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BY THE COMPTROLLER GENERAL

Report To The Congress

OF THE UNITED STATES

Appliance Efficiency Standards: Issues Needing Resolution By DOE

The National Energy Conservation Policy Act directs the Secretary of Energy to prescribe efficiency standards, or make a no standard determination, for each of 13 major household appliances. DOE began analyses in 1978 and proposed standards for eight appliances. DOE then revised the standards but did not publish them. Additional work was done under the current administration resulting in an April 1982 proposal that no standards be established for appliances.

GAO concluded that the analytical basis for the April 1982 proposal is questionable and a no standards decision may adversely affect energy conservation and utility load management efforts in many States. GAO pointed out the potential viability of proposing standards for certain appliances and indicated that the appliance labeling program for furnaces has limited potential.

GAO recommends that the Secretary of Energy make no decision on the need for appliance efficiency standards until he considers and resolves the issues raised in this report.



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COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON D.C. 20548

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To the President of the Senate and the
Speaker of the House of Representatives

This report discusses the need for the Department of Energy to consider and resolve certain issues before making a final decision on the need for appliance efficiency standards.

The National Energy Conservation Policy Act (P.L. 95-619) directs the Secretary of Energy to prescribe energy efficiency standards for specified major household appliances. The Department began work in 1978 on the analyses which would support the standards, and in April 1982 it proposed that no standards be established. This proposal is currently the subject of public hearings scheduled for May 1982.

The Department was not asked to provide written comments on this report to assure that it would be available to the Congress and the public for the May hearings. This action was consistent with a request by the Chairman, Subcommittee on Energy Conservation and Power, House Committee on Energy and Commerce. We did, however, provide Department officials an opportunity to give their views on the report's contents, but they believed it would be inappropriate to comment since the report concerns a matter that is the subject of an ongoing rulemaking procedure.

Copies of this report are being sent to the Director, Office of Management and Budget; the Secretary of Energy; the Chairman, Subcommittee on Energy Conservation and Power, House Committee on Energy and Commerce; and the chairmen of other energy-related congressional committees.

A handwritten signature in cursive script that reads "Charles A. Bosher".

Comptroller General
of the United States



D I G E S T

The National Energy Conservation Policy Act directs the Secretary of Energy to prescribe an energy efficiency standard for each of 13 major household appliances. No standard was to be prescribed which would not be economically justified, would not be technologically feasible, or would not result in significant conservation of energy. In assessing the economic justification of standards, the Secretary was directed to consider a standard's impact on, among other things, manufacturers, consumers, life-cycle costs, appliance usefulness, and national energy conservation. GAO undertook its review to provide information which would be useful to the Congress in deliberating a continued Federal involvement in energy conservation programs. (See pp. 1 and 2.)

The Department of Energy (DOE) published proposed rules on June 30, 1980, recommending standards for eight of the appliances. The proposal brought a strong reaction from manufacturers, who contended the standards would be too difficult to achieve and the proposed enforcement program would be unnecessarily burdensome. DOE revised its originally proposed standards and enforcement approach, but never published them for comment because the administration decided to review the entire standards development process.

DOE published new proposed rules April 2, 1982, concluding that no appliance standards be established. (See pp. 4 to 7.)

DOE'S ANALYTICAL BASIS FOR PROPOSING
NO APPLIANCE STANDARDS IS
HIGHLY QUESTIONABLE

DOE's no appliance standards proposal is based on economic analyses which were done using computer simulation models. GAO evaluated DOE's analytical efforts and concluded that the basis for DOE's proposal for no appliance standards is highly questionable. The analyses contain an unvalidated key assumption, are inconsistent in their treatment of the effects of market forces,

and use high energy price projections. The potential impact of this is to decrease the energy savings from, and increase the costs of, appliance standards.

Unvalidated key assumption

The analysis supporting DOE's proposal relies heavily on an unvalidated key assumption that consumers purchase substantially more efficient appliances in response to rising energy prices.

DOE's assumption is not supported by available historical evidence, particularly for furnaces, central air conditioners, and water heaters. For example, despite a 40-percent increase in real natural gas prices from 1975 to 1978, the average efficiency of gas furnaces sold over these years remained essentially the same. In addition, from 1972 to 1978, gas water heaters improved only 1.7 percent while real gas prices increased about 65 percent. Moreover, DOE's assumption is questionable since builders purchase many major appliances and are more sensitive to initial costs than energy efficiency in making such purchases. (See p. 12.)

Inconsistent projection of the effect of market forces on achieving appliance efficiency

DOE inconsistently treated market force effects in projecting future energy savings from standards as well as in establishing the cost and risk to manufacturers from standards. By not consistently treating market force effects throughout its analysis, DOE has undermined the comparability of its different cases and the reliability of its conclusions. (See p. 13.)

Varying projections of future energy prices

DOE projected future energy savings from standards using four markedly different assumptions about future energy prices. In particular, the April 2, 1982, proposal is based on energy price projections which are significantly higher than other available estimates--78 percent higher for electricity, 12 percent higher for natural gas, and 25 percent higher for heating oil than the average increase projected by others. (See p. 14.)

DOE'S REVISED 1980 STANDARDS IS
A POTENTIALLY VIABLE PROPOSAL

DOE revised its June 1980 standards proposal based on public comments. However, this revision was never published for comment because the administration decided to review the standards development process. The revision appeared to be a potentially viable standards proposal because it addressed major concerns of the appliance industry and contained standard levels which could benefit consumers. (See p. 18.)

GAO estimates that the revised efficiency standards could save about 10 percent of the energy consumed by six appliances in the year 2000. Essentially all of these savings would result from standards on furnaces, water heaters, central air conditioners, and refrigerators, major energy consuming appliances. Also, most of the revised standard levels would permit consumers to recover, in less than 3 years, the increased purchase price of appliances resulting from standards. (See p. 21.)

ISSUES RELATED TO A NO
STANDARDS DETERMINATION

Two issues related to a no standards decision by DOE are (1) the implications such a decision will have for existing State appliance standards programs and (2) the extent to which the Federal appliance labeling program will, through enhanced consumer awareness, increase the number of high efficiency appliances being purchased.

By law a no standards decision by DOE preempts existing State appliance standards programs. Such a situation could adversely affect States which have standards programs or have promoted increased appliance efficiency through building codes. In addition, since the law provides that States may petition DOE for exemption from the no standards determination, a proliferation of divergent State standards could follow. (See p. 25.)

DOE expects that increased consumer awareness of appliance efficiency will result from higher energy prices in combination with the Federal Trade Commission's appliance labeling program. GAO's work indicates that the labeling program

for furnaces--the largest single user of residential energy--is not likely to significantly affect consumers' purchase decisions and thus, increase appliance energy efficiency. GAO found that labeling was not working effectively for furnaces because the labels do not contain key data and few consumers have an opportunity to see comparative efficiency information before buying a new furnace. (See p. 27.)

RECOMMENDATION

GAO recommends that the Secretary of Energy make no decision on the need for appliance efficiency standards until he considers and resolves the issues raised in this report. In carrying out this recommendation, the Secretary should either demonstrate more conclusively for each appliance that a determination of no standard is justified or prescribe an appropriate energy efficiency standard.

AGENCY COMMENTS

To assure that information in this report would be available to the Congress and the public for DOE's May 1982 public hearings on its April 1982 no standards proposal, GAO did not obtain written agency comments. This action was consistent with a request by the Chairman, Subcommittee on Energy Conservation and Power, House Committee on Energy and Commerce. However, GAO gave DOE officials an opportunity to provide their views on the matters discussed in this report. DOE officials told GAO it would be inappropriate for them to discuss the report's contents since the report concerns a matter that is the subject of an ongoing rulemaking proceeding.

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the use of Energyguide labeling and
fact sheet program in the home heating
business

ABBREVIATIONS

AFUE	Annual Fuel Utilization Efficiency
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
Btu	British thermal unit
DOE	Department of Energy
EER	Energy Efficiency Ratio
EPCA	Energy Policy and Conservation Act
FTC	Federal Trade Commission
GAO	General Accounting Office
LBL	Lawrence Berkeley Laboratory
NECPA	National Energy Conservation Policy Act
NOPR	Notice of Proposed Rulemaking
Quad	Quadrillion Btu's
SEER	Seasonal Energy Efficiency Ratio

CHAPTER 1

INTRODUCTION

The National Energy Conservation Policy Act (NECPA) (P.L. 95-619, Nov. 9, 1978) directs the Secretary of Energy to prescribe energy efficiency standards for certain appliances. The requirement to prescribe standards replaced a requirement for energy efficiency improvement targets which was established in the Energy Policy and Conservation Act (EPCA) (P.L. 94-163, Dec. 22, 1975). The Department of Energy (DOE) initially proposed standards for eight appliances in June 1980. Based on public comments received, DOE revised its analyses but did not formally propose revised standards. Under the current administration, however, a reevaluation of the entire standards development process took place, culminating in DOE's April 2, 1982, proposed rule which states that no Federal efficiency standards for the eight appliances would result in a significant conservation of energy or be economically justified.

REQUIREMENT TO PRESCRIBE STANDARDS

NECPA directs the Secretary of Energy to prescribe for each of 13 appliances 1/ a standard that would achieve the maximum improvement in energy efficiency provided the standard was both technologically feasible and economically justified. The 13 appliances are:

Furnaces	Clothes dryers
Water heaters	Freezers
Home heating equipment other than furnaces	Room air conditioners
Central air conditioners	Dishwashers
Refrigerators	Humidifiers/dehumidifiers
Ranges/ovens	Clothes washers
	Television sets

NECPA also provides that the Secretary of Energy could include additional appliances if their energy use and potential for improvement warrants inclusion.

1/NECPA uses the terms covered products and consumer products; however, in this report we will use the term appliances.

No standard was to be prescribed, however, if (1) it would not result in "significant conservation of energy," a phrase the law did not define or (2) it would not be technologically feasible or economically justified. In its assessment of the economic justification of standards, DOE was directed to weigh the standards' potential impact on manufacturers, consumers, life-cycle costs, total energy conservation, appliance usefulness, competition, and national energy conservation needs.

The Congress gave priority to 9 of the 13 appliances specified in NECPA and required that final regulations be issued. Final rules for the other four appliances were to be issued later. The law permitted DOE to phase in standards over a 5-year period by establishing intermediate (or interim) standards, in which case final standards for the nine priority appliances would take effect in January 1986. Also, the law provided that standards prescribed by DOE were to supercede State appliance standards, and that a DOE determination that no standards were justified also preempted State standards.

The nine priority appliances and their estimated share of energy use in 1980 are listed in table 1.

Table 1

The Priority Appliances and Their

Estimated Use of Energy in 1980

<u>Appliance</u>	<u>Type of energy (note a)</u>	<u>Quadrillion Btu's 1980 (note b)</u>	<u>Percent of residential energy use</u>	<u>Percent of national energy use</u>
Furnaces	E, NG, O, Other	5.57	30.9	7.3
Water heaters	E, NG, O, Other	2.43	13.5	3.2
Space heaters	E, NG, Other	1.84	10.2	2.4
Central air conditioners	E	1.50	8.3	2.0
Refrigerators	E	1.18	6.6	1.5
Ranges/ovens	E, NG, Other	.91	5.0	1.2
Clothes dryers	E, NG	.52	2.9	.7
Freezers	E	.48	2.7	.6
Room air conditioners	E	<u>.42</u>	<u>2.3</u>	<u>.6</u>
Total		<u>14.85</u>	<u>82.4</u>	<u>19.5</u>

a/E- Electricity
NG - Natural Gas
O - Oil
Other - Primarily propane

b/One quadrillion (10^{15}) British thermal units (Btu's) equals one quad.

Source: DOE Monthly Energy Review Jan. 1982.
DOE Economic Analyses for appliance standards.

STANDARDS DEVELOPMENT AND
PROPOSAL PROCESS

DOE's appliance standards development process, begun in 1978, involved analysis of industry data on the efficiency of appliances sold as well as engineering studies and analyses of the economic impacts of standards. DOE's initial standards proposal in June 1980 ^{1/} resulted in significant public comment. To address the public comments, DOE revised its initial proposal and planned to publish it for public comment in February 1981. However, the administration decided to review the entire standards development process.

DOE's basis and support for its June 1980 interim and final standards proposal included analysis of industry appliance sales data and engineering and economic studies. To develop the proposed interim standard levels, which were to take effect in July 1981, DOE relied on data supplied by appliance manufacturers on the efficiency of products sold in 1978, the latest data available at the time of the analysis. For each of the eight appliances included in the proposal, an average energy efficiency, ^{2/} weighted for the number of units shipped at each level of efficiency, was calculated. DOE used this 1978 average efficiency as its proposed interim standard for all appliances except air conditioners. The proposed interim standard for room air conditioners was somewhat higher than the 1978 average efficiency and for central air conditioners, substantially higher. Overall, about half of the appliances sold in 1978 had efficiency levels below the proposed interim standards.

With respect to the final standards, which were to take effect in 1986, DOE relied on engineering studies by the consulting firm of Arthur D. Little, Inc. The firm identified the performance characteristics of a typical 1978 model in each appliance category, and estimated the efficiency gains which

^{1/}DOE's June 30, 1980, Notice of Proposed Rulemaking (NPR) contained interim and final standards proposals for eight of the nine priority appliances. Home heating equipment other than furnaces was exempted by DOE because many of these "space heaters" are electric and virtually 100 percent efficient. DOE did, however, reserve the right to propose standards for vented gas space heaters. Certain other classes of appliances were also exempted, such as electric furnaces and oil water heaters, generally because there were not many in use or because little could be done to improve their efficiency.

^{2/}Average efficiency was expressed as a shipment-weighted energy factor. The energy factors are all ratios of output to input, but their definitions vary from product to product. For reference, they are defined in appendix I.

could be achieved by redesigning the appliance using available energy-saving features which lower its life-cycle cost. The entire analysis of design changes was done by computer simulation. DOE used this analysis to select efficiency levels for its proposed 1986 appliance standards. The levels were much higher than 1978 average appliance efficiencies, so few appliances sold in 1978 would have qualified under the proposed standards.

Along with its appliance standards proposal, DOE published five support documents. These documents represented the work of five consulting firms and three national laboratories, 1/ and cost nearly \$2.5 million. Much of this effort involved projecting the economic effects of the proposed appliance standards using five computer simulation models. 2/ The Oak Ridge National Laboratory Residential Energy End Use Model, hereafter referred to as the Oak Ridge model, was central to the analytical process. Staff at Lawrence Berkeley Laboratory (LBL) modified and then used the model to project the savings in both energy and disposable income that would result from imposing the proposed standards. Based on this analysis, the projected energy savings of the proposed standards ranged from 13.6 to 24.9 quadrillion Btu's (quads) over the period 1982 to 2005 and the monetary savings were projected to be from \$15.2 to \$19.3 billion.

The June 1980 NOPR, brought some 1,800 comments and submissions of testimony from industry, the public, and government. While many of the comments focused on DOE's proposed standards enforcement approach, industry spokesmen stated that DOE had underestimated the cost and practical problems involved in meeting the proposed final standards. For example, representatives of air conditioning manufacturers argued that meeting DOE's proposed standard level would result in producing central air conditioners that would not properly dehumidify inside air. In addition, these representatives stated that room air conditioners meeting the proposed standards would be too large for existing windows and wall openings where they are installed. Within the Government, DOE was criticized by the Regulatory Analysis Review Group 3/ for minimizing its discussion of the impact standards would have on the economy, and especially on small companies.

1/The consulting firms were Arthur D. Little, Inc.; Science Applications, Inc; DOW Associates; Vitro Laboratories, Division of Automation Industries, Inc; and Energy Applications, Inc. The national laboratories were Oak Ridge, Lawrence Berkeley, and Pacific Northwest.

2/Oak Ridge National Laboratory Residential Energy End Use Model; Financial Impacts Model; Life Cycle Cost Model; Macroeconomic Impact Model (EXPLOR); and Manufacturers Market Assessment.

3/A unit within the former Council on Wage and Price Stability, Executive Office of the President.

DOE attempted to accommodate the manufacturers' criticisms by moderating its certification and enforcement proposal and by reducing the standard levels for most of the appliances. In addition, at a cost of more than \$1.2 million, DOE contracted for a second round of supporting studies to analyze the revised standards. For this second round analysis, DOE made several changes in the assumptions used in the Oak Ridge model. These changes contributed to markedly different projections of expected energy savings, which fell to 10.9 quads. For some appliances, such as refrigerators and furnaces, energy savings declined dramatically from the first analysis.

DOE intended to publish a revision of its June 30, 1980, NOPR in February 1981. In the revised NOPR, standards were to be lowered for most appliances and dropped entirely for ranges/ovens and clothes dryers. However, the administration decided to review the analyses done in support of the revised proposal.

RECENT RULEMAKING PROPOSES NO STANDARDS

During 1981, offices within DOE disagreed over the need for, and benefits of, appliance efficiency standards. Consequently, a third economic analysis of the impact of standards was performed. These activities culminated in an April 2, 1982, NOPR proposing no standards for eight appliances. 1/

During the spring and summer of 1981, offices within DOE debated over how to satisfy the legislative mandate for appliance efficiency standards. The office of the Assistant Secretary for Conservation and Renewable Energy argued for standards on at least three large users of residential energy--furnaces, water heaters, and central air conditioners. DOE's Office of Policy, Planning, and Analysis outlined various options for satisfying the mandate, but it recommended against proposing standards for any appliances.

In August 1981, DOE formed an internal task force, chaired by a Special Assistant to the Assistant Secretary, to review the appliance standards developmental work that had been done and make recommendations on how DOE should proceed. The task force did further economic analysis of appliance standards based on assumptions that no interim standards would be established and energy prices would rise more rapidly than had been assumed in previous analyses. The results of this analysis indicated that

1/The eight appliances are the same as those included in DOE's June 1980 NOPR.

market forces would achieve nearly as much conservation as appliance standards. In view of these results and comments it received on the June NOPR, DOE subsequently proposed no standards for eight appliances.

DOE's Office of General Counsel assumed responsibility for preparing the new proposed rule and revising the support documents. In the April 2, 1982, NOPR, DOE proposed that no standards be established for any of the eight appliances because it determined that energy efficiency standards for these appliances would not result in a significant conservation of energy or be economically justified. Public hearings were scheduled for May 1982 with written comments due by June 16, 1982.

OBJECTIVES, SCOPE, AND METHODOLOGY

Our primary objective was to evaluate DOE's appliance efficiency standards developmental efforts. ^{1/} Since DOE emphasized in its development process the potential energy and monetary savings which would result from standards, we focused our work in these areas. Our review was made between May 1981 and April 1982.

We gave particular attention to DOE's use of the Oak Ridge model to project future energy use with and without standards. We visited LBL and discussed with staff scientists the working principles of the model, the changing assumptions used for DOE's three different analyses, and the sensitivity analyses done. We performed an analysis to estimate the energy savings potential of standards if market forces are not considered. In doing this analysis, the LBL staff assisted us in using the model.

An additional objective of our work was to assess the reaction of the appliance industry to DOE's June 1980 NOPR and determine industry reaction to DOE's revised standards levels prepared subsequent to the NOPR. To meet this objective, we reviewed industry testimony submitted in response to DOE's June 1980 NOPR and visited the following three trade associations and six manufacturers to obtain their views. The associations are the primary trade groups representing manufacturers affected by the appliance standards program. The manufacturers represent, in our view, a balance between large and small firms which produce heating and air conditioning equipment. Furthermore, such equipment represents major energy consumer appliances.

^{1/}We issued two prior reports related to DOE's appliance efficiency standards program--"Preliminary Information on Appliance Energy Labeling and Appliance Efficiency Standards," EMD-81-122, July 20, 1981 and "Information on the Department of Energy's Analysis to Determine the Need for Appliance Efficiency Standards," EMD-82-33, Dec. 23, 1981.

Trade Associations

Association of Home Appliance Manufacturers.
Air Conditioning and Refrigeration Institute.
Gas Appliance Manufacturers Association.

Manufacturers

Carrier Corporation/BDP Company.
General Electric Corporation.
Luxaire Division of Borg Warner Corporation.
Magic Chef, Inc.
The Trane Company.
The Williamson Company.

Our third objective was to assess the use being made of appliance energy labels and the extent that the labeling program would minimize the need for appliance standards. Since the labeling program began in May 1980, an assessment of the entire program was not practical. We concentrated our efforts, therefore, on heating equipment, which accounted for about one-third of 1980 estimated residential energy use. We mailed questionnaires to a nationwide random sample of 514 heating contractors to determine the extent to which they were providing consumers with comparative information on the energy efficiency of their products. We used a random numbers program to select contractors from the classified sections of the telephone directories of all standard metropolitan statistical areas with at least 3,000 annual heating degree days. ^{1/} We used two follow-up letters and achieved a final response of 381, or 74 percent of the sample. We cannot predict the answers of the 26 percent who did not respond. Appendix II is a copy of the survey questionnaire. Appendix III provides a tabulation of the responses.

Our final objective was to assess the potential effect of a final no standards decision on States' efforts to regulate the efficiency of major appliances. We visited the National Conference of States on Building Codes and Standards and also obtained information from the National Association of Home Builders Research Foundation. We met with officials in 7 States and contacted by telephone officials in 17 other States. Together, the 24 States account for about 70 percent of the U.S. population and, in our judgment, represent States which are geographically dispersed. The seven States we visited were selected because of their proximity to where our field work was conducted.

During our review, we also obtained future energy price projections from the following organizations which had prepared such projections:

^{1/}Since our questionnaire emphasized furnace sales, we wanted to eliminate the warmest parts of the country which might bias our sample.

Data Resources, Inc.
Edison Electric Institute.
American Gas Association.
Institute for Energy Analysis.
Petroleum Industry Research Foundation, Inc.

We also obtained information from Arthur D. Little, Inc., and Science Applications, Inc., contractors which had substantial involvement in the analyses supporting DOE's appliance standards proposals.

Our review was performed in accordance with GAO's current "Standards for Audit of Governmental Organizations, Programs, Activities, and Functions."

To assure that information in this report would be available to the Congress and the public for DOE's May 1982 public hearings on its April 2, 1982, NOPR, we did not obtain written agency comments. This action was consistent with a request by the Chairman, Subcommittee on Energy Conservation and Power, House Committee on Energy and Commerce. However, we gave DOE officials an opportunity to provide their views on the matters discussed in this report. DOE officials told us it would be inappropriate for them to discuss the report's contents with us since the report concerns a matter that is the subject of an ongoing rulemaking proceeding.

CHAPTER 2

DOE'S ANALYTICAL BASIS FOR ITS

APPLIANCE STANDARDS PROPOSAL IS HIGHLY QUESTIONABLE

DOE's basis for its proposal that no appliance efficiency standards be established is highly questionable. First, the analysis in support of DOE's proposal relies heavily on an unvalidated key assumption that consumers will purchase substantially more efficient appliances in response to increases in real energy prices. Secondly, DOE has been inconsistent in projecting the effect of market forces on consumers and appliance manufacturers. Finally, during the standards development process, DOE projected future energy savings from standards using four markedly different energy price assumptions, and used a significantly higher price assumption in its April 1982 NOPR than other available estimates. The potential impact of the inconsistent treatment of market forces and the use of high energy price assumptions is to decrease the energy savings from, and increase the costs of, appliance standards.

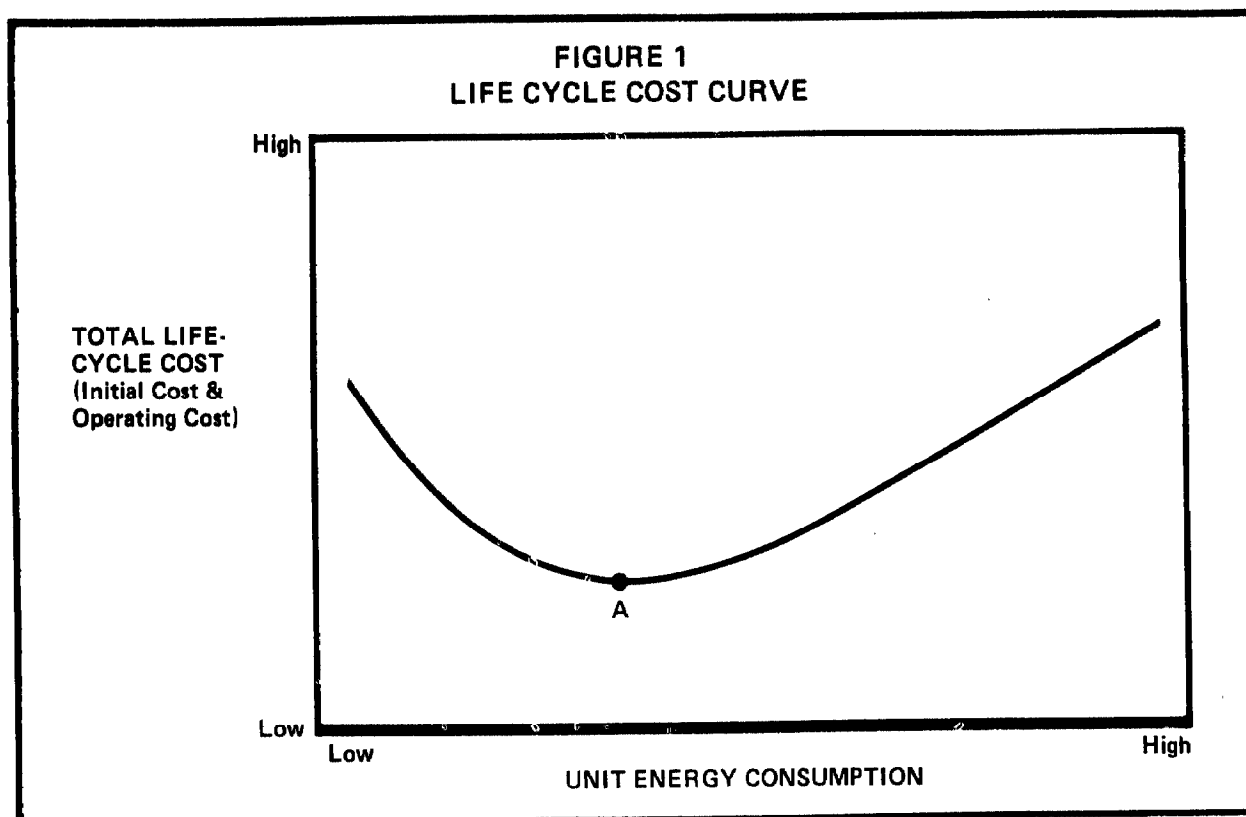
HOW THE OAK RIDGE MODEL WAS USED TO PROJECT THE EFFECTS OF THE MARKET AND THE STANDARDS

DOE used the Oak Ridge model to project energy use by appliances over the period 1982 to 2005. Two scenarios were projected--one in which market forces led to improved appliance efficiency in response to the rise in real energy prices, and one in which minimum efficiency standards substituted for the market beginning in the year of implementation. DOE considered the difference between these two projections to be the effect of standards, expressed as both energy and monetary savings.

To project the market, or base case, the Oak Ridge model used life-cycle cost curves to predict the average efficiency of appliances purchased in future years. Such a curve represents the total cost (purchase price plus operating cost) of various models of an appliance available in a given year. As shown in figure 1, both ends of the curve represent high total cost models. The least efficient model would use so much energy that its operating cost would outweigh its lower purchase price. The most efficient model, on the other hand, would use little energy to operate, but its purchase price would be so high as to nullify the energy savings. The minimum point on the curve (Point A) would be the best combination of purchase price and efficiency, producing the lowest life-cycle cost.

The Oak Ridge model used a critical assumption to predict future appliance purchases. This assumption was that consumers would purchase substantially more efficient appliances in response

to increases in real energy prices. The model's computations begin from a base year (1978 in these analyses) in which actual consumer purchases are known. The model assumes that average consumer purchases will move closer to the life-cycle minimum as real energy prices rise, and further away if prices fall. According to a simple, but very important formula in the model, changes in real energy prices produce substantial changes in the efficiency of appliances consumers purchase. The Oak Ridge model is thus very sensitive to assumptions about future energy prices.



To project a standards case for each appliance, DOE computed an average appliance efficiency by using data on appliances sold in 1978 and assumed all units purchased below the standard level in that year met the standard. This new average (which actually represents the effect a standard would have had on 1978 sales) was

used in the model to represent the average appliance efficiency in the first year of the standard (1987 in DOE's last analysis). This level of efficiency was assumed without change in each succeeding year, until the average efficiency computed in the base case, influenced by rising energy prices, exceeded the average in the standards case. When that happened, the base case once again replaced the standards case for the remaining years of the simulation.

DOE'S MARKET CASE RELIES ON
AN UNVALIDATED KEY ASSUMPTION

DOE's key assumption that consumers will purchase substantially more efficient appliances in response to increases in real energy prices is not supported by available evidence on changes in the efficiency of major energy using appliances. The experience of the 1970s raises questions about whether the appliance market responds in this way. Moreover, builders purchase many of the major energy-using appliances for new houses, and they are more sensitive to first costs than to future operating costs.

The authors of the Oak Ridge model acknowledged they had no data to estimate the strength or weakness of the relationship between higher energy prices and consumer appliance purchases, so they used a simple formula which had the effect of making the model very sensitive to assumptions about future energy prices. They also cautioned users about the fragility of the model's critical assumption:

"Our model contains a simple algorithm * * * that estimates changes in new equipment and structure efficiencies over time as functions of consumer interest rates, fuel prices, and available technologies. However, our model is ad hoc; it lacks a theoretical basis and empirical validation." 1/

Staff scientists at the Lawrence Berkeley Laboratory, who did the actual work with the Oak Ridge model for the appliance program, told us they considered the model optimistic in its predictions of consumer response. They tried to validate the model's formula by studying consumer investments in more energy-efficient housing from 1973-79, but their results did not support the model's assumption.

Energy prices rose rapidly during the 1970s, but they did not have the effect on appliance efficiency that DOE assumed. This is illustrated by estimates of appliance efficiencies DOE obtained in a survey of manufacturers--1975 for furnaces and 1972 for other

1/Eric Hirst and Janet Carney, The ORNL Engineering Economic Model of Residential Energy Use, ORNL/CON-24, July 1978, p. 71.

appliances. While the data showed that some appliances, such as refrigerators, freezers, and kitchen ranges had significantly improved in efficiency from 1972-78, major energy users such as furnaces, central air conditioners, and water heaters showed little change. ^{1/} For example, despite a 40-percent increase in real (non-inflated) natural gas prices from 1975-78, the average efficiency of gas furnaces sold over these years remained essentially the same. In addition, gas water heaters improved only 1.7 percent from 1972-78, while real gas prices increased about 65 percent. A 14-percent rise in real electricity prices from 1972-78 produced only a 5-percent increase in central air conditioner efficiency.

The market's ability to improve appliance efficiency may also be hampered by the inclination of builders to purchase low cost, low efficiency appliances for new houses. Some major energy-using products are sold in large numbers to the new housing industry. According to manufacturers, about half the new furnaces and central air conditioners go to the new housing industry in a typical year (less when the housing market is depressed). Five of the six appliance manufacturers we visited pointed out that builders are very price sensitive and that future operating costs are not a major consideration in their appliance purchase decisions. Because of this situation, these manufacturers said companies would feel obliged to manufacture low efficiency appliances if there are no national efficiency standards.

This characterization of the new housing market was largely confirmed in a 1980 survey by the National Association of Home Builders Research Foundation. Most of the builders responded that they chose the brand and model of appliances put in the houses they built, and 61 percent said they did not consider energy efficiency in making the choice. Only 11 percent said efficiency was a primary consideration.

INCONSISTENT PROJECTION OF THE
EFFECTS OF MARKET FORCES ON CONSUMERS
AND APPLIANCE MANUFACTURERS

In using the Oak Ridge model, DOE projected a base case in which market forces would achieve very substantial improvements in appliance efficiency without standards, but assumed the market would not improve appliance efficiency once a minimum standard was put in place, unless average efficiency in the base case exceeded

^{1/}The Lawrence Berkeley staff did a sensitivity analysis using this data. They projected the 1972-78 trend into the future rather than allowing the Oak Ridge model to predict future efficiencies. In this analysis, the energy saved by standards increased 130 percent over the prevailing DOE analysis.

the standard. Furthermore, in a separate analysis of the financial impact of standards on manufacturers, DOE assumed that the market would not cause firms to invest in improving appliance efficiency. Instead, the analysis assumed that the cost and risk of producing more efficient appliances was incurred because of standards. By not consistently using its assumption about market forces throughout its various analyses, DOE has undermined the comparability of its different cases and the reliability of its conclusions. The inconsistencies have the effect of decreasing the savings from, and increasing the costs of, standards.

In projecting future energy consumption in the Oak Ridge model base case, the previously discussed assumption of the effect increasing energy prices have on consumer purchase decisions (see pp. 12-13) was used for the entire time period in the analysis, 1978 to the year 2005. In the standards case, the model was programmed to ignore the effect of this assumption once a standard takes effect unless average efficiency in the base case exceeded that in the standards case. In order to be consistent, DOE should have used its assumption throughout both cases, and projected that an increasing number of consumers would buy appliances above the standard level as energy prices increased. The overall effect of this inconsistent treatment of market forces is to decrease the projected energy savings that standards would achieve.

DOE's April 1982 NOPR is also based on inconsistent treatment of market forces in assessing the potential cost burden on manufacturers from appliance standards. In estimating the cost burden, DOE assumed that all appliance manufacturers' costs and risks in improving the efficiency of appliances resulted from the imposition of standards. This assumption was made even though DOE's base case projection of future energy consumption from appliances disclosed substantial gains in the efficiency of appliances manufactured and purchased. While DOE recognized some inconsistency in its analysis, it nonetheless asserted that appliance standards would impose a burden on manufacturers. We do not believe DOE's supporting analyses to its April proposal reasonably demonstrated such a cost burden.

VARYING PROJECTIONS OF FUTURE ENERGY PRICES IN ESTIMATING APPLIANCE STANDARDS IMPACT

DOE projected future energy savings from standards using four markedly different assumptions about future energy prices. Further, its April proposal is based on an energy price assumption which is significantly higher than other available estimates. DOE's successive analyses have generally been based on increasingly higher future energy price assumptions and this has resulted in lower estimates of energy savings from appliance standards. The changing assumptions about future energy prices and the energy price assumption used in the April proposal raise concerns about DOE's basis for its no standards proposal.

As explained in chapter 1, DOE revised its economic analysis twice, once in response to public comments on its June 1980 NOPR, and once in response to the energy price assumptions of the administration. Since the June NOPR analysis used two different assumptions about future energy prices, DOE has now produced four different estimates of the impact of appliance standards. The results of each succeeding analysis showed reduced energy savings from standards. DOE based its April 1982 NOPR on the last of these analyses.

In revising its analyses, DOE made changes to some of the assumptions and basic input data. According to LBL staff, the following principal changes were made for the second analysis:

- Higher energy prices forecast by the Energy Information Administration were used.
- Proposed standard levels were lowered.
- The starting points from which the model predicted future appliance efficiencies were revised to represent 1978 new appliances rather than pre-1978 existing appliances.
- Average lifetimes of appliances were increased.

In addition, the LBL staff cited the following three principal changes that were made for the third analysis:

- Energy prices forecasts in the Administration's National Energy Policy Plan were used.
- Interim standards were eliminated from consideration, and final standards were dropped for clothes dryers and ranges/ovens.
- The effective date of final standards was postponed from January 1, 1986, to July 1, 1987.

Table 2 shows the results of DOE's three analyses, with the energy savings projected over a 24-year period from 1982 to 2005. DOE's highest energy savings projection was nearly five times greater than its lowest (and last) projection. Energy savings from certain appliances, such as furnaces and refrigerators, changed dramatically from the first to the last analysis.

Table 2

Results of DOE's Three Analyses Projecting
Energy Savings From Efficiency Standards
Cumulative Savings 1982 to 2005

<u>Appliance</u>	<u>First analysis (note a)</u>	<u>Second analysis</u>	<u>Third analysis</u>
		(quads)	
Furnaces	2.00-4.27	0.47	.00
Water heaters	3.87-5.91	2.75	1.80
Central air conditioners	2.62-3.73	5.20	2.62
Refrigerators	3.64-7.56	0.63	0.16
Ranges/ovens	0.26-0.82	0.00	(b)
Clothes dryers	0.32-0.59	0.04	(b)
Freezers	0.82-1.69	1.14	0.33
Room air conditioners	0.22-0.65	0.71	0.30
Total	<u>13.75-25.13</u>	<u>10.94</u>	<u>5.21</u>

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

b/Not analyzed in standards case.

Sources: DOE's Economic Analyses, June 1980, June 1981, and March 1982.

The most questionable changes were the energy price assumptions. DOE has used four different assumptions about future energy prices, reflecting the fundamental uncertainty of such forecasting efforts. Table 3 shows the difference in the total percentage change in real (constant dollar) residential energy prices projected over the period 1980 to 2005 for each of the three analyses.

Table 3

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

	<u>First analysis</u>		<u>Second analysis</u>	<u>Third analysis</u>
	<u>Low (note a)</u>	<u>High (note a)</u>		
Electricity	28	86	22	41
Natural gas	57	109	131	172
Fuel oil	57	109	133	127

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

With few exceptions, DOE raised its price forecasts for successive analyses. The Department's forecast of natural gas prices in its last analysis was three times as high as its lowest forecast. When these prices are used in the model, consumers would be projected to purchase much more efficient gas appliances, and thus lower the projected impact of standards.

Most energy price assumptions of nongovernmental organizations 1/ we examined were lower than what DOE used in its third analysis. DOE's projected increases were 78 percent higher for electricity, 12 percent higher for natural gas, and 25 percent higher for heating oil than the average increase assumed by these other organizations. The price increases used in the last analysis were so high that the Oak Ridge model predicted market forces alone would improve appliance efficiency enough to save 27.5 quads of energy over the 24-year simulation period. The model attributed an additional 5.2 quads of savings to efficiency standards.

1/Data Resources, Inc.; Edison Electric Institute; American Gas Association; Oak Ridge Institute for Energy Analysis.

CHAPTER 3

DOE'S REVISED 1980 STANDARDS--A

POTENTIALLY VIABLE PROPOSAL

DOE's revision to its June 1980 NOPR appears to have potential because it addressed major appliance industry concerns and contained standard levels which could benefit consumers. The revised final standards generally reflected industry recommended efficiency levels. In addition, these levels represented a significant increase over the average efficiency of appliances sold in 1978 and could have resulted in energy and consequently cost savings to consumers. However, the revised standards were never published for public comment because the administration decided to review the standards development process.

INDUSTRY CONCERNS ADDRESSED IN REVISED JUNE 1980 STANDARDS

DOE's revision to its June 1980 NOPR focused on resolving concerns expressed by industry over the level of standards and the certification and enforcement process. In its revision, DOE lowered 1981 interim standard levels below the levels apparently acceptable to industry and established 1986 final standard levels reasonably close to industry recommended levels. With respect to certification and enforcement, DOE's revision significantly relaxed such provisions in response to industry concerns.

Appliance manufacturers, in commenting on DOE's June 1980 NOPR, expressed concern over the high levels for DOE's proposed final appliance standards. DOE officials told us they were aware at the time of the proposal that the 1986 levels were high, but they proceeded with the proposal to elicit industry views on what industry considered acceptable standard levels.

Based on appliance manufacturers' comments primarily concerning the proposed 1986 standard levels, DOE revised both the proposed interim and final standard levels. Tables 4 and 5 show DOE's original standard level proposals, its revisions, and the average levels recommended by manufacturers for the interim and final standards. As shown in table 4, manufacturers were prepared to accept the originally proposed interim standard levels for most products, yet DOE lowered nearly all of them. ^{1/} In the case of central air conditioners, manufacturers considered the standards too high, but DOE revised them below what manufacturers recommended. Concerning final standard level proposals, table 5 shows that DOE came quite close to industry recommendations with its revised levels, although it remained slightly higher in some areas and lower in others.

^{1/}According to DOE officials, the revised levels were generally selected to reflect DOE's response to comments from small manufacturers.

Table 4

Changes In Proposed Interim Standard Levels
from First to Second DOE Analysis and a
Comparison to the Levels Recommended by Industry

<u>Appliance/class (note a)</u>	<u>Originally proposed for 1981</u>	<u>Revised</u>	<u>Percent change</u>	<u>Manufacturers' proposed levels (note b)</u>
—(energy efficiency factors) (note c)—				
<u>Refrigerators - 17 cu. ft.</u>				
Top mount/automatic defrost	4.7	4.5	-4	4.7
Side by side - automatic	4.7	4.3	-9	4.6
<u>Freezers - 15 cu. ft.</u>				
Chest - manual defrost	11.2	No standard	N/A	11.2
Upright - manual	8.9	No standard	N/A	9.0
Upright - automatic	6.3	No standard	N/A	6.3
<u>Water heaters - 52 gal.</u>				
Electric	79.0	80.0	+1	82.0
Gas	45.0	44.0	-2	47.0
<u>Room air conditioners (note d)</u>				
6,000 Btu's or less	6.5	6.2	-5	7.1
6,001 - 14,000 Btu's	7.5	7.4	-1	7.7
14,001 - 20,000 Btu's	7.5	6.6	-12	7.7
Over 20,000 Btu's	6.7	6.5	-3	7.2
<u>Central air conditioners</u>				
<u>Split system</u>				
under 39,000 Btu's	7.8	6.5	-17	7.4
over 39,000 Btu's	7.8	7.0	-10	7.4
<u>Single package</u>				
under 39,000 Btu's	7.5	6.6	-12	7.2
over 39,000 Btu's	7.5	6.6	-12	7.2
<u>Furnaces</u>				
Gas, forced air indoor	65.0	63.0	-3	66.0
Oil, forced air indoor	75.0	73.0	-3	74.0

a/Some DOE standards are expressed as formulas, so we have calculated the result for representative models of refrigerators, freezers, and water heaters. We omitted clothes dryers and ranges/ovens because DOE dropped its proposed standards for them when the economic analysis was revised.

b/This column gives the average standard levels recommended by manufacturers in their testimony on the June 1980 NOPR.

c/See appendix I for definitions.

d/DOE revised the classes after the June 1980 NOPR.

Table 5

Changes in Proposed Final Standard Levels from
First to Second DOE Analysis and a Comparison
to the Levels Recommended by Industry (note a)

<u>Appliance/class</u>	<u>Originally proposed for 1986</u>	<u>Revised</u>	<u>Percent change</u>	<u>Manufacturers' proposed levels</u>
—————(energy efficiency factors)—————				
<u>Refrigerators - 17 cu. ft.</u>				
Top mount/automatic defrost	8.0	7.6	-5	7.1
Side by side - automatic	6.6	6.1	-8	6.1
<u>Freezers - 15 cu. ft.</u>				
Chest - manual defrost	18.7	14.9	-20	13.7
Upright - manual	16.0	13.2	-18	13.5
Upright - automatic	9.5	8.9	-6	9.0
<u>Water heaters - 52 gal.</u>				
Electric	93.0	88.0	-5	88.0
Gas	62.0	57.0	-8	57.0
<u>Room air conditioners</u>				
6,000 Btu's or less	8.4	7.9	-6	8.0
6,001 - 14,000 Btu's	9.5	9.1	-4	8.6
14,001 - 20,000 Btu's	9.5	8.1	-15	8.6
over 20,000 Btu's	8.4	7.5	-11	8.0
<u>Central air conditioners</u>				
<u>Split system</u>				
under 39,000 Btu's	11.0	9.5	-14	9.5
over 39,000 Btu's	11.0	9.5	-14	9.5
<u>Single package</u>				
under 39,000 Btu's	10.5	9.3	-11	9.0
over 39,000 Btu's	10.5	9.5	-10	9.0
<u>Furnaces</u>				
Gas, forced air indoor	81.0	79.0	-2	77.6
Oil, forced air indoor	80.0	78.0	-3	76.5

a/See footnotes for table 4.

With respect to certification and enforcement, the appliance industry expressed serious concern. DOE's proposed program included a significant amount of appliance testing as well as quarterly reporting of production and testing schedules. The Association of Home Appliance Manufacturers and the Gas Appliance Manufacturers Association commented on the need to relax the proposed certification and enforcement program. The air conditioning industry focused strong criticism on the certification proposal stating that the proposal would compete directly with the industry's ongoing certification program operated by the Air Conditioning and Refrigeration Institute.

After considering the above comments, DOE proposed changes to its appliance standard enforcement procedures at a public meeting in October 1980. While the proposal did not fully address industry concerns, it was a compromise position. Subsequently, DOE further revised its proposal to be more in line with industry views. However, DOE did not publish this revision because the administration decided to review the standards development process.

CONSUMER ENERGY AND COST BENEFITS FROM REVISED STANDARDS

Our analysis of the future impact from DOE's revised 1980 standards indicates that they could save about 10 percent of the energy consumed by six appliances in the year 2000, or about 1.5 quads of energy. On a life-cycle cost basis, consumers could realize savings of between \$40 and \$1,320, depending on the appliance purchased.

In assessing future energy savings from standards, DOE's analytical approach relied heavily on future energy price projections. Because of the subjectivity of such projections and the Oak Ridge model's sensitivity to them as previously discussed, we sought to determine what efficiency standards could potentially save, excluding the effects of future energy prices. To do this, we assumed that appliance efficiencies existing in 1978 remained unchanged unless standards were imposed. We recognize that consumers might, in their appliance purchase decisions, respond to changes in future real energy prices. This response would affect the actual amount of energy saved by standards. However, because of the subjectivity in predicting future events, we believe an estimate of overall potential energy savings can contribute to an appliance standards analysis.

Using the above method, staff scientists at LBL assessed, at our request, the energy savings potential from imposing the revised standards considered by DOE after its June 1980 proposal. The results of this analysis indicate that the potential energy savings in the year 2000 from DOE's revised standard levels would be 1.5 quads, about a 10-percent energy savings, as shown in table 6.

Table 6

Potential Energy Savings from DOE's Revised
Appliance Standards
in the Year 2000

<u>Appliance (note a)</u>	<u>Projected energy use</u>		<u>Potential savings</u>	<u>Bbl. oil per day equivalent</u> (thousands)
	<u>Without standards (at 1978 efficiency levels)</u>	<u>With standards (at revised levels)</u>		
	<u>quads</u>			
Furnaces	6.37	6.11	.26	130
Water heaters	4.05	3.56	.49	244
Central air conditioners	2.34	2.00	.34	170
Refrigerators	1.45	1.17	.28	139
Room air conditioners	.49	.44	.05	25
Freezers	.47	.43	.04	20
Total	<u>15.17</u>	<u>13.71</u>	<u>1.46</u>	<u>728</u>

a/ Only six appliances are included in this analysis because DOE had already decided against standards for clothes dryers and ranges/ovens at the time it revised its June 1980 proposals. These two appliances had consistently shown little potential for savings in DOE's earlier analyses.

Source: Computed by GAO from a special analysis by LBL, using the Oak Ridge model.

As shown in table 6, four appliances--furnaces, water heaters, central air conditioners, and refrigerators--account for essentially all of the savings potential from imposing standards. Our energy savings estimate for central air conditioners was reasonably close to an estimate by the Carrier Corporation, a major air conditioning manufacturer. In its analysis, Carrier considered standard levels similar to DOE's revised levels and projected savings of 178,630 barrels of oil equivalent per day in 1996.

Concerning cost benefits to consumers, a DOE comparison of the revised standard levels with efficiencies of typical appliances available at the time of the analysis shows that consumers would realize life-cycle cost benefits from purchasing appliances meeting the revised standards. DOE's economic analysis of its revised June 1980 standards disclosed, as shown in table 7, that consumers would save between \$40 and \$1,320 over an appliance's useful life, depending on the type of appliance. These savings would result from reduced energy consumption from more efficient appliances.

Table 7

Life-Cycle Cost Savings from DOE's
Revised June 1980 Standard Levels

<u>Appliance</u>	<u>Savings (note a)</u>	
	<u>Lowest</u>	<u>Highest</u>
	—1980 dollars—	
Furnaces	\$333	\$1,320
Water heaters	158	255
Central air conditioners	210	646
Refrigerators	58	363
Room air conditioners	40	279
Freezers	100	220

a/ Range of savings reflect different classes of each appliance type.

Source: DOE's second economic analysis using energy price assumptions from the Energy Information Administration's Nominal Forecast.

DOE also assessed how long it would take consumers to recover the increased initial appliance costs which would result from increased efficiency required by the revised standard levels. This analysis disclosed that such costs would be recoverable in less than 3 years for five of the six appliances included in the analyses, as shown in table 8. Manufacturers told us the average consumer will generally not consider a payback period longer than 3 years. Only central air conditioners would require a longer recovery period.

Table 8

Increased Purchase Price Recovery
Periods Under DOE's Revised Standards

<u>Appliance</u>	<u>Maximum recovery period</u> <u>(years)</u>
Furnaces	1.5
Water heaters	0.5
Central air conditioners	4.5
Refrigerators	1.8
Room air conditioners	2.8
Freezers	1.2

Source: DOE's second economic analysis.

CHAPTER 4

ISSUES RELATED TO A

NO STANDARDS DECISION

Two issues relating to a final no standards decision by DOE are (1) the implications such a decision will have for existing State appliance standards programs and (2) the extent to which the Federal appliance labeling program will, through enhanced consumer awareness, increase the number of high efficiency appliances being purchased. With respect to State appliance standards programs, a no standards decision, which preempts such programs, may adversely affect energy conservation and utility load management efforts in many States. Concerning the appliance labeling program, our work indicates that the program for furnaces--the largest single user of residential energy--has limited potential for affecting consumer appliance purchase decisions, and thus increasing appliance energy efficiency.

PREEMPTION OF STATE APPLIANCE STANDARDS

DOE's April 2, 1982, proposal of no standards for appliances, if finalized, will preempt existing State appliance standards programs. Such a situation could adversely impact on States which have standards programs or have promoted increased appliance efficiency through building codes. In addition, NECPA provides that States may petition DOE for exemption from the standards determination; consequently, a proliferation of divergent State standards could follow DOE's determination.

EPCA, as amended by NECPA, provided that any Federal efficiency standard adopted for a covered appliance would supersede State and local appliance standards or efficiency requirements. Furthermore, if DOE makes a no standard determination for a given appliance, that determination also preempts State and local appliance efficiency regulations. Thus, DOE's April proposal of no standards for eight appliances, if finalized, preempts State and local programs regulating the efficiency of those appliances.

A preemption of appliance efficiency regulations in some States would impact on energy conservation and utility load management efforts. Overall, officials of 9 of 24 States we contacted told us they would likely petition DOE to exempt their programs from preemption. Of these nine, we believe California and New York which have actively promoted appliance efficiency by establishing State appliance efficiency standards, would be most adversely affected.

California implemented standards or requirements for eight appliances, including refrigerators, freezers, and room and central air conditioners. The California Energy Commission uses projected energy savings from the standards program in its electricity demand forecasts for approving new powerplants. Commission officials believe loss of their standards program could increase the demand for generating capacity by nearly 1,000 megawatts by 1985, the equivalent of a nuclear powerplant.

In addition, the California appliance standards may have increased the overall efficiency of appliances sold in the United States. Five of the six manufacturers said the California standards have increased the availability of more efficient models and generally led to an upgrading of overall efficiency levels (the sixth company had no opinion because it does not sell in California). Data collected by the Air Conditioning and Refrigeration Institute shows that the only significant increase in average central air conditioner efficiency from 1975 to 1980 occurred in 1978, the first year after the California standard became effective.

New York began regulating appliance efficiency in 1977 and has extended its program to include refrigerators, freezers, room air conditioners, and water heaters. New York officials believe elimination of their standards would increase peak electricity demand and necessitate building new generating capacity.

Other States have programs which would be affected by a final DOE no standards decision. For example, nine States we contacted prohibit installation of gas appliances with standing pilot lights (thus requiring an automatic ignition device). DOE's determination of "no standards" would preempt this type of State regulation.

Efficiency standards for air conditioning and water heating equipment have been incorporated into building codes in 49 States. These standards are generally based on standards recommended by the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE). Although the ASHRAE standard for central air conditioners is not very stringent and its preemption would not significantly affect energy conservation efforts, the ASHRAE standard for water heaters has had an impact on energy conservation. For example, State Industries, a water heater manufacturer, in testifying on DOE's June NOPR, stated that the average efficiency of water heaters sold had improved substantially since 1978 because of the implementation of standards by California and the widespread adoption of ASHRAE standards in State building codes.

NECPA permits States to petition the Secretary of Energy for exemption from the Federal rules. The Secretary may grant exemption if he finds the State regulation

- is more stringent than the Federal standard,
- serves a significant State or local interest, and
- would not unduly burden interstate commerce.

Many State officials told us they would not petition DOE for such an exemption to preserve appliance efficiency standards within their State building codes. However, as previously stated, nine States told us they would likely petition DOE for an exemption from the preemption provision. Should DOE grant these petitions, a number of potentially differing State appliance standards programs could remain in effect and additional States might be encouraged to develop appliance standards programs.

EXTENT TO WHICH APPLIANCE LABELING PROGRAM WILL INCREASE CONSUMER AWARENESS OF APPLIANCE EFFICIENCY

In its April 1982 NOPR, DOE states it expects that increased consumer awareness of appliance efficiency will result from higher energy prices in combination with the Federal Trade Commission's (FTC's) appliance labeling program. DOE adds, however, that neither it nor FTC have evaluated the labeling program to determine its impact. Our work, however, shows that with respect to furnaces--the largest single user of residential energy--appliance labeling is not likely to significantly affect purchase decisions. Unlike the labels for other appliances, furnace labels themselves do not contain any efficiency information but refer the consumer to fact sheets which consumers are not asking for, nor are dealers providing. Also, about one-half of furnaces sold are for the new housing market, and builders rather than the ultimate consumers are making appliance purchase decisions.

The Federal appliance labeling program, authorized in EPCA, requires that selected appliances bear an energy label disclosing pertinent information about the appliances' energy efficiency and/or energy cost of operation. FTC, responsible for administering the program, has published labeling rules for seven appliances--refrigerators, freezers, dishwashers, water heaters, room air conditioners, clothes washers, and furnaces. FTC has exempted five appliances from the requirement and is in the process of preparing rules for central air conditioners (including heat pumps).

While most appliances bear labels which contain comparative efficiency information, FTC determined that labels for furnaces and eventually for central air conditioners would contain no specific comparative information, but rather refer the customer to "fact sheets" maintained by dealers. These fact sheets provide

the comparative information contained on the labels of other appliances. Dealers are required to make the fact sheets available to customers at the point of sale.

To determine the extent that energy efficiency labels and fact sheets were being used in selling furnaces, we conducted a nationwide survey of heating contractors. ^{1/} We found that furnace customers are not requesting efficiency information, and heating contractors are not providing them information required to be furnished to them under the appliance labeling program. Thus, the impact of the furnace labeling program is questionable.

Fifty-five percent of those contractors responding said that no customers have ever asked to see a fact sheet, while 36 percent said a few customers had asked. Concerning how often fact sheets were used when discussing sales with customers, 61 percent of those responding said occasionally or never, and an additional 10 percent said about half of the time.

We analyzed the answers according to various characteristics of the respondents, and found no significant difference among large, medium, or small heating contractors or from different size cities. We did, however, find a variation among climatic regions. Contractors in cold climates (over 7,000 heating degree days) were least likely to use the fact sheets. Even though efficient furnaces would have a better payback in colder climates, 80 percent of these contractors said they have used the fact sheets occasionally or never.

Overall, most of the survey respondents doubted the usefulness of the labeling program for improving furnace efficiency. More than half of those with an opinion said the program is of slight use or no use in getting customers to buy more efficient furnaces. A minority of contractors (18 percent), however, believed the program had substantial value. All but 1 of the 54 respondents who took the opportunity to provide additional comments were critical of the program. Among the most frequent comments were:

- The fact sheets are too complex for customers.
- The fact sheets are misleading.
- Customers prefer to depend on their contractors to advise them on choosing a furnace.

^{1/}Questionnaires were mailed to 514 heating contractors selected randomly from the classified sections of the telephone directories of all standard metropolitan statistical areas with at least 3,000 annual heating degree days. Of 381 respondents, 54 did not complete the questionnaire because they did not sell furnaces for single-family homes.

During FTC's rulemaking process for the appliance labeling program, FTC concluded that residential consumers would not see energy labels on furnaces and central air conditioners prior to sale because heating contractors usually visited a customer's home, made an estimate of what was needed, and sold these products with the aid of promotional literature. Appliance manufacturers have questioned the value of the furnace label, pointing out that customers do not see it until the furnaces are installed in their homes. Furthermore, based on our survey of heating dealers, only 29 percent of those responding said they had a showroom where customers could look at furnaces before they made a purchase.

In addition to the above information on use of the label and fact sheets, we noted that about 50 percent of furnaces and central air conditioners are purchased for the new housing market, and builders make most of these purchase decisions before the ultimate customer, the homeowner, has an opportunity to see energy efficiency information. As previously discussed, since builders give primary emphasis to initial cost of appliances in their purchase decisions for new homes, it is unlikely that energy labeling for these products would have much of an impact.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATION

CONCLUSIONS

NECPA directs the Secretary of Energy to prescribe efficiency standards for each of 13 appliances. The standards are to assure that appliances meet a specific level of energy efficiency. The act required, however, that any standard prescribed be technologically feasible, economically justified, and result in significant conservation of energy. DOE began work in 1978 on the analyses which would support the standards and, in June 1980, proposed standards for eight appliances. Since that time, DOE has completed two additional analyses which contain significantly different estimates of the standards' impact on energy conservation.

The administration has argued that Federal conservation programs are not needed because the market will respond to higher energy prices and achieve conservation goals. This view was included in DOE's analysis supporting its April 1982 NOPR that proposed no efficiency standards be established for eight appliances covered by NECPA.

We believe that the analytical basis for DOE's April 1982 NOPR is highly questionable. The analyses contain an unvalidated key assumption, are inconsistent in treating the impact of market forces, and use energy price projections significantly higher than other projections we obtained. All of this had the effect of enhancing the case for a no standards determination by decreasing the energy savings from, and increasing the costs of, establishing appliance efficiency standards.

We believe that the revised June 1980 standard levels could form a basis for proposing standards for four significant energy consuming appliances--furnaces, central air conditioners, water heaters, and refrigerators. These standards were never published for public comment because the administration suspended rulemaking to reevaluate the entire standards development process. The revised standards appear to have potential because they addressed major appliance industry concerns and were established at levels which could offer consumers life-cycle cost savings and reasonable paybacks. The revised standards generally reflected industry recommended efficiency levels. In addition, these levels represented a significant increase over the average efficiency of appliances sold in 1978. We estimate that the revised standards could save about 10 percent of the energy consumed by these four appliances in the year 2000.

Related to a no standards decision are the issues of the implications such a decision will have for existing State appliance standards programs and the extent to which the Federal appliance

labeling program can influence consumer purchases of efficient appliances. A no standards decision, which preempts State standards, may adversely affect energy conservation and utility load management efforts in States which have such standards or have promoted increased appliance efficiency through building codes. With respect to the appliance labeling program, our work indicates that the labeling program for furnaces--the largest single user of residential energy--has limited potential for affecting consumer appliance purchase decisions, and thus increasing appliance energy efficiency.

Like other Federal conservation programs, the appliance standards program is at a crossroads. The public comment period on the April 1982 NOPR should provide DOE an opportunity to gauge public and industry opinions on a no standards proposal. The issues discussed in this report indicate that the basis for DOE's no standards proposal is highly questionable and that further consideration should be given to the DOE analyses supporting revisions to its June 1980 NOPR.

RECOMMENDATION

We recommend that the Secretary of Energy make no decision on the need for appliance efficiency standards until he considers and resolves the issues raised in this report. In carrying out this recommendation, the Secretary should either demonstrate more conclusively for each appliance that a determination of no standard is justified or prescribe an appropriate energy efficiency standard.

ENERGY EFFICIENCY FACTORS

<u>Appliance</u>	<u>Energy Efficiency Factor</u>
Refrigerators -	The volume of the refrigerator expressed in cubic ft., divided by the kilowatts needed per day for operation.
Freezers -	The volume of the freezer expressed in cubic ft., divided by the number of kilowatts needed per day for operation.
Water heaters -	The energy content of average daily hot water consumption divided by the average daily energy consumption of the heater, expressed as a percent.
Room air conditioners -	Cooling capacity per hour divided by electrical power in watts. This is expressed in Btu's and referred to as the energy efficiency ratio (EER).
Central air conditioners -	The Btu's of cooling capacity per watt hour measured over a normal cooling season. Referred to as the seasonal energy efficiency ratio (SEER).
Furnaces -	The ratio of the annual output of useful energy delivered to the heated space divided by the annual fuel energy input. This is expressed as a percent and referred to as the annual fuel utilization efficiency (AFUE).



U.S. General Accounting Office
 Survey of the Use of the ENERGYGUIDE
 Labeling and Fact Sheet Program
 in the Home Heating Business

Introduction

The U.S. General Accounting Office, an agency of the U.S. Congress, is reviewing the Federal Trade Commission's ENERGYGUIDE labeling and fact sheet program for furnaces. We would like your candid opinions on the program based on your experience in the home heating business.

For your reference, we have attached sample copies of an ENERGYGUIDE label and ENERGYGUIDE fact sheet. Our questions refer to these ENERGYGUIDE labels and fact sheets.

The questionnaire is numbered only so we can avoid sending unnecessary follow-up requests. Your answers will be strictly confidential and will be combined with all other answers to give an overall view.

Throughout this questionnaire there are numbers printed within parentheses to assist our keypunchers in coding responses for computer analysis. Please disregard these numbers.

If you have any questions, please call Mr. Ken Libbey or Mr. Art Foreman, collect, at (513) 684-2105.

Thank you for your help.

NOTE: Except in question 4, the term "furnace" includes boilers but not space heaters.

1. Do you sell furnaces for single family homes? (9)

- 1. Yes
- 2. No

(If no, do not answer the rest of the questionnaire but please return it in the enclosed envelope.)

2. Do you have a showroom where customers may look at the furnaces you sell? (10)

- 1. Yes
- 2. No

3. About what percent of your residential furnace sales are for new housing and what percent are for replacement furnaces?

	<u>Percent of Sales</u>
1. New housing	_____ % (11-12)
2. Replacement furnaces	_____ % (13-14)
Total	100%

4. During 1981, about how many units of each of the following have you sold for residential use?

	<u>Number of Units</u>
1. Gas furnaces	_____ (15-18)
2. Gas boilers	_____ (19-22)
3. Oil furnaces	_____ (23-26)
4. Oil boilers	_____ (27-30)
5. Electric furnaces	_____ (31-34)
6. Heat pumps	_____ (35-38)
7. Central air conditioners	_____ (39-42)

5. On the furnaces you've received since May 1980, have you seen the ENERGYGUIDE labels which the Federal Trade Commission requires manufacturers to place on their equipment? (Check one.) (43)

- 1. Yes, on all or almost all furnaces
- 2. Yes, on some furnaces
- 3. No, not on any furnaces



6. Have you received copies of the ENERGYGUIDE fact sheets from the furnace manufacturers you represent? (Check one.) (44)

- 1. Yes, from all or almost all
- 2. Yes, from some manufacturers
- 3. No, not received from any manufacturers

7. Have you found the ENERGYGUIDE fact sheets useful to you for evaluating different brands and models of furnaces? (Check one.) (45)

- 1. Yes, very useful
- 2. Yes, somewhat useful
- 3. No, not useful
- 3. No basis to judge

8. How often do you use the ENERGYGUIDE fact sheets when discussing sales with customers? (Check one.) (46)

- 1. Always or almost always
- 2. Frequently
- 3. About half of the time
- 4. Occasionally
- 5. Have not used them

9. How many of your customers, would you estimate, have asked to see the ENERGYGUIDE fact sheets before buying furnaces? (Check one.) (47)

- 1. All or almost all
- 2. Most of them
- 3. About half of them
- 4. A few of them
- 5. None of them

10. How would you rate the information in the ENERGYGUIDE fact sheets in terms of accuracy, clarity, and adequacy? (Check one for each row.)

	Very Good	Good	Neither Good nor Poor	Poor	Very Poor	No Basis to Judge	
	1	2	3	4	5	6	
1. Accuracy - presents the customer with factual information							(48)
2. Clarity - presents the customer with easily understood information							(49)
3. Adequacy - presents the customer with sufficient information							(50)

11. Overall, in your opinion, of how much use is the ENERGYGUIDE program (labels and fact sheets) to customers in making a decision to buy an energy-efficient furnace? (Check one.) (51)

- 1. Of great use
- 2. Of substantial use
- 3. Of moderate use
- 4. Of slight use
- 5. Of little or no use
- 6. No basis to judge

12. If you have any suggestions or comments regarding the ENERGYGUIDE labels or fact sheets for furnaces, please use the back of this page. (52)



TABULATION OF RESPONSES TO
GAO SURVEY ON THE USE OF THE
ENERGYGUIDE LABELING AND FACT
SHEET PROGRAM IN THE HOME
HEATING BUSINESS

1. Do you sell furnaces for single family homes?

	<u>Number of responses</u>	<u>Percent of responses</u>
Yes	327	86
No	<u>54</u>	<u>14</u>
Total	<u>381</u>	<u>100</u>

We eliminated the 54 contractors who answered "No" from all further analyses.

2. Do you have a showroom where customers may look at the furnaces you sell?

	<u>Number of responses</u>	<u>Percent of responses</u>
No answer	3	-
Yes	95	29
No	<u>229</u>	<u>71</u>
Total	<u>327</u>	<u>100</u>

3. About what percent of your residential furnace sales are for new housing and what percent are for replacement furnaces?

Number of responses = 317

	<u>Average percent of sales ^{1/}</u>
New housing	21
Replacement furnaces	<u>79</u>
Total	<u>100</u>

^{1/}This "average" is not weighted by size of contractor. Thus, the figures do not represent national allocations to the two market segments.

4. During 1981, about how many units of each of the following have you sold for residential use?

	<u>Average number of units sold</u>
1. Gas furnaces	46
2. Gas boilers	8
3. Oil furnaces	3
4. Oil boilers	4
5. Electric furnaces	6
6. Heat pumps	13
7. Central air conditioners	36

5. On the furnaces you've received since May 1980, have you seen the ENERGYGUIDE labels which the Federal Trade Commission requires manufacturers to place on their equipment?

	<u>Number of responses</u>	<u>Percent of responses</u>
1. Yes, on all or almost all furnaces	246	77
2. Yes, on some furnaces	71	22
3. No, not on any furnaces	<u>4</u>	<u>1</u>
Total	<u>321</u>	<u>100</u>

6. Have you received copies of the ENERGYGUIDE fact sheets from the furnace manufacturers you represent?

	<u>Number of responses</u>	<u>Percent of responses</u>
1. Yes, from all or almost all	174	54
2. Yes, from some manufacturers	98	31
3. No, not received from any manufacturers	<u>48</u>	<u>15</u>
Total	<u>320</u>	<u>100</u>

7. Have you found the ENERGYGUIDE fact sheets useful to you for evaluating different brands and models of furnaces?

	<u>Number of responses</u>	<u>Percent of responses</u>
1. Yes, very useful	56	21
2. Yes, somewhat useful	140	52
3. No, not useful	72	27
4. No basis to judge	<u>46</u>	<u>-</u>
Total	<u>314</u>	<u>100</u>

8. How often do you use the ENERGYGUIDE fact sheets when discussing sales with customers?

	<u>Number of responses</u>	<u>Percent of responses</u>
1. Always or almost always	34	11
2. Frequently	59	19
3. About half of the time	30	9
4. Occasionally	110	35
5. Have not used them	<u>83</u>	<u>26</u>
Total	<u>316</u>	<u>100</u>

9. How many of your customers, would you estimate, have asked to see the ENERGYGUIDE fact sheets before buying furnaces?

	<u>Number of responses</u>	<u>Percent of responses</u>
1. All or almost all	4	1
2. Most of them	10	3
3. About half of them	16	5
4. A few of them	116	36
5. None of them	<u>177</u>	<u>55</u>
Total	<u>323</u>	<u>100</u>

10. How would you rate the information in the ENERGYGUIDE fact sheets in terms of accuracy, clarity, and adequacy?

1. Accuracy - presents the customer with factual information.

	<u>Number of responses</u>	<u>Percent of responses</u>
1. Very good	31	13
2. Good	133	55
3. Neither good nor poor	57	24
4. Poor	14	6
5. Very poor	6	2
6. No basis to judge	<u>44</u>	<u>-</u>
Total	<u>285</u>	<u>100</u>

2. Clarity - presents the customer with easily understood information.

	<u>Number of responses</u>	<u>Percent of responses</u>
1. Very good	24	10
2. Good	107	43
3. Neither good nor poor	77	31
4. Poor	26	10
5. Very poor	16	6
6. No basis to judge	<u>34</u>	<u>-</u>
Total	<u>284</u>	<u>100</u>

3. Adequacy - presents the customer with sufficient information.

	<u>Number of responses</u>	<u>Percent of responses</u>
1. Very good	29	12
2. Good	107	43
3. Neither good nor poor	73	29

4. Poor	25	10
5. Very poor	15	6
6. No basis to judge	<u>38</u>	<u>-</u>
Total	<u>287</u>	<u>100</u>

11. Overall, in your opinion, of how much use is the ENERGYGUIDE program (labels and fact sheets) to customers in making a decision to buy an energy-efficient furnace?

	<u>Number of responses</u>	<u>Percent of responses</u>
1. Of great use	13	4
2. Of substantial use	39	14
3. Of moderate use	78	27
4. Of slight use	77	27
5. Of little or no use	82	28
6. No basis to judge	<u>32</u>	<u>-</u>
Total	<u>321</u>	<u>100</u>

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