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ENERGY AND MINERALS
DIVISION

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B-204064

The Honorable Richard L. Ottinger, Chairman
Subcommittee on Energy Conservation and Power
Committee on Energy and Commerce
House of Representatives

Dear Mr. Chairman:

Subject: Information on the Department of Energy's analyses to determine the need for appliance efficiency standards (EMD-82-33)

On December 1, 1981, your office asked that we provide the Subcommittee the following information on Department of Energy (DOE) efforts to develop appliance efficiency standards: (1) an historical overview of the three separate DOE analyses performed to determine the need for appliance efficiency standards, (2) an identification of the assumptions used in each of the analyses, and (3) the conclusions reached in each analysis. The enclosure to this letter provides this information.

This report supplements information provided you in our previous report "Preliminary Information on Appliance Energy Labeling and Appliance Efficiency Standards" (EMD-81-122, July 20, 1981). Since we have not completed an overall evaluation of DOE's efforts to develop appliance energy efficiency standards, we have no recommendations to make at this time. We have, however, included some overall observations in the enclosure with respect to the DOE analyses.

We plan to make no further distribution of this report until 30 days from the date of the report unless you publicly announce its contents earlier. At that time we will make copies available to others upon request.



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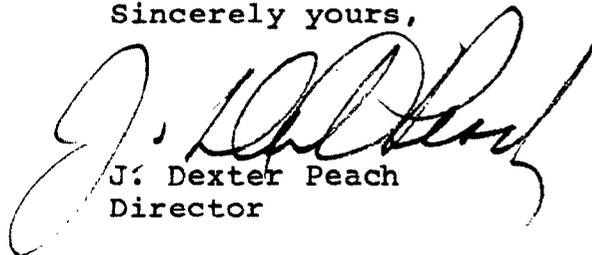
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We are ready to assist the Subcommittee in its consideration of these matters and we trust that the information we have furnished will meet the Subcommittee's needs.

Sincerely yours,

A handwritten signature in black ink, appearing to read "J. Dexter Peach". The signature is fluid and cursive, with a large initial "J" and a long, sweeping underline.

J. Dexter Peach
Director

Enclosure

DOE EFFORTS TO ANALYZE THE IMPACT
OF APPLIANCE EFFICIENCY STANDARDS

The National Energy Conservation Policy Act (P.L. 95-619, Nov. 9, 1978) directs the Secretary of Energy to prescribe minimum energy efficiency standards for 13 types of products. 1/ The standards are to assure that covered products made available to consumers meet a specific level of energy efficiency, thus, eliminating from the marketplace the less efficient products. The act required, however, that any standard prescribed be technologically feasible, economically justified, and result in significant conservation of energy.

Beginning in 1978, the Department of Energy (DOE) engaged a number of consulting firms to work on the preparation of standards and the analyses which would support them. Since that time, DOE has completed three separate analyses to support a final rule on appliance efficiency standards. The analyses have resulted in significantly different estimates of the impact appliance efficiency standards could have in achieving energy conservation. As such, questions have been raised by the Congress and the public

1/Refrigerators

Freezers

Dishwashers

Clothes dryers

Water heaters

Room air conditioners

Furnaces

Kitchen ranges and ovens

Clothes washers

Humidifiers and dehumidifiers

Central air conditioners

Home heating equipment other than furnaces

Television sets

concerning DOE's standards development and more specifically, the basis for the three DOE analyses.

A description of each of the DOE analyses of the impact of the standards, the major assumptions made in each analysis, and the results achieved follows. The tables on pages 7 to 10 give a more detailed comparison of the assumptions and results.

DOE'S FIRST ANALYSIS

DOE published a notice of proposed rulemaking (NPR) on June 30, 1980, accompanied by five technical support documents containing nearly 1,400 pages. These analyses supported proposed efficiency standards for eight products identified in the 1978 act.

These analyses and the principal contractors included

- an engineering analysis which detailed the design options for improving the various products and estimated the efficiency gains and costs of each (Arthur D. Little, Inc.);
- an environmental analysis which assessed the positive or negative impact appliance standards might have on the environment (DOW Associates);
- a study of certification/enforcement approaches (Vitro Division of Automation Industries, Inc.);
- an economic analysis which projected the impact of the proposed standards on energy use; consumer spending; industry profits and net worth; employment; and competition. (Science Applications, Inc. supported by Oak Ridge, Pacific Northwest, and Lawrence Berkeley Laboratories); and
- a summary regulatory analysis prepared for the Regulatory Analysis Review Group (Science Applications, Inc.).

Although DOE's analyses covered a wide variety of impacts, the central issue in DOE's policy discussions has been the significance of the energy and monetary savings that could be expected

from a standards program. For its June 1980 proposal, DOE used a "significant energy savings" threshold of 840 million kilowatt hours per year for a product type 1/ and 30 kilowatt hours per year per unit for a product class. 2/

DOE concluded in its first analysis that standards for the eight products were justified and would collectively result in savings of 13.8 to 25.1 quads of energy and \$15.2 to \$19.3 billion in consumer costs over the period 1982-2005. This amounted to from 3.6 to 6.2 percent less energy than the products would use if no standards were in effect over the period. 3/ For some products (central air conditioners and refrigerators), the projected energy savings ranged as high as 15 percent. On the other hand, room air conditioners, ranges/ovens, and clothes dryers marginally exceeded the significant energy savings criteria.

DOE'S SECOND ANALYSIS

The first NOPR brought some 1,800 comments and submissions of testimony during the public comment period. Many of these focused on the proposed standard enforcement approach, but DOE was also criticized for proposing final standards that were too strict, would save only small amounts of energy, and underestimated the cost of efficiency improvements. Responding to this

1/The 13 products identified in the act.

2/Sub-category of a product type, i.e., different size or fuel used.

3/It should be kept in mind that the impact of a standard builds up gradually, as new products replace those in use. It was assumed that standards would take effect July 1981 and their impact was calculated beginning in 1982.

criticism, DOE modified its enforcement proposals, lowered the proposed standard levels, and commissioned a revision of the economic analysis.

As in the first analysis, the projection of energy and monetary savings was done at Lawrence Berkeley Laboratory using the Oak Ridge residential energy model. In the second analysis, DOE imposed two conditions which, according to the Lawrence Berkeley staff, caused the model to project lower energy savings from the standards. DOE

- used higher energy prices forecast by the Energy Information Administration (see table 4). In the model, this causes consumers to purchase more efficient appliances on their own initiative, lessening the need for standards; and

- lowered proposed standard levels for most products, (see tables 2 and 3) which also lessens the difference between the impact of standards and what consumers would purchase anyway.

The Lawrence Berkeley staff also made some changes to the model's data base, the most important of which was the use of a different starting point for the projection of future efficiency gains. The staff substituted data obtained from manufacturers on the average efficiency of new 1978 products for older data contained in the model and used in the first analysis. This change recognized recent improvements in efficiency and for some products (especially refrigerators, freezers, and ranges/ovens), it substantially reduced the amount of further improvements that could be expected.

On the other hand, the projected impact of standards on central air conditioners increased in the second analysis because assumptions about the usage of these products were increased.

Additionally, Arthur D. Little, Inc. revised upward the estimated cost of efficiency improvements, causing the model to project lower efficiency purchases in the marketplace.

The second analysis credited standards with 10.9 quads of energy and \$8.6 billion saved over the same period used in the first analysis. The energy savings impact of the standards for some products, such as furnaces and refrigerators, decreased significantly compared to the first analysis. DOE intended to publish a new NOPR which would have dropped ranges/ovens and clothes dryers because standards for these products did not meet the significant energy savings criteria. DOE suspended its plan to publish a new NOPR when the new administration took office.

DOE'S THIRD ANALYSIS

During the Spring and Summer of 1981, a policy debate took place in DOE over how to satisfy the legislative mandate for appliance efficiency standards. The DOE program staff argued for standards on at least the three largest users of residential energy--furnaces, water heaters, and central air conditioners. DOE's Office of Policy outlined various options, but recommended against issuing any standards. The administration had decontrolled oil prices, and its National Energy Policy Plan (NEPP) projected sharply higher prices for natural gas.

In August 1981, DOE formed an internal task force to make a final recommendation on efficiency standards. As part of this review, Lawrence Berkeley Laboratory was asked to once again use the Oak Ridge model. According to the Lawrence Berkeley staff, the principal changes in the third analysis were

- using energy price projections from the NEPP which were sharply higher than any previously used for natural gas;
- dropping clothes dryers and ranges/ovens from the standards;
- dropping an analysis of interim standards 1/ and delaying the effective date of final standards from January 1, 1986, to July 1, 1987.

This final analysis reduced the projected energy savings from standards to 5.2 quads over the period 1987-2005, most of which was accounted for by central air conditioners and water heaters. The dollar savings were reduced to \$5.7 billion. DOE concluded that the projected savings in each product category were not significant enough in proportion to total energy used to justify the imposition of standards.

In its current draft NOPR, DOE discusses the energy savings impact resulting from the third analysis and also points to FTC's energy labeling program and industry's own propensity to improve efficiencies as justification for proposing no standards. Although the model had projected most of the savings in the categories of water heaters and central air conditioners, DOE cast doubt on the reliability of these projections and suggested that the model may be too optimistic in crediting the standards.

1/The act gave DOE 5 years to phase in standards. In the first NOPR, DOE proposed interim standards to take effect July 1, 1981, and final standards to take effect January 1, 1986.

MAJOR ASSUMPTIONS USED
IN THE ANALYSIS

The following tables show the results and key assumptions used in DOE's analyses of the impact of appliance standards.

Table 1

Results of DOE's Three Analyses Projecting
Energy Savings from Efficiency Standards

Cumulative Savings 1982 to 2005

<u>Product (note a)</u>	<u>Percent of national energy use - 1980</u>	<u>First analysis</u>	<u>Second analysis</u>	<u>Third analysis</u>
		- - - - - (quads) - - - - -		
Furnaces	7.3	2.00-4.27	0.47	None
Water heaters	3.2	3.87-5.91	2.75	1.8
Central air conditioners	2.0	2.62-3.73	5.20	2.6
Refrigerators	1.5	3.64-7.56	0.63	0.2
Ranges/ovens	1.2	0.26-0.82	None	None
Clothes dryers	.7	0.32-0.59	0.04	None
Freezers	.6	0.82-1.69	1.14	0.3
Room air conditioners	.6	0.22-0.56	0.71	0.3
Total	17.1	13.75-25.13	10.94	5.2

a/Since DOE did not propose a standard for home space heaters, we omitted them from this presentation.

Table 2Changes in Proposed Interim Standard
Levels from First to Second DOE Analysis

<u>Product/class</u>	<u>Originally proposed for 1981</u>	<u>Revised</u>	<u>Percent change</u>
- - -(energy efficiency factors) - - -			
<u>Refrigerators - 17 cu. ft.</u>			
Top mount/automatic defrost	4.7	4.5	-4
Side by side - automatic	4.7	4.3	-9
<u>Freezers - 15 cu. ft.</u>			
Chest - manual defrost	11.2	None	0
Upright - manual	8.9	None	0
Upright - automatic	6.3	None	0
<u>Water heaters - 52 gal.</u>			
Electric	.79	.80	+1
Gas	.45	.44	-2
<u>Room air conditioners</u>			
8,000 Btu or less	6.5	6.2	-5
8,000-20,000	7.5	7.4	-1
Over 20,000	6.7	6.5	-3
<u>Central air conditioners</u>			
<u>Split System</u>			
under 39,000	7.8	6.5	-17
over 39,000	7.8	7.0	-10
<u>Single Package</u>			
under 39,000	7.5	6.6	-12
over 39,000	7.5	6.6	-12
<u>Furnaces</u>			
Gas, forced air indoor	65.0	63.0	-3
Oil, forced air indoor	75.0	73.0	-3

Table 3Changes in Proposed Final Standard
Levels from First to Second DOE Analysis

<u>Product/class</u>	<u>Originally proposed for 1986</u>	<u>Revised</u>	<u>Percent change</u>
- - - (energy efficiency factors) - - -			
<u>Refrigerators - 17 cu. ft.</u>			
Top mount/automatic defrost	8.0	7.6	-5
Side by side - automatic	6.6	6.1	-8
<u>Freezers - 15 cu. ft.</u>			
Chest - manual defrost	18.7	14.9	-20
Upright - manual	16.0	13.2	-18
Upright - automatic	9.5	8.9	-6
<u>Water heaters - 52 gal.</u>			
Electric	.93	.88	-5
Gas	.62	.57	-8
<u>Room air conditioners</u>			
8,000 Btu or less	8.4	7.9	-6
8,000-20,000	9.5	9.1	-4
Over 20,000	8.4	7.5	-11
<u>Central air conditioners</u>			
Split system			
under 39,000	11.0	9.5	-14
over 39,000	11.0	9.5	-14
Single package			
under 39,000	10.5	9.3	-11
over 39,000	10.5	9.5	-10
<u>Furnaces</u>			
Gas, forced air indoor	81.0	79.0	-2
Oil, forced air indoor	80.0	78.0	-3

Table 4

Energy Cost Forecasts Used by DOE
Total Increase in Real Prices, 1980 to 2005

	First analysis percent increase (note a)	Second analysis percent increase	Third analysis percent increase
Electricity	28-86	22	41
Gas	57-109	131	172
Oil	56-109	133	127

Table 5

Assumed Starting Efficiencies of
Products for Each Analysis

<u>Product/class</u>	<u>Analysis 1</u>	<u>Analyses 2 and 3</u>	<u>Percent change</u>
(energy efficiency factors)			
<u>Furnaces</u>			
Gas	63.24	63.55	0.5
Oil	73.65	75.20	2.1
<u>Room air conditioner</u>	6.22	6.75	8.5
<u>Central air conditioner</u>	6.66	6.99	5.0
<u>Water heater</u>			
Electric	79.80	80.67	1.1
Gas	47.35	48.17	1.7
<u>Refrigerator/freezer</u>	4.16	5.09	22.4
<u>Freezer</u>	7.53	10.0	32.8
<u>Range/oven</u>			
Electric	42.8	53.6	25.2
Gas	13.9	17.6	26.6
<u>Dryer</u>			
Electric	2.61	2.59	-0.8
Gas	2.10	2.38	13.3

a/ In DOE's first analysis it projected both low and high price scenarios.

OBSERVATIONS

Overall, the task charged to DOE to develop appliance efficiency standards was complex. The type of analysis needed to develop and support ultimate standards was highly susceptible to judgment. The process used by DOE since 1979 to reach a final decision on standards exemplifies these problems.

A critical assumption made in each of DOE's analyses was the projected price of energy fuels and the effect such prices would have on the Oak Ridge model's determination of consumers appliance purchase decisions. In each successive DOE analysis, the projected level of energy prices increased. The result of this changing assumption was that each successive analysis resulted in market forces alone generating increasingly greater energy savings, with the impact of standards decreasing. In the most recent analysis, the model attributed 27.6 quads of savings to market forces while standards were credited with saving only an additional 5.2 quads.

The model's assumption that consumers' purchases of more efficient appliances varies directly with the real price of energy has not been validated. Staff scientists at Lawrence Berkeley Laboratory attempted to do so in a study of thermal integrity improvements in houses from 1973-1979. Their results did not support the proposition in the model. The author of the Oak Ridge model acknowledged he had no data to estimate the strength or weakness of the relationship between higher energy prices and consumer purchases, assumed to be a simple one-to-one relationship.

One change which affected the results of the second analysis and which was somewhat questionable was DOE's decision to lower the interim standard levels scheduled to take effect in 1981. The testimony given by manufacturers after the June 1980 NOPR revealed that the industry would accept the originally proposed interim standards with very little change. Industry spokesmen focused their main attention on the final standard levels set for 1986, which they considered too high. Yet DOE revised both the interim and final standard levels substantially downward in preparation for its second analysis. This caused the model to attribute very little energy savings to interim standards relative to marketplace conservation. As a result, DOE dropped interim standards altogether from the third analysis.