreciation rules, §167(1). Utility equipment with a life of between 18 and 25 years will be 10 year property (§168(e)(2)(c)), and utility equipment with an ADR life of 25 years or more will be 15 year property. §168(c)(2)(E). Other production equipment will be in the 5 year class. Trucks will be in a special 3 year class, which has not been discussed here because discussion would be immaterial.

Under the old asset depreciation rules, the class lives of utility equipment is set out in Rev. Proc. 77-10:

<u>Class</u>	<u>Property</u>	<u>Life</u>
49.13	Electric Utility Steam Production Plant	28
49.15	Electric Utility Combustion Turbine Production Plant	20
49.4	Central Steam Utility Production and Distribution	28
49.5	Waste Reduction and Resource Recover Plant	10

The majority of assets that would be part of the district heating utility system would most likely fall within either the electric or central steam utility production and distribution equipment classes. These have a 28 year life. Hence depreciation would presumably be subject to the 15 year ACRS asset tables.

It should be noted that the preceding discussion is predicated on the property involved being classified as public utility property. Should the property in question be owned by an entity which is not a public utility then a different set of rules would apply. In this case most of the assets would be considered equipment (See §1245(a)(3)), and therefore meet the definition of 5 year class property. §168(a)(2)(D).

Consequently, a determination of whether a particular entity is a public utility within the meaning of §167(1)(3)(A) is critical. See §168(g)(1).

Leasing. In the case of a lease, the regulations make it clear that under current law a utility cannot avoid specific restrictions on its use of accelerated depreciation methods by way of a leasing transaction. Treas. Reg §1.167(1)-3(b)(1) clearly states that:

"leased property qualifies as public utility property under section 167(1) if the predominant use of such property by the lessee or any sub-lessee is in section 167(1) public utility activity."

While there are currently no regulations under the new ACRS system, we would assume a similar rule would apply to prevent the use of leasing techniques to convert 15 year class utility property into 5 year class property.

APPENDIX B. LEASES UNDER THE ECONOMIC RECOVERY TAX ACT OF 1981

The Economic Recovery Tax Act of 1981 opened some new possibilities for the use of lease financing as a way of using leasing techniques to obtain tax benefits not otherwise available, or to obtain those benefits immediately where they would otherwise be deferred.

The use of the lease technique predates the 1981 Tax Act. However, the new Act dramatically liberalized the tax rules in this area, though at the same time left existing rules in place for certain types of lease transactions. In this context, we will outline the tax rules which existed prior to the 1981 Act, describe the situations in which they remain in effect, and then describe the new "safe harbor" provisions outlined in the 1981 Act.

A. Rev. Proc. 75-21

The IRS has typically approached leases under an analysis which tries to determine whether a transaction which purports to be a lease is so in fact, or is rather an installment sale disguised as a lease.

Under §167 depreciation is allowed to the owner/lessor property and not to the lessee. Similarly, investment credit is available under §§ 46-48 only to the owner of property, though under certain circumstances, as described in 48(d), the owner may elect to waive his credit and pass it through to a lessee.

If parties to a transaction structure it as a lease with the lessor entitled to credits and depreciation, and the IRS reclassifies the transaction as a sale then the lessor would lose the depreciation writeoffs and the ITC, which would then belong to the lessee. This outcome would effectively ruin the economics of the deal so reclassified.

The basic rules for determining whether a particular transaction is considered a sale or a lease are found in Rev. Proc. 75-21. In this document the IRS outlined a series of guidelines for distinguishing true leases. Briefly these guidelines require:

- that the lessor make and maintain minimum "at risk" investment in the property of 20%. (This means that 100% nonrecourse financing cannot be used, though recourse financing would be considered as part of the lessor's investment).
- It is anticipated that at the end of the lease term (including renewals) the property will have at least 20% of its original value.
- The lease term, including renewals, must not exceed 80% of the asset's useful life.
- Any options to purchase by the lessee must be at fair market value price.
- The lessee may not finance the project or guarantee any lessor debt.
- The lessor must demonstrate that it expects a profit from the project aside from tax benefits.

In addition, in Rev. Proc. 76-30 the IRS has indicated that it will not issue rulings pertaining to certain "limited use" property. Limited use property has been defined as property that is not expected to be useful to the lessor at the end of the lease term except for continued leasing to the original lessee. Section 5 of Rev. Proc. 76-30 sets out a number of examples of limited use property transactions. In example (5) a power plant was held to be limited use property where the lessor did not have rights to a fuel source. In example (6) the conclusion was reversed where the lessor also had the option to acquire the lessee's fuel source at the end of the lease term.

These rules remain in effect for individuals. However, under newly enacted rules, corporate lessors may elect to avoid Rev. Proc. 75-21.

B. Economic Recovery Tax Act Changes

The Economic Recovery Act of 1981 has completely liberalized the rules set out in Rev. Proc. 75-21. In certain transactions, the rules set out in Rev. Proc. 75-21, 75-28, and 76-30 no longer apply, and the form of a transaction will govern over its substance. Under this new provision (see §201(a) of the Act), parties to a transaction that would otherwise be considered a sale (under Rev. Proc. 75-21) have the option of treating the transaction as a lease, thereby allocating the tax benefits to the lessor. Under new Code 168(f)(8), if all parties to an agreement characterize the transaction as a lease it shall be so treated provided certain qualifications are met:

- Corporate Lessor. The lessor must be a corporation (Rev. Procs. 75-21, 75-28, and 76-30 remain in effect for individuals)
- 10% at risk requirement. The lessor must have a minimum investment at the time the property is placed in service of 10% of the adjusted basis of the property, and must maintain that percent investment at all times during the term of the lease.
- Lease term requirement. The lease term cannot exceed the greater of 90% of the property's useful life, or 150% of present ADR class life.
- Qualified lease property. The property must be new section 38 property of a kind which qualifies for the ITC. In addition, the parties have 3 months from the time property was placed in service in which to actually transact the lease without affecting the status of the property as new Section 38 property.

These are the essential requirements of a safe harbor lease. The option price, special use, and economic profit requirements of the IRS's Rev. Procs. are waived where the parties elect the new safe harbor provisions.

APPENDIX C. CLASSES OF PROPERTY QUALIFYING FOR
TAX EXEMPT REVENUE BOND FINANCING

The following are classes of property which may qualify for exempt revenue bond financing, and therefore warrant consideration:

1. Qualified steam-generating facilities (§103(g));
2. Facilities for the local furnishing of gas, or solid waste or sewage disposal facilities. (§103(b)(4)(E));
3. Facilities for the furnishing of water to the public under regulated rates (§103(b)(4)(G));
4. Certain small issues (§103(b)(6));
5. Miscellaneous provision: industrial parks, sports facilities, pollution control (§103(b)(4))

Qualified Steam-Generated Facilities. Steam-generating facilities are specifically mentioned as facilities for which tax-exempt revenue bonds may be available. However, the facilities must meet certain very strict qualifications. Specifically, a facility must depend on solid waste for more than half of its fuel (determined on a BTU basis); substantially all of the solid waste derived fuel must be produced at an adjacent facility; and the same person must own both facilities. §103(g). PSE&G has suggested that a solid waste steam distribution facility at the Essex plant is under consideration. Otherwise, the Essex and the Hudson plants do not appear to offer any opportunity under this provision.

Gas Distribution Facilities. A provision allowing the use of tax-exempt revenue bonds to finance facilities for the local furnishing of gas may be considered steam distribution facilities. (§103 (b)(4)) We understand PSE&G has considered a steam distribution system for the Essex facility. The IRS may very likely oppose tax-exempt status for steam facilities on the basis that steam is not a "gas" within the meaning of the statute. See Revenue Ruling 78-12 in which a steam distribution system was

held to be outside of the provisions allowing the use of the exempt bonds for the financing of gas distribution systems. However, in Reich et al. v. Comm., 72-USTL ¶ 9202 (9th Cir, 1972), the IRS unsuccessfully challenged a depletion deduction for geothermal steam on the grounds that the production of geothermal steam was not a gas within the meaning of the depletion provisions. The court held that the term "gas" was to be interpreted literally and that steam was a gas. We see no reason why the same logic would not apply here, but the final determination would be made by bond counsel, and may be challenged by the IRS. Should the IRS fail to rule favorably, a declaratory judgement by the Tax Court on the issue of bond exemption under §7478 should be sought.

The other major statutory requirement with respect to steam production involves the requirement that the product be furnished locally. The IRS regulations (Reg. §1.103-8 (f)(2)(iii)(d)) define this to mean that the system is providing service in no more than two contiguous counties. While PSE&G's electric services encompass more than two counties, a particular cogeneration project probably would not. The IRS, by regulation, has added the additional requirement that a facility "must serve or be available to the public on a regular basis," and that a facility for the use of a limited number of persons in their trades or businesses would not qualify. Treasury Regulation §1.103-8(a)(2). The regulations further explain that a use by a company which in turn engages in an activity which serves the general public would be considered as meeting the public use requirement, but that providing services to a single manufacturing plant would not.

In view of PSE&G's overall plan to provide district heating to large commercial, apartment and industrial users, an IRS ruling on the issues raised would be necessary. However, Rev. Rul. 78-12 clouds whether the ruling would be favorable.

Water Distribution. In the case of the Essex and Hudson plants, we understand that the cogeneration system will distribute hot water. In this regard, revenue bonds used to finance facilities for the furnishing of water for any purpose are tax exempt if two conditions are met: 1) the water is made available to the general public; and 2) the rates are regulated. Industrial, commercial and electric utility users are considered to be part of the public, by reason of a specific statutory amendment to §103(b)(3)(G)(i). And, recently, the IRS ruled in P.R. 80421138 that a water facility initially built to serve a single industrial user qualifies on the theory that the facility was a component part of a public water system.

Attention should also be given to the requirement pertaining to regulated rates. It is PSE&G's understanding that rates will, in part, be regulated for water distribution but that the final determination would lie with the New Jersey Board of Public Utilities. The determination would be made in conjunction with consideration of other issues by bond counsel. However, due to the fact that retrofit of power plants would involve installation of equipment not connected with furnishing water (e.g., generators), it may be necessary to obtain an IRS ruling to determine which equipment would be eligible for exempt bond financing.

Small Issue Exemption. Should no other provision be available to qualify a revenue bond as tax exempt, then the small issue provision may have some application. This exception is subject to numerous and complex restrictions. The most relevant of these is the \$10,000,000 limitation. Under this provision, the user of a facility is limited to an aggregate of \$10,000,000 of exempt financing for facilities in the same incorporated municipality, or in the same county (not taking into account facilities in incorporated municipalities within the county).

The large capital needs associated with cogeneration projects make the small issue exemption a less likely option. However, in cases where private ownership and financing of

peaking units is considered, the small issue exemption may be a means of having potential customers finance their purchase of peaking units. See discussion of Option 7 in text and Appendix.

Miscellaneous Provision - A series of miscellaneous provisions might also be available provided certain circumstances are involved. For example, peaking units installed with respect to convention centers, sport facilities and airports might be included under this provision.

In the case of industrial parks, the same would be true to the extent the distribution system would be considered a land improvement. However, the regulations pertaining to land improvements are somewhat restrictive in that they cover only such items as incidental "water" facilities and a class referred to as "similar" facilities." Reg. §1.103-9. This provision may have some application with respect to the Meadowlands project, but a ruling on the "water" or similar facilities provisions would be advisable.

Financing for sewage or solid waste disposal is also exempted. §103(b)(4)(E). An argument might be made that if the Essex plant's entire output is used by a waste disposal operation that the steam cogeneration and distribution system is actually an integral part of that and therefore covered by this exemption. Again a ruling would be necessary.

It has also been suggested that a cogeneration system might fall within the exception for pollution control equipment (§103(b)(3)(F)) on the theory that thermal pollution of rivers is avoided if waste steam is used in a district heating project. The regulations make acceptance of this theory unlikely. In the case of property serving a "significant purpose" other than controlling pollution, only the incremental cost qualifies. Reg. §1.103-8(g)(2)(iv).

In all of these cases, the use of a particular exemption will depend on particular facts and would encompass only the financing of property within that particular class of exception. Consequently, the use of any particular exception would depend on analysis of the facts, opinion of bond counsel, and rulings from the IRS.

APPENDIX D. EFFECT OF TAX-EXEMPT BOND FINANCING
ON AVAILABILITY OF CREDITS

Energy Credits

In cases where tax-exempt bonds are used to finance qualified energy property, the amount of otherwise available credits will be reduced. §48(1)(11). Exactly how much of otherwise available credits will be lost will depend on the type of property involved and the date it is placed in service.

In the case of cogeneration equipment, exempt bonds or other "subsidized energy financing" will not be included in the qualified basis of energy property available for the credits. The amount of exempt bond or subsidized energy financing to be removed from the basis of qualified property is determined under an allocation formula which treats the proceeds as having been used pro rata to finance both qualified and nonqualified equipment. §48(1)(11)(B). For example, if 60% of a project is financed with exempt bonds, 60% of the cost of otherwise qualified energy property would not be available for energy credits.

In the case of heat exchangers and certain other "specially defined energy property" which qualify for energy credits, use of the exempt bond financing will lead to a 1/2 reduction of the energy credit (from 10% to 5%, typically) for items placed in service prior to January 1, 1983. The use of subsidized energy financing will have no effect on the computation of energy credits in the case of heat exchangers and other specially defined energy property. See §223(c)(2) of P.L. 96 -223 relating to effective dates.

Investment Credits

The use of tax-exempt bonds or subsidized energy financing will not affect in any way the computation of otherwise available investment credits. However, to the extent government grants are

available, the IRS would take the position that the basis should be reduced by the amount in computing credits regardless of the type of property. In this regard, §362(c) states a rule for reducing basis in the case of contribution to capital by nonshareholders.

APPENDIX E. INVESTMENT TAX CREDIT RULES

Eligibility. An investment in certain qualified depreciable property with a three-year or more useful life entitles the owner to a tax credit that can equal as much as 10% of the cost of the property. The property must be used in the United States.

Qualified investment credit property includes, in relevant part:

1. Tangible personal property §48(a)(1)(A);
2. Other tangible property (not including a building and its structural components) but only if such property is used as an integral part of manufacturing, production, or extraction, or of furnishing transportation, communication, electrical energy, gas, water, or sewage disposal services. §48(a)(1)(B); or
3. Bulk storage facilities for fungible commodities for use in any activity described in (2) §48(a)(1)(B).

While electric utilities have considerable tangible property which qualifies for the investment credit, the majority of a utility's capital investment is in power generating plants and transmission equipment. Since this equipment is for the most part considered to be real rather than personal property, it would qualify under the second category as property used as an integral part of furnishing electrical energy services. Cogeneration equipment, including transmission equipment, would presumably also qualify under this category as tangible personal property used as an integral part of providing gas or water services.

Should independent third parties own any of the cogeneration production or transportation equipment, the availability of the credit then would depend on their ability to show that the equipment falls into one of the categories of qualified property, e.g., as tangible personal property, or as other property used as an integral part of manufacturing or production, or in the

distribution of gas or water services. It is worth noting that the IRS takes a very narrow view of this provision, arguing in a number of instances that property does not qualify as "other property" where not directly used in manufacturing or production, or where the owner is not in the business of "selling" utility services. See Rev. Rul. 68-184; Westroads Inc, 69 T.C. 682; and Johnston v U.S., 80-1 USTC ¶ 9199. (D.C. Mont), but note that the taxpayer prevailed in these cases, though in Johnston on the theory that the property was tangible personal property. The cost of qualified property is available for a credit depending upon its ACRS class, as follows (§46(c)(7)):

<u>ACRS LIFE</u>	<u>% of Cost Available</u>
3 yr	6%
5, 10 or 15 yr.	10%

Note: If property is disposed of prior to the expiration of its ACRS life then all or a portion of the credit will be recaptured, depending on the length of time the property is held. See §47(a)(5). The recapture of the % of credit taken on ten and fifteen ACRS class property is as follows:

<u>Time Held</u>	<u>Amount Recaptured</u>
0-1 year	10%
1-2 year	8%
2-3 year	6%
3-7 year	4%
4-5 year	2%
5 or more	0%

The amount of the credit computed is then offset dollar for dollar against the first \$25,000 of tax liability. A percentage of tax liability in excess of \$25,000 may be offset by remaining credits. §46(a)(3). This percentage is:

<u>For years ending in:</u>	
1981	80%
1981 or later	90%

Consequently, the maximum credit is obtained on property with a seven year or more life, and the credit cannot be used to eliminate a taxpayer's full tax liability in cases where liability exceeds \$25,000.

Any remaining unused credit may be carried back three years and forward fifteen.

Claiming the Credit. The credit is claimed in the year in which a plant is placed in service. This is the year in which all critical testing has been completed and the plant is in a state of readiness. Reg. §1.46-2(d). However, in the case of long-term projects (those taking two year or more to complete), and having a seven-year or more life, an election may be made to take credit as progress expenditures as made. §46(a)

Leasing. In the case of a lease that meets the provisions of Rev. Procs. 72-21 and 76-30, or falls within the new safe harbor lease provisions of §168(f)(8), the lessor would obtain the credit.

APPENDIX F. ENERGY TAX CREDIT RULES

As an incentive for the production of alternatives to oil or gas fuels, and to encourage industry to economize on its use of energy, Congress has enacted a series of energy tax credits for investment in qualified properties. The amounts of the credits, their expiration dates, and the type of properties which qualify, are outlined in the table on the following page.

The energy tax credit operates independently of the regular investment credit. Consequently, the fact that a property qualifies for energy credits does not necessarily mean that it will also qualify for the investment credit. However, in many cases property will meet the requirements of both energy property and investment credit property (generally the combined credit will equal 20% of cost.)

Some of the features which distinguish the energy credit from the investment credit are that only new property qualifies for the energy credit, whereas \$125,000 per year of used property qualifies for ITC; energy property may be a structural component of a building, whereas the general rule is that ITC property may not be; and the energy credit may offset 100% tax liability while the ITC is limited to 80% of tax liability above \$25,000 for 1981. See generally §48(1)(1).

In order to qualify for energy credits, property must fall within certain narrowly defined categories. However, property which otherwise qualifies as energy property may not be available for the credit if used by a public utility. §48(1)(17). This exception is extremely important with respect to PSG&E's plans, and will be discussed in detail subsequently. The relevant categories of energy property that deserve mention in the context of PSG&E's cogeneration project plans are:

- . Cogeneration equipment §48(1)(14);
- . Boilers fueled by alternate substances (fuels other than oil or gas) §48(1)(3)(i); and

- . Specially defined energy property (particularly heat exchangers) §48(1)(5)(D);
- . Public utility property

Cogeneration Equipment. Cogeneration equipment is a separate category of energy property §48(1)(14), and one which could appear tailored to PSG&E's project plans. This category covers cogeneration equipment in a system to the extent it increases cogeneration capacity at an industrial or commercial facility which, as of Jan. 1, 1980, was producing electricity or qualified energy provided that the system does not use oil or gas as its primary fuel. However, use of these fuels for back-up or flame control or as a supplemental fuel is permitted if they represent less than 20% of yearly BTU consumption.

The Hudson plant is coal fired; the Essex plant is oil fired. Consequently, cogeneration equipment installed at the Hudson plant would appear to qualify. However, §48(1)(17) specifically states that cogeneration property which is public utility property (discussed infra) does not qualify for energy credits. See, however, our discussion of ownership of Hudson plant retrofit by a joint venture which sells its output back to PSE&G. Substation and peaking units, as well as transport equipment, are not cogeneration equipment.

Alternative Energy Property - Boilers fueled by an alternative fuel qualify for energy credits §48(1)(3)(i). Coal is an alternative fuel, but oil and gas are not. Substation boilers, to the extent they are coal fired, would fall within this definition. However, it is our understanding that peaking units are to be fired by gas.

We understand that PSE&G may derive its gas from landfills. While the equipment used to obtain this gas might be considered alternative energy property, the gas is still not considered to be an alternative fuel. Hence, boilers using this gas would not be alternative energy property for which the credits are available.

Again, the credit would be denied to the extent the property is public utility property.

Specially Defined Energy Property. Retrofit items such as heat exchangers qualify as energy property provided they are installed in "industrial or commercial processes" carried on prior to October 1, 1978. Under IRS regulations, heat exchangers are defined as equipment which receives energy, usually in the form of waste heat, from high temperature gases, liquids, or solids for transfer to low temperature gases, liquids, or solids. Reg. §1.48-9(f)(7).

Since heat exchangers are expected to be used to retrofit customers' heating systems so the latter can accept steam or hot water, the customers would also have to meet the above requirements. In other words, heat exchangers installed with respect to a customer's new construction would not qualify (e.g., the Meadowlands). Further, in defining the term "process" the IRS has indicated that equipment installed in connection with retail sales, general office use, and "residential use," does not qualify. Reg. §1.48-9(f)(3). The IRS definition of process would prove to be very limiting, since many of the PSG&E's potential customers for cogeneration would be office, apartment or retail buildings.

Public Utility Property - The availability of energy credits are severely restricted for energy property owned by a public utility. §48(1)(17). Public utility property is defined for purposes of energy credits by cross reference to §46(f)(5). Section 46(f)(5), in turn, defines the term public utility property by further cross reference to §46(c)((3)(B), which essentially provided that public utility property means property used predominately in the business of furnishing or selling:

- 1) electrical energy water or sewage disposal services;
or
- 2) gas through a local distribution system,

but, only if the rates for furnishing the service or for the sale of the product are established or approved by a governmental body.

The key then is whether the furnishing of hot water or steam is regulated. If it is, the cogeneration property would be considered public utility property, and the energy credit would be denied. If it is not, the cost of the property which otherwise meets the requirements for energy credits, would enter into the computation of those credits.

Note: We cannot at this point suggest an answer as to whether the New Jersey Board of Public Utilities would regulate the sale of cogenerated water or steam.

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