

A RAND NOTE

AN UPDATED DATA BASE FOR LIGHT WATER
REACTOR POWER PLANTS

William E. Mooz

October 1982

N-1899-RC



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PREFACE

Statistical analyses of light water reactor power plants require a carefully constructed data base that includes information about as many of these plants as is possible. Since plants under construction continue to be completed and enter commercial operation as time passes, the data base is continually expanding.

The purpose of this Note is to list the available data as of the spring of 1982, and to present them in a form consistent with that used heretofore by the author. Consequently the data are shown in easy-to-read tables, as well as in machine-readable format, and should be of interest and use to the community of governmental and private analysts who work with nuclear power plants.

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INTRODUCTION

In June 1978 and December 1979, the author published cost analyses[1] of light water reactor power plants. Those analyses relied upon the then available cost data, and a large part of the effort was expended on development of a consistent data base. That data base proved popular with other analysts, and its whole or partial use has pervaded many other cost studies.

Data about light water reactor power plants change steadily. New plants come on-line as time passes, and the store of information about licensing time, construction time, and cost steadily increases. Therefore, to assist in future analysis of nuclear power plants, I have updated my data base to July 1981 (reflecting 1981 dollars), using information published by the Department of Energy (DOE) in September 1981 and unpublished information obtained from the Federal Energy Regulatory Commission (FERC) in the spring of 1982.

Tables 1, 2, and 3 present the most recent estimates of capital cost. Table 1 lists the most accurately known costs. These are based upon data submitted annually to the FERC by utilities. The data have been adjusted to 1981 dollars by methods described in the first publication on this subject[2].

Table 2 lists the same information for plants that are operating, but which for various reasons have yet to submit their costs to the

[1] William E. Mooz, Cost Analysis of Light Water Reactor Power Plants, The Rand Corporation, R-2304-DOE, June 1978; and William E. Mooz, A Second Cost Analysis of Light Water Reactor Power Plants, The Rand Corporation, R-2504-RC, December 1979.

[2] R-2304-DOE, page 54 ff.

Table 1
CAPITAL COST DATA FOR OPERATING LWR POWER PLANTS

DOE NO.	NAME	FERC COSTS (mixed current dollars, millions)		One Year after commercial operation	COST (1981 dollars)	SIZE (MWE)	COST (1981 dollars per KWE)
		Year commercial operation began	Year after commercial operation				
24	Pilgrim 1	231.54	239.33	(4)	672.30	655	1,026.41
27	Turkey Point 3	108.71	146.69	(4)	303.21	693	437.54
29	Palisades	NR	276.18	(1)	421.68	805	523.83
34	Browns Ferry 1	NR	276.18	(1)	710.60	1,065	667.24
35	Browns Ferry 2	256.33	276.18	(1)	695.25	1,065	652.81
36	Oconee 1	155.61	(4)		416.04	887	469.03
37	Oconee 2	160.42	160.42	(1,3)	410.30	887	462.58
39	Peach Bottom 2	371.08	376.99	(1)	967.56	1,065	908.50
40	Peach Bottom 3	371.08	376.99	(1)	952.55	1,065	894.41
41	Salem	850.32	850.98	(1)	1,945.35	1,090	1,784.72
42	Vermont Yankee	172.04	184.48		504.57	514	981.66
43	Fort Calhoun 1	173.87	175.80	(4)	463.14	490	945.18
44	Surry 1	146.71	(4)		397.87	822	484.02
45	Surry 2	250.15	(3)		667.55	822	812.09
47	Three Mile Is. 3	398.34	400.93		1,013.87	819	1,237.93
49	Crystal River 3	365.54	415.17		942.39	825	1,142.28
50	Kewaunee 1	202.19	203.39		514.73	535	952.12
51	Maine Yankee	NR	219.23		587.99	825	712.70
53	Prairie Island 1	233.23	(4)		601.62	530	1,135.12
55	Three Mile Is. 2	715.47	719.29	(4)	1,498.58	906	1,654.06
56	Zion 1	275.99	(4)		711.92	1,040	684.53
57	Arkansas One 1	233.03	238.75		589.62	850	693.66
58	Cooper	246.27	269.29		675.47	778	868.21
60	Turkey Point 4	122.53	(4)		317.30	693	457.85
61	Calvert Cliffs	428.75	430.67		1,044.16	845	1,235.69
62	Calvert Cliffs 2	335.32	347.04	(3)	777.50	845	920.12
63	Oconee 3	160.42	160.42	(1,3)	395.04	887	445.36
64	Salem 2	680.51	(5)		1,332.30	1,170	1,138.71
65	Browns Ferry 3	300.97	(3)		674.60	1,065	633.43
66	Prairie Island 2	172.14	176.98	(3)	434.57	530	819.94
67	Donald Cook 1	583.61	544.65		1,300.67	1,054	1,234.02
68	Donald Cook 2	451.53	481.18	(3)	944.35	1,100	858.49
69	Zion 2	289.83	292.00	(3)	721.61	1,040	693.84
70	Rancho Seco 1	343.62	343.44		828.17	918	902.14

Table 1--continued

FERC COSTS (mixed current dollars, millions)						
DOE NO.	NAME	Year commercial operation began	One Year after commercial operation	COST (1981 dollars)	SIZE (MWE)	COST (1981 dollars per KWE)
71	Beaver Valley	NR	598.72	1,355.19	852	1,590.60
74	North Anna 1	781.74	(5)	1,624.67	907	1,791.25
75	Edwin Hatch 1	390.39	390.39	912.48	777	1,174.36
76	St. Lucie 1	NR	486.23	1,106.89	802	1,380.16
77	Millstone 2	418.37	426.27	990.69	870	1,138.72
78	Brunswick 1	318.44	325.81 (3)	714.61	821	870.42
79	Brunswick 2	382.25	389.12	904.79	821	1,102.06
80	Duane Arnold 1	288.82	279.93	667.76	538	1,241.19
89	Davis Besse 1	635.15	634.83	1,304.00	906	1,439.28
90	Trojan	451.98	451.98	999.90	1,130	884.86
92	Jos. Farley 1	727.43	734.52	1,461.63	829	1,763.12
98	North Anna 2	534.13 (3)	(5)	958.78	978	980.35
101	Edwin Hatch 2	528.03	(5)	911.43	784	1,162.54
102	Arkansas One 2	638.36 (3)	662.57 (3)	1,197.69	943	1,270.08
110	Jos. Farley 2	780.652 (3)	(5)	1,291.36	888	1,454.23

NOTE: DOE = Department of Energy; FERC = Federal Energy Regulatory Commission; MWE = Megawatts electrical; KWE = Kilowatts electrical. Numbers in parentheses indicate the following: (1) half the cost of two units; (2) one-third the cost of three units; (3) value obtained by subtraction of previous units; (4) cannot estimate due to additional units being reported; (5) no data available for this year; NR, not reported.

^a As assigned in U.S. Department of Energy, 2/11/S. Central Station Nuclear Electric Generating Units: Significant Milestones 2/R1/DOE/NE-0030/3(81), U.S. Department of Commerce, NTIS, Springfield, VA, September 1981.

Table 2

ESTIMATED CAPITAL COST DATA FOR OPERATING LWR POWER PLANTS

a DOE No.	NAME	ESTIMATED COST (mixed current dollars, millions)	COST (1981 dollars, millions)	SIZE (MWE)	COST (1981 dollars per KWE)
59	Indian Point 3	551	1,275	965	1,321
81	Sequoyah 1	632	1,192	1,140	1,048
82	Sequoyah 2	632	1,149	1,148	1,001
91	James Fitzpatrick	347	793	821	965

a
As assigned in U.S. Department of Energy, U.S. Central Station
Nuclear Electric Generating Units: Significant Milestones, DOE/NE-
0030/3(81), U.S. Department of Commerce, NTIS, Springfield, VA,
September 1981.

Table 3

ESTIMATED CAPITAL COST DATA FOR NEARLY COMPLETED LWR POWER PLANTS

^a DOE No.	NAME	ESTIMATED COST (mixed current dollars, millions)	COST (1981 dollars, millions)	SIZE (MWE)	COST (1981 dollars per KWE)
46	Diablo Canyon 1	627 (1)	1,287	1,084	1,188
87	Diablo Canyon 2	627 (1)	1,191	1,106	1,077

NOTE: Numbers in parentheses indicate the following: (1) half the cost of two units; (2) one-third the cost of three units; (3) value obtained by subtraction of previous units; (4) cannot estimate, due to additional units being reported; (5) no data available for this year; NR, not reported.

^a

As assigned in U.S. Department of Energy, U.S. Central Station Nuclear Electric Generating Units: Significant Milestones, DOE/NE-0030/3(81), U.S. Department of Commerce, NTIS, Springfield, VA, September 1981.

FERC. Estimates of the costs of these plants were taken from public hearings at which the utility testified, or from information supplied to public utility commissions by the utilities.

Table 3 has similar estimates for Diablo Canyon units one and two. These are listed as almost completed because the definition of completion used here is the issuance of an operating license. While construction of these units probably was completed some time ago, numerous delays in granting operating licenses have occurred; hence their listing in Table 3.

Table 4 is a complete data listing of all LWR power plants presently included in the latest issue of the DOE reference used in previous studies[3]. All data used in the statistical analyses in the two earlier studies are included, and the format is the same.

Research analysts in the field should find this data base useful in performing up-to-date analyses of trends in light water reactor power plants.

[3] U.S. Department of Energy, U.S. Central Station Nuclear Electric Generating Units: Significant Milestones, DOE/NE-0030/3(81), U.S. Department of Commerce, NTIS, Springfield, VA, September 1981.

Table 4 (cont.a)

7769.0870.9275.67	22	57	3	870	1	N	990.69	1	120	
7868.5070.0876.67	19	79	6	821	1	S	714.61	1	41	
7968.5070.0874.92	19	53	11	921	1	S	904.79	1	3	
8068.8370.4274.08	19	44	11	538	1	C	667.76	11	119	
8969.5071.1777.25	20	73	7	906	1	C	1304.00	1	1122	
9069.4271.0875.83	20	57	11	1130	1	W	999.90	1	121	
9269.7572.5877.42	34	58	6	829	1	S	1461.63	1	123	
9869.1771.0980.25	23	110	8	907	1	S	958.78	1	101	
10170.5072.9278.42	29	66	15	784	1	S	911.43	11	1261	
10270.6772.9278.67	27	69	18	912	1	M	1197.69	1	124	
11070.4272.5880.75	26	98	8	29	1	S	1291.36	1	1231	
5967.2569.5875.92	28	76	8	965	1	N	1275.06E	1	2	
8168.7570.3380.08	19	117	1	140	1	S	1192.01E	1	3	
9268.7570.3381.42	19	133	1	148	1	S	1149.30E	1	31	
9168.9270.3374.75	17	53	9	821	1	N	792.81E	1	7	
4667.0068.25	15			1084	1	W	1287.38E	1	1	
8768.4270.92	30			1106	1	W	1190.87E	1	21	
9670.6773.0891.00	29	95	1	180	1	S		1	1	
2165.2566.0069.92	9	47	8	794	1	C	251.51T	1	3	
2365.8366.2569.67	5	41	10	470	1	N	251.40T	1	1	
2565.8366.3370.75	6	53	5	660	1	N	289.56T	1	1	
2665.9266.7571.75	10	60	22	873	1	N	575.08T	1	1	
2866.0866.7571.00	8	51	9	794	1	C	299.94T	1	41	
3066.5067.2570.58	9	40	7	700	1	S	241.32T	1	2	
3166.5867.5070.75	11	39	2	497	1	C	218.82T	1	110	
3266.5867.4270.67	10	39	9	545	1	C	304.90T	11	1	
3366.3367.0871.67	9	55	11	789	1	C	294.99T	1	5	
3866.5867.0872.17	6	61	7	789	1	C	290.96T	1	51	
5267.5068.5071.83	12	40	17	497	1	C	188.99T	1	1131	
8969.2572.67	41			1093	1	C		11	9	
9570.2572.75	30			810	1	C		11	10	
9369.0072.92	47			460	1	C			1125	
8469.0072.92	47			811	1	C			1125	
10771.3373.00	20			1177	1	S		1	4	
10971.3373.00	20			1177	1	S		1	4	
9770.6773.08	29			1180	1	S		1	11	
11171.4273.17	21			900	1	S		1	4	
11271.5873.17	19			1093	1	R		11	5	
5468.3373.25	59			819	1	N		1	11	
10370.8373.67	34			1078	1	C		1	11	

Table 4 (cont.b)

10470-8373.67	34	1078	1	C	1	111	1	111
9970-3373.75	41	1100	1	M	1	127	1	127
10070-3373.75	41	1100	1	M	1	1271	1	1271
8571-1773.83	32	1050	1	N	11	128	11	128
9671-1773.93	32	1050	1	N	11	1281	11	1281
4870-5874.33	45	643	1	C	11	12	11	12
12272-8374.33	18	833	1	N	11	121	11	121
7270-1774.42	51	1055	1	N	11	129	11	129
7370-1774.42	51	1055	1	N	11	1291	11	1291
12073-0974.42	16	1110	1	S	11	130	11	130
12173-0874.42	16	1110	1	S	11	1301	11	1301
12372-4274.42	24	1099	1	N	1	13	1	13
11971-6774.50	34	907	1	S	1	14	1	14
14773-0874.58	18	1156	1	N	1	15	1	15
12472-8374.67	22	1250	1	C	11	131	11	131
12572-8374.67	22	1250	1	C	11	1311	11	1311
9370-0874.83	57	1067	1	N	11	132	11	132
9470-0874.93	57	1067	1	N	11	11	11	11
10970-9274.83	47	1113	1	M	1	5	1	5
10573-4274.92	18	1213	1	S	1	5	1	5
10673-4274.92	18	1213	1	S	1	51	1	51
13673-5074.92	17	1111	1	M	1	1	1	1
13773-5074.92	17	1111	1	H	1	11	1	11
13272-7575.58	35	1145	1	S	11	2	11	2
13372-7575.58	35	1145	1	C	11	21	11	21
11773-6775.92	27	1120	1	C	11	13	11	13
11873-6775.92	27	1120	1	C	11	131	11	131
13473-6775.92	27	1120	1	C	11	13	11	13
13573-6775.92	27	1120	1	C	11	131	11	131
14073-7575.92	26	1219	1	W	1	1	1	1
15674-5075.92	17	1250	1	M	1	11	1	11
15774-5075.92	17	1250	1	H	1	11	1	11
12973-5076.50	36	1200	1	N	1	6	1	6
13073-5076.50	36	1200	1	N	1	61	1	61
14573-7576.08	28	933	1	C	1	14	1	14
14673-7576.08	28	933	1	C	1	141	1	141
16674-4276.25	22	1120	1	H	11	133	11	133
16874-4276.25	22	1120	1	H	11	1331	11	1331
16074-7576.33	19	1270	1	W	1	134	1	134
16174-7576.33	19	1270	1	W	1	1341	1	1341
16274-7576.33	19	1270	1	W	1	134	1	134
13173-6777.17	42	934	1	M	11	16	11	16
15973-6777.17	42	934	1	M	11	161	11	161
12773-5077.33	46	1205	1	C	11	5	11	5
12873-5077.33	46	1205	1	C	11	51	11	51
13973-3377.33	48	810	1	S	1	61	1	61
14174-6777.33	32	1233	1	S	11	6	11	6
14274-6777.33	32	1233	1	S	11	61	11	61
14374-6777.33	32	1233	1	S	11	6	11	6
14474-6777.33	32	1233	1	S	11	6	11	6

PLANTS
UNDER
CONSTRUCTION

Table 4 (cont.c)

16774.3377.33	36	1150	1	M	1	135
15374.3377.92	43	1280	1	S	1	3
15474.3377.92	43	1280	1	S	1	31
15574.3377.92	43	1280	1	S	1	3
17775.8378.00	26	1233	1	S	11	7
17875.8378.00	26	1233	1	S	11	71
11371.6778.00	76	900	1	S	1	7
11471.6778.00	76	900	1	S	1	71
11571.6778.00	76	900	1	S	1	7
11671.6778.00	76	900	1	S	1	7
17074.5878.09	42	1219	1	W	1	7
17174.5878.25	44	1240	1	W	1	81
15874.5878.25	40	1242	1	W	1	8
17275.6778.25	29	1130	1	C	1	15
17375.6778.25	29	1130	1	C	1	151
17576.5078.83	24	1285	1	S	1	7
17676.5078.83	24	1285	1	S	1	71
14973.92	92	1150	1	M	1	
15074.33	87	1280	1	S	1	
15274.33	87	1280	1	S	1	1 CONSTRUCTION
15174.33	87	1280	1	S	1	PERMITS
14874.58	84	1260	1	W	1	IN
16974.58	84	1260	1	W	1	PROCESS
12674.92	90	1150	1	N	1	
16375.92	68	1150	1	M	11	
16475.92	68	1150	1	M	11	1

NOTE: E IN COLUMN 56 MEANS THAT THE COST IS AN ESTIMATE; T IN COLUMN 56 MEANS THAT THE PLANT WAS A TURKEY PLANT.

Table 5

LEGEND FOR ABBREVIATIONS IN TABLES 1 THROUGH 4

Columns	Designated	Meaning
1 - 3	DOE NO.	Identification number assigned by DOE in DOE publication DOE/NE-0030/3(81).
4 - 8	CPAP	Date construction permit applied for 67.00 = January 1967; 70.67 = September 1970, etc.
9 - 13	CPIS	Date construction permit was issued.
14 - 18	OLIS	Date operating permit was issued.
26 - 27	T1	Number of months elapsed between CPAP and CPIS, the amount of time required to obtain a construction permit.
29 - 31	T2	Number of months elapsed between CPIS and OLIS, the amount of time required to construct the plant.
33 - 35	T3	Number of months elapsed between OLIS and the date the plant is declared to be in commercial operation.
36 - 39	Size, Mwe	Nameplate rating of plant in megawatts electrical, as published in DOE/NE-0030/3(81).
42	LOC 1	Location of plant in FERC region I.
43	LOC 2	Location of plant in FERC region III.
44	LOC 3	Location of plant in FERC regions II and IV.
45	LOC 4	Location of plant in FERC regions V and VI.
46	LOC 5	Location of plant in FERC regions VII and VIII.
48	LOC	Letter symbol for plant location, N = LOC 1; S = LOC 2; C = LOC 3; M = LOC 4; W = LOC 5.

Table 5--continued

Columns	Designated	Meaning
49 - 55	Cost, 1981 dollars	Construction cost in millions of 1981 dollars, based on adjusting mixed current dollar costs reported to FERC by the utilities.
58	Tower	Indicates use of a cooling tower.
59	GE	Nuclear steam supply system manufactured by General Electric (GE).
60	W	Nuclear steam supply system manufactured by Westinghouse.
61	CE	Nuclear steam supply system manufactured by Combustion Engineering.
62	BW	Nuclear steam supply system manufactured by Babcock-Wilcox.
63	B	Architect-engineer is Bechtel.
64 - 65	N	Cumulative number of nuclear plants built by the architect-engineer who built this plant at the time it was completed.
66	DUP 2	Indicates that the plant is a duplicate of another on the same site.

REFERENCES

Mooz, William E., A Second Cost Analysis of Light Water Reactor Power Plants, The Rand Corporation, R-2504-RC, December 1979.

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