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PLANT-SPECIFIC REPLACEMENT ENERGY COST  
ESTIMATES FOR THE REGULATORY GUIDE 1.99,  
REVISION 2 VALUE-IMPACT ANALYSIS

November 1984

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Prepared by: Cost Analysis Group  
Office of Resource Management

U.S. Nuclear Regulatory  
Commission



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PDR REVGP NRCCRGR  
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PLANT-SPECIFIC REPLACEMENT ENERGY COST  
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REVISION 2 VALUE-IMPACT ANALYSIS

Purpose:

This report is in response to a request from the Materials Engineering Branch (MEBR), Division of Engineering Technology, RES to modify the replacement energy cost estimate contained in the Value-Impact Analysis of Regulatory Guide 1.99, Revision 2. Specifically, MEBR requested CAG to provide plant-specific replacement energy cost estimates in present value terms, and to include in our calculations a credit for those reactors that would benefit from the proposed revision.

Background:

CAG reviewed the cost analysis for Revision 2 of Regulatory Guide 1.99 and offered to assist MEBR by providing more precise replacement energy cost estimates. In our initial review, we observed that the cost analysis was dominated by the estimate of industry operating costs, i.e., replacement energy costs, and that the estimate was flawed in several respects. CAG's estimate of replacement energy cost is based on plant-specific data available in a recently published NUREG <sup>1/</sup> prepared under contract for CAG by the Argonne National Laboratory.

Replacement Energy Costs:

This analysis was performed using the following assumptions which were listed in the October 30, 1984 memorandum of Lloyd Donnelly to Charles Serpan:

1. Replacement energy cost penalties are assumed to be constant in real terms over the remaining useful life of the reactor. This means costs are not assumed to increase faster than the rate of general inflation.
2. For reactors already operational, replacement energy cost penalties are assumed to commence in 1985. Commercial operating life of a reactor is assumed to be 30 years. Thus, remaining useful life equals 30 minus number of years in operation prior to 1985.
3. For future reactors, replacement energy cost penalties will commence in estimated year of initial commercial operation and continue for 30 years.
4. All costs will be expressed in 1984 constant dollars and discounted back to 1984 assuming a 10% real discount rate. The final cost estimate will represent a 1984 present worth value in 1984 dollars.
5. The estimate of change in down time provided in the attachment to your memo of October 23, 1984 is assumed to be constant over the remaining useful life of each reactor.

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Van Kuiken, J.C., W.A. Buehring, and K.A. Guziel, Argonne National Laboratory, "Replacement Energy Costs for Nuclear Electricity - Generating Units in the United States," USNRC Report NUREG/CR-4012.

MEBR furnished CAG with a list of the affected plants and the estimated impact of Revision 2 in terms of hours per year of plant-specific replacement energy needed. Daily replacement energy costs in 1984 dollars were obtained from the previously mentioned Argonne work. The costs were converted to hourly figures. One additional adjustment was required because CAG assumes the reactors would have been fully available at the time of the incremental outages, whereas the Argonne study is based on an average availability factor. CAG calculated the yearly cost for each plant by multiplying the number of hours per year the plant would not be producing due to Revision 2, and hence requiring replacement energy, times the hourly replacement energy cost rate. The attached table contains the pertinent data. CAG identified the expected number of years remaining for each plant assuming a 30 year lifetime. The plants were grouped by years of expected lifetime remaining. The plant yearly replacement energy costs were summed across each group. The present value of these annual costs were obtained using an annuity formula based on a ten percent discount rate. Future costs were discounted to provide a 1984 present worth value expressed in 1984 dollars. This value is calculated to be \$70,742,600, which is approximately sixty percent less than the \$180,000,000 estimate given in the original Value-Impact Analysis.

CHANGES IN PLANT ENERGY REPLACEMENT COSTS  
DUE TO REGULATORY GUIDE 1.99, REVISION 2

	Change in Plant Down Time Due to Requirement (hours/year)	Average Daily Energy Replacement Cost (thousands of 1984 dollars)	Change in Plant Energy Replacement Costs Per Year (thousands of 1984 dollars)
Palisades	12.2	297	207.4
Sequoyah 2	10.8	306	189.0
Indian Point 2	9.5	580	314.4
Hatch 1	7.8	349	155.2
Hatch 2	7.8	362	161.5
Peach Bottom 2	7.7	521	228.7
Peach Bottom 3	7.7	513	225.6
Calvert Cliffs 1	7.1	440	178.2
Maine Yankee	5.5	646	203.0
Davis Besse 1	5.4	273	84.2
Fitzpatrick	5.4	574	177.1
Sequoyah 1	4.8	306	84.0
Kewawnee	4.8	90	24.5
Watts Bar 1	4.8	310	85.0
Monticello	4.8	116	31.7
McGuire 2	4.2	527	126.4
Midland 2	4.2	334a	80.2
Bellefonte 1	4.2	329h	79.0
Bellefonte 2	4.2	329f	79.0
Washington Nuclear 1	4.2	380m	91.1
Millstone 1	4.2	511	122.6
Oyster Creek	4.2	343	82.3
Browns Ferry 1	4.2	288	68.9
Browns Ferry 2	4.2	288	68.9
Browns Ferry 3	4.2	288	68.9
Brunswick 1	4.2	341	81.9
Brunswick 2	4.2	341	81.9
Cooper	4.2	130	31.1
Duane Arnold	4.2	106	25.2
La Salle 1	4.2	598	143.2
Susquehanna 1	4.2	545	130.6
Fermi 2	4.2	522	125.2
Perry 1	4.2	376	90.3
Perry 2	4.2	376f	90.3
Clinton 1	4.2	527i	126.4
Grand Gulf 2	4.2	553f	132.7
Hope Creek 1	4.2	564k	135.2
Limerick 1	4.2	555	133.1
Limerick 2	4.2	555f	133.1

CHANGES IN PLANT ENERGY REPLACEMENT COSTS  
DUE TO REGULATORY GUIDE 1.99, REVISION 2  
(continued)

	Change in Plant Down Time Due to Requirement (hours/year)	Average Daily Energy Replacement Cost (thousands of 1984 dollars)	Change in Plant Energy Replacement Costs Per Year (thousands of 1984 dollars)
Nine Mile Point 2	4.2	683j	163.8
River Bend 1	4.2	396b	94.9
Shoreham 1	4.2	541c	129.8
Susquehanna 2	4.2	556	133.1
Cook 2	3.7	299	63.3
Cook 1	3.6	288	59.0
Arkansas 2	3.6	369	76.0
Trojan	3.6	324	66.6
San Onofre 2	3.6	758	155.9
San Onofre 3	3.6	758	155.9
Summer 1	3.6	399	82.1
St. Lucie 2	3.6	420	86.4
Midland 1	3.6	201d	41.4
Braidwood 1	3.6	383e	78.8
Braidwood 2	3.6	383f	78.8
Byron 1	3.6	580	119.2
Byron 2	3.6	580f	119.2
Callaway 1	3.6	349	71.6
Comanche Peak 1	3.6	711	146.2
Comanche Peak 2	3.6	684a	140.4
Marble Hill 1	3.6	444n	91.1
Marble Hill 2	3.6	444f	91.1
Millstone 3	3.6	856e	175.7
Wolf Creek 1	3.6	430	88.2
Shearon Harris 1	3.6	360e	73.8
Palo Verde 1	3.6	836	171.7
Palo Verde 2	3.6	822g	168.8
Palo Verde 3	3.6	822f	168.8
Seabrook 1	3.6	856a	175.7
Seabrook 2	3.6	856f	175.7
South Texas 1	3.6	773p	158.8
South Texas 2	3.6	773f	158.8
Waterford 3	3.6	496	101.9
Washington Nuclear 3	3.6	373m	76.7
Beaver Valley 2	3.6	254e	52.2
Catawba 1	3.6	487c	100.1
Catawba 2	3.6	487f	100.1
Vogtle 1	3.6	553l	113.8
Vogtle 2	3.6	553f	113.8



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(continued)

	Change in Plant Down Time Due to Requirement (hours/year)	Average Daily Energy Replacement Cost (thousands of 1984 dollars)	Change in Plant Energy Replacement Costs Per Year (thousands of 1984 dollars)
Pilgrim 1	3.6	548	112.7
Grand Gulf 1	3.0	553	94.8
La Salle 2	3.0	598	102.3
Surry 2	3.0	321	54.9
Washington Nuclear 2	3.0	331	56.7
North Anna 2	3.0	393	67.2
Three Mile Island 1	2.5	406	58.0
Indian Point 3	1.8	649	66.6
Zion 2	1.8	537	55.1
Crystal River 3	1.8	476	49.0
North Anna 1	1.8	387	39.8
Beaver Valley 1	1.8	271	27.9
McGuire 1	1.8	527	54.2
Diablo Canyon 2	1.8	850	87.3
Salem 2	1.7	585	56.8
Watts Bar 2	1.2	310f	21.2
Diablo Canyon 1	1.2	852	58.3
Farley 1	1.2	351	24.0
Salem 1	1.2	570	39.0
Arkansas ANO 1	1.2	360	24.6
Robinson 2	0	N/A	N/A
Oconee 2	0	N/A	N/A
Fort Calhoun	0	N/A	N/A
Rancho Seco	0	N/A	N/A
Oconee 1	0	N/A	N/A
Ginna	0	N/A	N/A
Oconee 3	0	N/A	N/A
Farley 2	0	N/A	N/A
St. Lucie 1	0	N/A	N/A
Big Rock Point	0	N/A	N/A
Dresden 2	0	N/A	N/A
Dresden 3	0	N/A	N/A
Nine Mile Point 1	0	N/A	N/A
Quad Cities 1	0	N/A	N/A
Quad Cities 2	0	N/A	N/A
Vermont Yankee	0	N/A	N/A
Prairie Island 2	- 1.2	106	- 7.2
Zion 1	- 1.2	537	- 36.7
Calvert Cliffs 2	- 1.2	440	- 30.1

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(continued)

	Change in Plant Down Time Due to Requirement (hours/year)	Average Daily Energy Replacement Cost (thousands of 1984 dollars)	Change in Plant Energy Replacement Costs Per Year (thousands of 1984 dollars)
Surry 1	- 1.8	321	- 32.9
Point Beach 1	- 3.0	115	- 19.8
Turkey Point 3	- 3.5	424	- 84.7
Turkey Point 4	- 3.5	424	- 84.7
Point Beach 2	- 3.6	115	- 23.8
Prairie Island 1	- 3.6	106	- 21.6
LaCrosse	- 3.6	10	- 2.2
Yankee Rowe	- 5.3	131	- 39.8
Millstone 2	- 4.8	669	-183.4
Haddam Neck	-10.8	436	-268.9
San Onofre 1	-16.8	295	-282.2

NOTES FOR COLUMN 2

- Based only on the Summer 1986 estimate.
- Average of Winter 1985/86, Spring 1986, and Summer 1986 cost estimates.
- Average of Summer 1985 through Spring 1986 estimates.
- Based only on the Summer 1986 estimate for Midland 2 and scaled down due to size.
- Average of Spring 1986 and Summer 1986.
- Used same estimate as for Unit 1 because they are the same size.
- Average of Fall 1985 through Summer 1986.
- Sequoyah 1 and 2 are \$306 each @ 1,148 net MWe. Bellefonte is 1235 net MWe, therefore its cost is estimated to be \$329.
- LaSalle 1 and 2 are \$598 each @ 1,078 net MWe. Clinton is 950 net MWe, therefore its cost is estimated to be \$527.
- Nine Mile Point 1 is \$386 @ 610 net MWe. Unit 2 is 1,080 net MWe, therefore its cost is estimated to be \$683.