FINAL REPORT

UTILITY AND PERFORMANCE RELATIVE TO
CONSUMER PRODUCT ENERGY EFFICIENCY STANDARDS

Prepared under
Contract No. DE-AC03-79CS20315

For the
U.S. Department of Energy
Buildings and Community Systems Division
Consumer Products Efficiency Branch

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December 14, 1979

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ABSTRACT

This report summarizes an investigation of the relative utility and performance of nine major household consumer products covered by the Energy Policy and Conservation Act. The objective was to define the terms utility and performance, to recommend methods for quantifying these two concepts, and to recommend an approach for dealing with utility and performance issues in the energy efficiency standards program. The definitions developed are: Performance of a consumer product is the objective measure of how well, with the expected level of consumer input (following the manufacturer's instructions for installation and operation), the product does its intended job; and Utility of a consumer product is a subjective measure, based on the consumer's perception, of the capability of the product to satisfy human needs. Quantification is based on test procedures and consumer survey methods which are largely already in use by industry. Utility and performance issues are important in product classification for prescribing energy efficiency standards. The recommended approach to utility and performance issues and classification is: Prior to setting standards, evaluate utility and performance issues in the most quantitative way allowed by resources and schedules in order to develop classification guidelines. This approach requires no changes in existing Department of Energy test procedures.

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EXECUTIVE SUMMARY

The Energy Policy and Conservation Act (EPCA), as amended by the National Energy Conservation Policy Act (NECPA), requires that the Department of Energy (DOE) prescribe energy efficiency standards for nine major household consumer products no later than December 1980.

In Section 325(d) of EPCA, Congress mandated that standards requiring improvement of energy efficiency for the covered products are economically justified only if the benefits of imposing the standards exceed their burdens. This determination of economic justification is to be based upon a weighing of seven factors, one of which is any lessening of the utility or performance of the product. In combining the House and Senate versions of the bill, the conferees states that the Secretary of Energy is expected to quantify these individual factors (such as utility and performance) to the greatest extent practicable. However, the Act provides little guidance as to how to quantify utility or performance nor does it define utility or performance.

The purpose of this report is to define the terms utility and performance, to recommend methods for quantifying these two concepts, and to recommend an approach for dealing with utility and performance issues in the energy efficiency standards program. The approach to dealing with utility and performance issues was to be considered within the context of nine priority products, for which standards are to be established by December 1980. These nine products are:

1. Refrigerators and refrigerator-freezers
2. Freezers
3. Clothes dryers
4. Water heaters
5. Room air conditioners
6. Home heating equipment, not including furnaces
7. Kitchen ranges and ovens
8. Central air conditioners, and
9. Furnaces

The definition of performance recommended for use in the energy efficiency standard program is:

Performance of a consumer product is the objective measure of how well, with the expected level of consumer input, the product does its intended job. Measures of performance include capacity and quality. Capacity can be stated in terms of thermal flux (in units such as Btu/hour) and either storage or working volume. Quality is a measure of the consistency (with time), uniformity (in space), or thoroughness with which the product does its job.

From the consumer viewpoint, the "expected level of consumer input" is the care and attention that the consumer is expected to provide by following the manufacturer's instructions for installation and operation.

From the standpoint of the test program, the expected inputs are instructions similar to the manufacturer's which are codified into the test procedures.

Performance can be measured by prescribed test procedures, although not necessarily by existing DOE test procedures. The measures of the performance of a consumer product are typically few and do not change

in time as long as external conditions (such as ambient temperature and electrical supply voltage) are not changed and the condition of the product has not deteriorated or otherwise changed. Thus, performance can be readily compared to a prescribed standard.

The definition of utility recommended for use in the standards program is:

Utility of a consumer product is a subjective measure, based on the consumer's perception, of the capability of the product to satisfy human needs. Energy efficiency and product performance as well as purely subjective factors can affect the consumer's perception of the product's utility.

Utility is inherently a subjective measure because it depends in part on the consumer's frame of reference, which can change with time. The utility of a product or an attribute of a product can vary from person to person as well as from time to time.

Utility can be measured using consumer surveys based on statistical methods although the values determined at any one time may not be the same as those determined earlier or later using the same methods.

Another approach to quantifying utility is to measure the number of products that are in use at any given time. Since utility depends on the value of the product or feature as perceived by the consumer, it can be measured in the market place.

The primary areas where utility and performance issues arise in the standards program are:

1. weighing of the benefits of a standard versus possible lessening of product utility or performance, and

2. creation of a class for models of a product with an attribute justifying an energy efficiency standard different from other models of the product.

Failure to provide appropriate product classifications could eliminate from the market product attributes, features, or options which provide substantial utility to consumers. Thus class selection is the main route to insuring that there is no lessening of the utility or the performance of the covered products.

The consideration of utility and performance issues is to be done prior to issuing energy efficiency standards for the product. There are no provisions in the Act for continual monitoring of utility or performance, although there are provisions for re-evaluation of a standard not later than five years after it is prescribed.

The recommended approach for handling utility and performance issues within the standards program is:

Prior to setting standards, evaluate utility and performance issues when creating classes. To the extent allowed by resources, schedules, and available data, this evaluation should be quantitative.

A further recommendation follows from this approach:

Do not change existing DOE test procedures for the purpose of acquiring data for defining classes and weighing the benefits versus burdens of proposed standards.

In order to provide a framework for further evaluation of class and other issues, a list of proposed classes has been developed based on a qualitative consideration of utility and performance and on other work done within the energy efficiency standards program. This list, along with the criteria used to develop it, is presented in Appendix II.

An example is provided of one type of quantitative analysis which may be used to determine whether or not a separate class should be established for a particular product feature or attribute. The assumption underlying this approach is that a separate class is justified to preserve the attribute in the market place if the value of the attribute in the eyes of the consumer is greater than its cost. This method of analysis, although straightforward, has been of limited use in this investigation because of lack of data on the value which consumers place on various product attributes.

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I. BACKGROUND

The Energy Policy and Conservation Act (Public Law 94-163), as amended by the National Energy Conservation Policy Act (Public Law 95-619), requires that the Department of Energy (DOE) prescribe energy efficiency standards for nine major household consumer products no later than December 1980.

Under the Energy Policy and Conservation Act (EPCA) of December 1975, the Federal Energy Administration was required to develop test procedures for thirteen specified products. Final test procedures have been prescribed for the thirteen products and have been published in the Federal Register.

The National Energy Conservation Policy Act (NECPA) of November 1978 amended EPCA by requiring energy efficiency standards based on the test procedures for the thirteen covered products as well as for any future products which come under this program. Additional products may be covered by energy efficiency standards if the average per household energy use within the United States of the product type (or class) exceeds 150 kilowatt-hours (or its Btu equivalent) annually and the aggregate household energy use in the United States exceeds 4,200,000,000 kWh (or its Btu equivalent) annually. These minimum energy efficiency levels made it mandatory that each product or class of products have an energy efficiency which meets the energy efficiency standard prescribed by the Secretary of DOE.

In Section 325(d) of EPCA, Congress mandated that standards requiring improvement of energy efficiency for the covered products are

economically justified only if the benefits of imposing the standards exceed their burdens. This determination of economic justification is to be based upon a weighing of seven factors, one of which is any lessening of the utility or performance of the product. In combining the House and Senate versions of the bill, the conferees stated that the Secretary of Energy is expected to quantify these individual factors (such as utility and performance) to the greatest extent practicable. However, the Act provides little guidance as to how to quantify utility or performance nor does it define utility or performance.

The purpose of this report is to define the terms utility and performance, to recommend methods for quantifying these two concepts, and to recommend an approach for dealing with utility and performance issues in the energy efficiency standards program. The approach to dealing with utility and performance issues was to be considered within the context of nine priority products, for which standards are to be promulgated by December 1980. These nine products are:

1. Refrigerators and refrigerator-freezers
2. Freezers
3. Clothes dryers
4. Water heaters
5. Room air conditioners
6. Home heating equipment, not including furnaces
7. Kitchen ranges and ovens
8. Central air conditioners
9. Furnaces

An Advanced Notice of Proposed Rulemaking (ANPR) Regarding Energy Efficiency Standards for these nine products was published in the Federal Register on January 2, 1979 (Ref. 1).

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II. APPROACH

A number of constraints were initially imposed on the choice of the definition of utility and performance. First, the definitions had to be compatible with the use of the terms in EPCA and by the DOE program office. They had to be compatible with use by the industry and by the public, as reflected in the public comments received by DOE. The definitions had to be compatible with dictionary definitions such as that given by Webster's Third New International Dictionary, Unabridged (Ref. 2). The definitions had to lend themselves to the quantification of the two terms. Finally, and perhaps most importantly, the definitions had to reflect the thinking of the consumers of the nine products. In a sense, the definitions found in industry, government, or the dictionary are simply vehicles for approximating the perception of the consumer.

With these constraints in mind, the project was divided into six tasks, each summarized in an interim or topical report (Ref. 3). Task I was begun in mid-May, and Task VI was completed in mid-September 1979.

Task I consisted of meeting with and discussing the concepts of utility and performance with engineers, economists, and others in the DOE Program Office (Consumer Products Efficiency Branch) and with designated staff from the National Bureau of Standards (NBS). Task II consisted of reviewing public comments submitted to DOE and the DOE Federal Register notices related to utility and performance of consumer products in connection with the standards program, test procedures,

and energy efficiency improvement targets. Task III consisted of developing definitions and methods for quantifying utility and performance based on the findings of the first two tasks. The objective of Task IV was to develop and recommend an approach in the energy efficiency standards program for handling utility and performance issues. The objective of Task V was to recommend any necessary changes to the DOE test procedures for consumer products. A summary of the investigation for use by the DOE Freedom of Information Office was prepared under Task VI.

In the context of the energy efficiency standards program, the word "product" is used to mean one of the fourteen categories of consumer products mentioned in Section I; for example, water heaters. The word "class" is used to mean a grouping within one of the product categories; for example, electric water heaters. A "model" is a specific type and size of consumer product offered by a specific company; for example, XYZ Corporation 80-gallon electric water heater.

III. INTERVIEWS

In order to get a sense of how the terms utility and performance were being used within the DOE Program Office, a number of people were interviewed. These people (listed in Appendix I) were mainly from the Program Office; a few were from NBS and other organizations. All were knowledgeable in the area of consumer products, and most were involved in the energy efficiency standards program. An effort was made to obtain the views of the various disciplines contributing to the standards program: attorneys, consumer education specialists, economists, engineers, home economists, operations research analysts, and policy analysts.

The interviews ranged from brief, informal conversations to two-hour discussions. There were follow-up communications in some cases. In general, each person was interviewed separately. Several people were interviewed by telephone. During Task I these discussions were kept relatively general, with unique features of specific products being referred to only when examples were helpful.

The most common definition of utility heard was: Utility is the availability of a feature on a model, usually a feature peripheral to the basic service provided by the product. (For example, the automatic defrosting feature of a refrigerator provides utility.) The next most commonly offered definition of utility was: The capacity or throughput (amount of a commodity that can be processed in a given time period; for example, pounds of clothes that can be dried during an hour by a clothes dryer) of a product. The third definition was: Utility is the

overall usefulness of a product. Another definition was: Utility relates to a person's perception of what he or she is getting from the product; that is, utility depends on the consumer's view of the product as well as on the product itself.

The most commonly heard definition of performance was: Performance is the measure of how well the product does its primary job. A refinement of this definition was: Performance is the measure of how well the product does its primary, or intended, job with the expected level of consumer input. Another definition offered was: the capacity or throughput of a product. A final definition was: Performance is a parameter that can be measured by tests, much like energy efficiency.

In summary, the definitions offered were:

- Utility -
1. available features
 2. capacity
 3. thoroughness of job
 4. usefulness
 5. usefulness as seen by consumer

- Performance -
1. thoroughness of job
 2. capacity
 3. thoroughness of job with consumer input
 4. parameter measured by tests

Other comments closely related to the definitions of utility and performance were:

1. The consumer buys not just the primary service offered by the product but also a certain level of convenience or consumer interaction with the product.
2. It is possible to have utility without performance and to have performance without utility. (For example, a manually defrosted refrigerator might perform extremely well in its primary job of keeping food cold but be seen by the consumer as lacking utility because it lacked the automatic defrost feature. On the other

hand, a clothes dryer with a broken heating element might lack performance but still have utility because it could dry permanent press clothes with room temperature air.)

3. It is conceivable that utility and performance (especially performance) could deteriorate in some cases as manufacturers concentrate on improving energy efficiency. (For example, the reduction, in order to increase energy efficiency, of the quantity of air used to ventilate an oven can reduce the performance of the oven in baking.) While there are natural market pressures on manufacturers to maintain performance levels, they have finite resources and can pursue only a limited number of improvements at a time.
4. It would be very useful to have a cost/benefit measure of utility. (This comment was offered in conjunction with Definition 2 of utility; it was understood to mean that, regardless of the exact definition finally adopted, it would be more widely accepted if it could be framed in cost/benefit terms.)
5. How is credit to be given (in terms of energy efficiency) to energy-conserving features which are used only at the owner's option (for example, fan switches on room air conditioners or switches for anti-sweat heaters on refrigerator-freezers)? How is credit to be given to energy-conserving features not covered by the test procedures (for example, moisture sensing controls on clothes dryers)?*
6. The focus of the standards program is on energy input to the product with too little concern for the output of useful services; the output of useful service can potentially decrease as energy efficiency is increased; this potential decrease of useful services should be prevented.
7. Stringent energy efficiency standards can potentially eliminate product features (or attributes or designs) from the market place. What is the intent of the Act with regard to the elimination of features? (For example, side-by-side refrigerator-freezers, which are inherently less energy efficiency than those with top-mounted freezers, could be eliminated from the market

*It is expected that DOE will amend the clothes dryer test procedure so that moisture sensing controls are covered.

place by standards set for top-mounted refrigerator-freezers if the side-by-sides are included in the same class as the top mounts.)

8. The comment was also offered that both the Association of Home Appliance Manufacturers (AHAM) and the American Gas Association (AGA) have standards on the performance of some consumer products; however, it is probably neither practical nor desirable to build these performance standards, or those of similar groups, into the energy efficiency standards program. The intent of the Act is not to have standards for utility and performance mandated in parallel with energy efficiency standards.

IV. PUBLIC COMMENTS

Task II involved reviewing DOE Federal Register notices and public comments received by DOE in connection with the standards program, test procedures, and energy efficiency improvement targets (Refs. 4-20). A number of related documents were also reviewed (See Selected Bibliography). The objective of Task II was to develop insight into the views of utility and performance held by manufacturers and users of consumer products. In addition, the amended Energy Policy and Conservation Act (Appendix III) was reviewed to glean insight concerning the Act's intent regarding utility and performance.

The use of the words utility and performance, as determined by a review of the NBS Analysis of Comments Relating to the Advanced Notice of Proposed Rulemaking (ANPR) (Ref. 19) and the DOE Summarizations of Issues Raised at Six Public Meetings conducted January 26 through February 8, 1979, (Ref. 9) is overwhelmingly connected with product classification. Most addressing this issue recommended that the number of classes be expanded so that performance-related features and those providing utility not be eliminated from the market. In the January 2, 1979, Federal Register ANPR (Ref. 1), DOE used the concepts of utility and performance as the foundation of its product class rationale in establishing 44 likely classes. Other related issues brought out in these comments were:

- o Failure to evaluate performance
- o Protection of proprietary data
- o Consumer attitudes toward features

The combination of the last two points poses a dilemma. It was pointed out that the perception of the consumer as to the desirability

of features should be the basis for retaining such features. Yet little data appear to exist which show how consumers view various features, at least outside of manufacturers' files. But it was frequently pointed out that this data, when available, is too sensitive to be released by manufacturers. A couple of exceptions to this general lack of data in the public domain are descriptions of work by Market Facts, Inc., (Ref. 21) and the University of Wisconsin (Ref. 22). Market Facts has done surveys of consumer attitudes on the utility of such features as automatic defrost for refrigerators as well as the consumer's view of relative first cost and yearly operating cost. Numerical values have been given to these relative attitudes. The University of Wisconsin work focused on user attitudes toward basic and supporting functions of appliances.

The following comments are extracted from the public comments in order to illustrate the utility and performance issues which concern consumers, manufacturers, and industry trade associations. No attempt has been made (in this project) to substantiate the claims made. Some of the comments related to product classes were:

The paramount limiting variables in establishing classes are consumer utility and product performance. They should not be sacrificed for marginal efficiency increases.

Expansion of the proposed product classes is necessary to maintain a choice of capacity, performance, utility, and features.

However, there are several additional classes required to prevent elimination of utility features from the market place.

Failure to provide more product classifications, where truly similar products are grouped, will jeopardize

continuation of features and characteristics consumers have grown to expect on their new appliances.

There were several commenters concerned with failure to evaluate possible performance degradation, including considerations of safety, reliability, and durability:

How is performance, other than energy performance, being checked?

These flaws (in the analysis), which seriously affect the determination of over-all efficiency of appliances, are as follows: failure to properly evaluate performance implications.

. . . the minimum efficiency levels will be so high that reliability and service will suffer and that soot buildup and "potentially hazardous conditions could result in fire or asphyxiation."

An additional utility of a large capacity dryer is its ability to provide better permanent press performance; i.e., less wrinkling.

Some of the comments related to the protection of proprietary data were:

AHAM believes that the protection of individual company data and information from disclosure is a matter of extreme importance to appliance manufacturers. The following specific types . . . are highly sensitive and should be considered proprietary and confidential

Much of the data requested by DOE is not available or is sensitive.

The appliance industry is extremely competitive, and much of the requested data is ultrasensitive. . . . Release of this information could lead to predatory practices and the eventual demise of many manufacturers.

. . . certain information was simply not going to be available from all companies

Some of the comments related to consumer attitudes toward various product features and information which should be provided to the consumer were:

Energy efficiency standards must still enable consumers to choose models which have the features they want.

The energy consumed by a time-of-day clock or the self-cleaning feature is irrelevant to everyday cooking and, in fact, are consumer options. The consumer has the right to know that an oven can be purchased with or without these options that will have the same efficiency.

V. ANALYSIS

In defining terms the Act states that "The term 'energy efficiency' means the ratio of the useful output of services from a consumer product to the energy use of such product" It also defines the term "energy efficiency standard" to mean a performance standard, as opposed to a device-oriented, or prescriptive, standard. The Act imposes a constraint on testing in requiring that product manufacturers not be required to conduct tests that would be ". . . unduly burdensome to conduct."

In the absence of precise mathematical definitions of utility and performance being prescribed by the Act, the definitions chosen should reflect the common usage of the words as given by the dictionary. To be both useful and widely and readily accepted, it would seem that these definitions would have to meet the following additional constraints:

1. Accommodate, without redefinition, innovative design changes and advanced technologies (for example, integrated appliances)
2. Provide guidance as to the threshold of change, or increment of increased utility, which is necessary to justify a new product class

Webster's Third New International Dictionary, Unabridged, gives definitions of utility as: (1) a useful factor or feature and (2) a tool, device, or other implement, especially one used as an adjunct to a more important machine (Ref. 2). In economics, utility is defined as the capacity of an object for satisfying a human want. Another definition is: usefulness, or the conditions or quality of being useful (Ref. 23). Black's Law Dictionary defines utility as: having industrial

value; the capability of being so applied in practical affairs as to prove advantageous in the ordinary pursuits of life, or add to the enjoyment of mankind (Ref. 24). Utility is established even if only partial success is obtained.

Webster's Dictionary defines performance as: the act or process of carrying out something; or capacity to achieve a desired result (Ref. 2). Another definition is: the way in which someone or something functions, performs, or operates. Perform means to begin and carry through to completion. It can also mean, as with machines, to function routinely. Black's Law Dictionary defines performance as: the fulfillment or accomplishment of a promise, contract or other obligation according to its terms (Ref. 24).

Another view of utility is: Utility is defined by the products that exist in the market at any given time (Ref. 25). It is measured by success in the market place. Performance can be defined as the consumer's perception of a product's ability to satisfactorily function throughout an expected life span under the varying conditions present in the consumer's environment (Ref. 25). Thus both utility and performance can be said to be defined in the minds of consumers. For a particular consumer these definitions will be affected by such factors as age, sex, family economics, and geographical location.

In public comments on consumer product features providing utility to the consumer, it was pointed out that the perception of the consumer as to the desirability of the features should be the basis for retaining such features. Another commenter said that "the paramount

limiting variables in establishing classes are consumer utility and product performance." Although, among DOE and NBS staff involved in the standards program and others working in the consumer product field, there seems to be some agreement as to what constitutes product performance; utility seems to be a more elusive concept.

In order to understand better what features of consumer products are of interest to consumers (and by inference, provide utility), reports on products covered by EPCA were reviewed in the 1977, 1978, and 1979 Buying Guide Issues of Consumer Reports (Ref. 26). Although this review does not constitute a survey of consumer attitudes and concerns, it does provide insight into what features an informed consumer might be looking for when choosing and purchasing one of the covered products. Several other related documents (listed in the bibliography) were reviewed to round out this viewpoint. For each of the nine products, the features and performance parameters mentioned were listed (using the words given in the referenced material) and then divided into the categories: energy efficiency, performance, and subjective factors. Most reports mentioned energy use (or operating costs) as being an important consideration. Some mentioned type of energy or type of fuel as being a factor underlying operating costs. Both energy use and fuel type were considered related to energy efficiency, as shown in Table 1 which summarizes the information obtained in this review. In the next category, performance, items which could be measured by test procedures were grouped; that is, any parameter which could conceivably be determined from information read from a meter (or meters) or other instrument was considered to be a measure of performance. Lastly,

TABLE 1. FACTORS AFFECTING UTILITY

PRODUCT	ENERGY EFFICIENCY	PERFORMANCE	SUBJECTIVE FACTORS
Refrigerators and refrigerator-freezers	energy use	storage volume, cooling capacity, spatial temperature uniformity	reliability, ease of cleaning, storage arrangement, defrosting, convenience
Freezers	energy use	spatial temperature uniformity, holding time, temperature swings	storage arrangement, defrosting, ease of cleaning
Clothes dryers	energy use, fuel type	temperature swings, speed, size of load	safety, convenience, features, treatment of delicate/permanent press fabrics
Water heaters	energy use, fuel type	storage capacity, recovery time	corrosion resistance, safety, features, ease of installation
Room air conditioners	energy use	cooling capacity, temperature swings, 120 or 240 volts	convenience, ease of installation, repair
Home heating equipment	energy use, fuel type		safety, convenience, features
Kitchen ranges and ovens	energy use, fuel type	temperature swings, speed, spatial temperature uniformity	safety, ease of cleaning, features, convenience, durability, control layout
Central air conditioners	energy use	correct sizing	
Furnaces	energy use, fuel type	correct sizing	safety, comfort

all other factors were grouped under the heading Subjective Factors. The subjective factors are not necessarily less important than energy efficiency and product performance, but they are typically more difficult to measure because they depend on the perception of the consumer as well as on the product. The parameters listed in Table 1 are not meant to be all inclusive but simply to represent the various types of consumer considerations which affect their perception of a product's utility.

A number of concerns applied generally to all products: purchase cost, seals of approval, reliability of dealer and manufacturer, guarantees and warranties, availability of servicing, construction (appearance, design, color, trim and size), hidden values (such as rustproofing), noise and heat generated, space required for use and storage, and operation directions. The choice of what particular model of a product best meets a family's needs is made keeping in mind such background as: health and energy of the homemaker, outside employment of the homemaker, attitudes of the family members, and the number and age of children.

Based on the information assembled in Tasks I, II, and III, the following tentative conclusions are advanced:

1. All of the nine products are thermal devices; five (clothes dryers, water heaters, home heating equipment, ranges and ovens, and furnaces) simply convert energy input into usable thermal energy, and four are Carnot* limited machines which use shaft work (usually

*The Carnot cycle for refrigeration machines is a hypothetical cycle of operations giving the maximum thermal efficiency obtainable by a refrigeration machine moving heat from one fixed temperature to a higher fixed temperature.

derived from electrical input) to move thermal energy from a lower to a higher temperature. (This conclusion is not true for three--dishwashers, television sets, and clothes washers--of the four additional products covered by the standards program; however.) The energy efficiencies of the four products which provide cooling are inherently limited to that of the Carnot cycle.

2. Since each of the nine products is a thermal device, one measure of its performance is capacity in terms of an energy flux (Btu/hour or a similar measure). Storage volume in cubic feet (or a similar measure of volume) or working volume is a further capacity measure for some of the products (such as refrigerators or freezers).
3. For some of the products a further measure of performance can be stated in terms of a "quality" parameter; for example, spatial temperature uniformity in a refrigerator (There should be no warm spots in the refrigerator's storage compartment).
4. All of the parameters in the Performance column of Table 1 can be viewed as either a measure of "capacity" or "quality".
5. The existing DOE test procedures for energy efficiency all include provisions for determining at least one measure of capacity. In general, they do not include provisions for determining measure of quality (where applicable to the product).
6. Most of the nine products cycle on and off to meet the load imposed; that is, they are either running at full load (not necessarily design point) or they are off. Some of the products have modulating controls (for example, a gas oven) and some are uncontrolled; that is, they run open-loop (for example, some burners on gas ranges).
7. It is impossible to characterize all of the parameters listed in the Subjective column of Table 1 by rigid (or deterministic) models, that is, the variables are not related in precise mathematical terms from which values may be determined exactly. Rather, it is necessary to consider the statistical nature of the variables.

8. The potential list of subjective factors is almost endless. These factors can vary in their "degree of subjectivity" from the purely subjective (such as status connotation) to those where the underlying physical features of the product are very important (such as corrosion resistance). Or said another way, subjective factors can be based on both tangible and intangible considerations. All of these factors are subjective because they cannot be assigned values in isolation from the consumer's thoughts and feelings. A product viewed by one consumer as having "adequate" safety might be viewed by another consumer as having "inadequate" safety. There is simply no objective scale of safety, which exists apart from a person's perception.

Other issues which became obvious during the first three tasks, yet remained unresolved are:

1. How much is utility worth in terms of energy savings?
2. Is the data available in the public sector adequate to set reasonable minimum energy efficiency levels?
3. How can the DOE Program Office insure against overly stringent minimum energy efficiency levels causing the standards program to be counter-productive?

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VI. RECOMMENDED DEFINITIONS

The definition of performance recommended for use in the energy efficiency standard program is:

Performance of a consumer product is the objective measure of how well, with the expected level of consumer input, the product does its intended job. Measures of performance include capacity and quality. Capacity can be stated in terms of thermal flux (in units such as Btu/hour) and either storage or working volume. Quality is a measure of the consistency (with time), uniformity (in space), or thoroughness with which the product does its job.

From the consumer viewpoint, the "expected level of consumer input" is the care and attention that the consumer is expected to provide by following the manufacturer's instructions for installation and operation. From the standpoint of the test program, the expected inputs are instructions similar to the manufacturer's which are codified into the test procedures. At minimum, the expected input should consist of those procedures necessary to keep the performance of the product from deteriorating (from the design level).

Performance can be measured by prescribed test procedures, although not necessarily by existing DOE test procedures. The measures of the performance of a consumer product are typically few and do not change in time as long as external conditions (such as ambient temperature and electrical supply voltage) are not changed and the condition of the product has not deteriorated or otherwise changed. Thus, performance can be readily compared to a prescribed standard.

Table 2 shows the performance parameters which are measured by DOE test procedures for the nine products. The parameters which are measured or can be calculated directly from measured data are

TABLE 2
PRODUCT PERFORMANCE PARAMETERS MEASURED BY DOE TEST PROCEDURES

	<u>Product</u>	<u>Capacity</u>	<u>Quality</u>
1.	Refrigerator and Refrigerator-freezers	Thermal capacity <u>Storage volume</u>	Temperature uniformity Temperature consistency Holding time ^a
2.	Freezers	Thermal capacity <u>Storage volume</u>	Temperature uniformity Temperature consistency Holding time ^a
3.	Clothes dryers	<u>Thermal capacity</u> <u>Working volume</u>	Temperature consistency
4.	Water heaters	<u>Thermal capacity</u> <u>Storage volume</u>	<u>Temperature consistency</u>
5.	Room air conditioners	<u>Thermal capacity</u>	Temperature consistency Temperature uniformity
6.	Home heating equipment	<u>Thermal capacity</u>	Temperature consistency Temperature uniformity
7A.	Cooking tops	<u>Thermal capacity</u>	Temperature consistency Temperature uniformity
7B.	Ovens	<u>Thermal capacity</u> Working volume	Temperature consistency Temperature uniformity
8.	Central air conditioners	<u>Thermal capacity</u>	Temperature consistency
9.	Furnaces	<u>Thermal capacity</u>	Temperature consistency

^a The maximum time that the temperature will stay below a given level with no power input and the door(s) closed.

underlined in the table. The parameters shown under capacity and quality are key measures of performance, which when specified numerically uniquely describe the basic performance of the consumer product; that is, its capability to do its intended job. There may be secondary measures of performance which are not listed in the table.

The definition of utility recommended for use in the standards program is:

Utility of a consumer product is a subjective measure, based on the consumer's perception, of the capability of the product to satisfy human needs. Energy efficiency and product performance as well as purely subjective factors can affect the consumer's perception of the product's utility.

Utility is inherently a subjective measure because it depends in part on the consumer's frame of reference, which can change with time. The utility of a product or an attribute of a product can vary from person to person as well as from time to time.

Utility can be measured using consumer surveys based on statistical methods although the values determined at any one time may not be the same as those determined earlier or later using the same methods.

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VII. QUANTIFICATION

Since the measure of the utility of a consumer product necessarily includes the consumer's reaction to the product, any quantification method must include the consumer's views. A survey using statistically designed samples appears to be one of the most straightforward way of measuring the utility of a product and of its features or attributes. An arbitrary scale could be developed so that the various features of a product could be numerically compared. (Market Facts, Inc., used the unit of "utility" in a consumer survey of appliance attributes--see Ref. 21.) The design of the survey questionnaire would depend on exactly what data is to be developed by the survey. It would seem that the following kinds of information, at minimum, might be useful in assessing the utility of a product:

1. The importance to the consumer of the
 - o purchase cost
 - o operating costs
 - o performance, and
 - o convenience featuresof the consumer product;
2. Demographic information; and
3. Household consumer product ownership--past, present and planned.

Another approach to quantifying utility is to measure the number of products that are used at any given time (Ref. 25). Since utility depends on the value of the product or feature as perceived by the consumer, then it can be measured by success in the market place. The products (or features) that are not justified by an overall volume that can be produced economically and sold at a justifiable

price will be excluded from the market place. Those that thrive are justified in a free system.

Since performance is based on variables which are related in precise mathematical terms and since the measures of performance are few for any one product, measuring performance should be easier than measuring utility. In general, prescribed DOE test procedures require the determination of a capacity figure(s) as part of establishing energy efficiency. The test procedures detail the parameters which must be held fixed in their values during the test. However, measures of "quality" are not generally developed during the determination of energy efficiency.

The following illustration is based on the "Proposed Rulemaking for Central Air Conditioners" (Ref. 8). Specifically, some of the key parameters from Test A for air-source-cooling-only units with single-speed compressors and single-speed condenser fans are used to illustrate the ideas of capacity, quality, and fixed conditions.

Capacity measured: Total steady state wet-coil cooling capacity in Btu/hour.

Quality measured: Not measured as such; specified testing operating tolerances are 2°F (total observed range) for leaving indoor dry bulb and 1°F for indoor leaving wet bulb temperature.

Fixed conditions: Outdoor dry bulb temperature, 95°F
Outdoor wet bulb temperature, 75°F
Indoor dry bulb temperature, 80°F
Indoor wet bulb temperature, 67°F

In addition to prescribing fixed conditions and measured parameters, the test procedures prescribe methods for installation and operation.

VIII. TEST PROCEDURES

The role of DOE test procedures for consumer products is discussed here in the context of an overall approach to utility and performance and to the establishment of classes.

The primary areas where utility and performance issues arise in the standards program are:

- a) weighing of the benefits of a standard versus possible lessening of product utility or performance, and .
- b) creation of a class for models of a product type with an attribute justifying an energy efficiency standard different from other models of the product type.

The inverse of area b) is the elimination of models where a class is not created to accommodate the inherently lower energy efficiency of particular models of a product type. The intent of the Act is not to force classes of products off the market, although this could happen if all models within a class are inherently energy inefficient to an unacceptable degree. In both areas a) and b), the consideration of utility and performance issues is to be done prior to issuing energy efficiency standards for the product. There are no provisions in the Act for continual monitoring of utility or performance, although there are provisions for re-evaluation of a standard not later than five years after it is prescribed.

Although there may be some lessening of the utility or the performance of the covered products resulting from the imposition of energy efficiency standards, this lessening should be small since manufacturers have little to gain by putting an undesirable product in the highly competitive market place for consumer products. On the other

hand, failure to provide appropriate product classifications could eliminate from the market product attributes, features, or options which provide substantial utility to consumers. Thus class selection is the main route to insuring that there is no lessening of the utility or the performance of the covered products. The more general question of whether the imposition of a standard is justified or not can be addressed more appropriately by weighing the projected energy savings against the costs and other (of the seven) factors listed in the Act. The Act provides some guidelines as to what is considered significant energy use. In Section 325(a)(2) two minimum energy use levels are provided for the purpose of comparing to the energy use of products to be potentially covered under Paragraph (14) of Section 322(a). These two energy use levels are:

- o an average per household energy use of 150 kilowatt-hours annually, and
- o an aggregate household energy use within the U. S. of 4.2×10^9 kWh annually.

There are no similar guidelines provided for what is considered significant conservation of energy.

The recommended approach for handling utility and performance issues within the standards program is:

Prior to setting standards, evaluate utility and performance issues when creating classes. To the extent allowed by resources, schedules, and available data, this evaluation should be quantitative.

There does not appear to be a single unified source for performance data for all nine products. Potential sources of performance data are:

1. The DOE Program Office;
2. National Bureau of Standards;
3. Other DOE contractors;
4. Manufacturers;
5. Trade associations; and
6. Consumer and trade publications

None of these information sources is likely to have all of the information needed under the approach described above. Manufacturers' information and test data already assembled by the DOE Program Office represent a logical beginning point for assembling further performance data.

Data from tests already performed by NBS and by other DOE contractors should form an important part of the necessary data base. Finally, the remaining data can be sought from manufacturers, trade associations, and consumer and trade publications.

A further recommendation follows from this approach:

Do not change existing DOE test procedures for the purpose of acquiring data for defining classes and weighing the benefits versus burdens of proposed standards.

This recommendation concerning test procedures is based on the following facts:

1. The DOE tests are not the proper vehicle for acquiring utility data since utility is measured by consumer opinion surveys and product shipment data, not engineering test procedures;
2. Utility and performance data should be available before final energy efficiency standards are issued and, by implication, before the underlying performance tests are routinely run by manufacturers or testing laboratories; and
3. There is no ongoing requirement for performance and utility data once the final standards are issued (except for the performance data acquired in the process of establishing energy efficiency by test).

4. There are other more appropriate sources for the information needed to prescribe standards and establish classes.

IX. CLASS GUIDELINES

The central issue which requires consideration of utility and performance is the creation of appropriate product classes. The Act provides for the creation of a separate class for models of a product which

- "(A) consume a different kind of energy from that consumed by other covered products within such type (or class), or
- (B) have a capacity or other performance-related feature which other products within such type (or class) do not have, justifying a higher or lower standard from that which applies (or will apply) to other products within such type (or class). In determining under this paragraph whether a performance-related feature justifies the establishment of a higher or lower standard, the Secretary shall consider such factors as the utility to the consumer of such a feature, and such other factors as he deems appropriate."

In addition to these basic functional differences which lead to different efficiencies, there are two other considerations which may provide the basis for creating new classes. The first is that of basic manufacturing differences among models of a product which result in different cost impacts in reaching a particular minimum energy efficiency level; for example, the cost of reaching a standard may be considerably greater for a refrigerator-freezer with a bottom-mounted freezer than for one with a top-mounted freezer even though the two models appear similar in everything but freezer placement. The second consideration is found in the DOE test procedures, where certain classes are implied due to different calculations or test methods being prescribed. For example, the test procedures for clothes dryers prescribe a 3.0 pound load for a compact dryer and a 7.0 pound load for a standard dryer.

In the January 2, 1979, ANPR (Ref. 1), 44 tentative classes were proposed for the nine priority products. The two criteria in the Act were used as the basis for the selection of classes. The use of the words utility and performance in the public comments in response to this ANPR (Refs. 9 and 19) is overwhelmingly connected with product classification. Most addressing this issue recommended that the number of classes be expanded so that performance-related features and those providing utility not be eliminated from the market.

There is a need for logical, consistent framework for answering such questions as:

1. How many classes should there be for the nine products?
2. What incremental improvement in utility is necessary to justify creating a separate class within a product type?

The following paragraphs outline an approach to answering this type of class-related question. This approach focuses on the utility of the product attribute to the consumer rather than the design or the underlying technology of the product (examples of underlying technology being the kind of energy consumed by the product or whether the attribute is an intrinsic part of the product or simply an accessory). The necessity for different classes for product models using different kinds of energy is clear from the wording of the Act. The assumption underlying this approach is that a separate class is justified to preserve the attribute in the market place if the value of the attribute in the eyes of the consumer is greater than its cost.

The example to be given is for the automatic defrost refrigerator-freezer, which was designated as a likely class in the January 2, 1979, ANPR (Ref. 1). This example is given because the utility of automatic defrost to the consumer was determined by Market Facts, Inc., in their 1977 consumer survey work for DOE (Ref. 21). Figure 1 shows the "utility" to the consumer of three levels of annual operating costs for refrigerators. Utility is shown in dimensionless, arbitrary units which were designated "utilities" by Market Facts. The measure of utilities is developed from aggregated consumer survey data and represents the intensity of consumer preference for a particular product feature. A smooth curve has been used to connect the three points determined by Market Facts. They also determined by survey that the automatic defrost feature was worth 2.066 utilities to the consumer. From Figure 1, it can be seen that 2.066 utilities is equivalent to approximately \$40 in annual operating costs. Or said another way, reducing operating costs from \$75 to \$35 is worth 2.066 utilities. Thus it can be argued that the consumer is willing to pay 2.066 utilities, or \$40 in additional operating costs, for the convenience of the automatic defrost feature.

Automatic defrost requires an additional 95 to 450 kWh/year (see for example, Refs. 18, 27, and 28). Based on DOE data for the average cost of residential electricity (4.97¢/kWh), 365 kWh/year (a typical value for a 16-cubic-foot refrigerator-freezer) costs \$18.14 per year. One can now weigh the potential energy savings of eliminating automatic defrost (365 kWh/year or \$18.14/year) against the loss of utility to the consumer (2.066 utilities or \$40/year). Even without

FIGURE 1. UTILITY OF AUTOMATIC DEFROST FEATURE FOR REFRIGERATOR

inflating the 1977 cost of \$40/year to 1979 levels, it is difficult to rationalize the elimination of a feature that is worth significantly more to the consumer (\$40/year) than it costs to operate (\$18/year). Thus one can conclude that the separate class for automatic defrost refrigerators should be maintained so that this feature will not be eliminated from the market by unattainable minimum energy efficiency levels. The fact that 60% of the refrigerators in existence have automatic defrost (Ref. 21) and that 77% of the refrigerators sold in 1977 had automatic defrost (Ref. 29) supports this conclusion.

The more rigorous approach to this example given would have been to develop a curve for purchase price similar to Figure 1 and then to convert both costs and values to their life cycle equivalent before comparing the two. (That is, 2.066 utilities is equivalent to some combination of incremental purchase value and incremental operating value, which can be converted to their equivalent life cycle value.) This was not done since it was obvious by inspection of the purchase price versus utility data that incremental purchase price was not an important consideration in the purchase of the automatic defrost feature (an increase of \$200 in purchase price was equivalent to only 1.052 utilities).

This type of data (such as Market Facts developed) on the utility of various product features is available for only a few of the tentative classes under consideration by DOE. In order to provide a framework for further evaluation of class and other issues, a list

of proposed classes has been developed based on a qualitative consideration of utility and performance and on the basis of work done elsewhere in the energy efficiency standards program, especially the manufacturing analysis being done by Arthur D. Little, Inc. This list, along with the criteria used to develop it, is presented in Appendix II.

The 71 proposed classes should be viewed as an upper limit to the number of classes for which standards are likely to be promulgated for the nine products. It is anticipated that no standard will be promulgated for some of the classes, and other classes will be combined on the basis of further technical analysis. If, for example, two classes within a product type have inherently equal energy efficiencies, there may be reason to combine the two classes.

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APPENDIX I

INDIVIDUALS INTERVIEWED

R. Nelson DuRant	Department of Energy
Richard R. Furlong	Department of Energy
Robert Hendrickson	National Bureau of Standards
Charles P. Howard	National Bureau of Standards
Robert Mussler	Department of Energy
Virginia Peart	Purdue University
George D. Pomeroy	Department of Energy
Jean Pruitt	Department of Energy
Loren D. Raap	Department of Energy
Frederick W. Root	Department of Energy
Christopher J. Rozycki	Department of Energy
James A. Smith	Department of Energy
Stephen F. Sousk	Department of Energy
Walter L. Warnick	Department of Energy

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APPENDIX II

PRELIMINARY CLASS RECOMMENDATIONS

The basic criteria for establishing the following list of 71 classes for the nine priority products are:

1. There must be models existing in the market place for each class (that is, no classes were listed for hypothetical models of a product type).
2. There must be existing DOE test procedures (or test procedures about to be published) which cover the models within the class.
3. The class must be distinguished by a performance-related feature which provides utility to the consumer.
4. Further technical investigation will be needed to determine if the inherent energy efficiency of each of the preliminary classes is, in fact, different from the other classes within the product type. It may be possible to combine some of the classes within a product type, based on similar energy efficiencies of the classes.
5. The list of classes is intended only as a framework for the analysis of whether or not to promulgate standards for each of the proposed classes, and of other class-related issues.

The recommended classes are:

1. Refrigerators and refrigerator-freezers

1. Manual defrost
2. Partial automatic defrost
3. Automatic defrost, top location of freezer
4. Automatic defrost, side location of freezer
5. Automatic defrost, bottom location of freezer
6. Automatic defrost, top located freezer, through-the-door service features
7. Automatic defrost, side location of freezer, through-the-door service features

2. Freezers

1. Manual defrost, chest
2. Manual defrost, upright
3. Automatic defrost, upright

3. Clothes dryers

1. Electric, 200 V and over, standard
2. Electric, 200 V and over, compact
3. Electric, under 200 V
4. Gas

4. Water heaters

1. Electric
2. Gas, compact
3. Gas, standard
4. Oil

5. Room air conditioners

1. Window and through the wall (with outdoor side louvers) under 200 V; 6000 Btu/h and under
2. Window and through the wall (with outdoor side louvers) under 200 V; over 6000 Btu/h
3. Window and through the wall (with outdoor side louvers) 200 V and over; under 20,000 Btu/h
4. Window and through the wall (with outdoor side louvers) 200 V and over; 20,000 Btu/h and over
5. Window and through the wall (no outdoor side louvers)
6. Packaged terminal
7. Reverse cycle

6. Home heating equipment

1. Electric, primary and supplementary
2. Gas, gravity, vented room heater
3. Gas, forced air, vented room heater
4. Gas, gravity, vented wall furnace
5. Gas, forced air, vented wall furnace
6. Gas, gravity, direct vented wall furnace
7. Gas, forced air, direct vented wall furnace
8. Gas, gravity, vented floor furnace
9. Gas, forced air, vented floor furnace
10. Oil, gravity, vented room heater
11. Oil, forced air, vented room heater
12. Oil, gravity, vented wall furnace
13. Oil, forced air, vented wall furnace
14. Oil, gravity, vented floor furnace
15. Oil, forced air, vented floor furnace

7. Kitchen ranges and ovens

1. Microwave oven
2. Electric cooking top
3. Electric oven
4. Electric oven, self-cleaning
5. Gas cooking top
6. Gas oven
7. Gas oven, self-cleaning

8. Central air conditioners

1. Split system, cooling only
2. Single package, cooling only
3. Split system, reverse cycle
4. Single package, reverse cycle
5. Split system, heating only

9. Furnaces

1. Gas, gravity
2. Gas, forced air, horizontal, indoor
3. Gas, forced air, horizontal, outdoor
4. Gas, forced air, configurations other than horizontal, indoor
5. Gas, forced air, configurations other than horizontal, outdoor
6. Gas, forced air, direct vent
7. Gas, forced air, high mass heat exchanger
8. Gas, boilers, indoor
9. Gas, boilers, outdoor
10. Oil, forced air, horizontal, indoor
11. Oil, forced air, horizontal, outdoor
12. Oil, forced air, configurations other than horizontal, indoor
13. Oil, forced air, configurations other than horizontal, outdoor
14. Oil, forced air, direct vent
15. Oil, boilers, indoor
16. Oil, boilers, outdoor
17. Electric, indoor
18. Electric, forced air, outdoor
19. Electric, boilers, outdoor

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APPENDIX III

ENERGY POLICY AND CONSERVATION ACT

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On the following pages, all text in italics represents amendments made by NECPA.

*Sections underlined are included in this appendix.

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ENERGY POLICY AND CONSERVATION ACT (PL 94-163)

AS AMENDED BY

NATIONAL ENERGY CONSERVATION POLICY ACT (PL 95-619)

PART B - ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS OTHER THAN AUTOMOBILES

DEFINITIONS

42 USC 6291. SEC. 321. (a) For purposes of this part:

Ante, p.901. ned in section 501(1) of the Motor Vehicle Information and Cost Savings Act) of a type--

(A) which in operation consumes, or is designed to consume, energy; and

(B) which, to any significant extent, is distributed in commerce for personal use or consumption by individuals; without regard to whether such article or such type is in fact distributed in commerce for personal use or consumption by an individual.

(2) The term "covered product" means a consumer product of a type specified in section 322.

(3) The term "energy" means electricity, or fossil fuels. The Administrator may, by rule, include other fuels within the meaning of the term "energy" if he determines that such inclusion is necessary or appropriate to carry out the purposes of this Act.

(4) The term "energy use" means the quantity of energy directly consumed by a consumer product at point of use, determined in accordance with test procedures under section 323.

(5) The term "energy efficiency" means the ratio of the useful output of services from a consumer product to the energy use of such product, determined in accordance with test procedures under section 323.

(6) The term "energy efficiency standard" means a performance standard--

(A) which prescribes a minimum level of energy efficiency for a covered product, determined in accordance with test procedures prescribed under section 323, and

(B) which includes any other requirements which the Administrator may prescribe under section 325(c)*.

(7) The term "estimated annual operating cost" means the aggregate retail cost of the energy which is likely to be consumed annually in representative use of a consumer product, determined in accordance with section 323.

(8) The term "measure of energy consumption" means energy use, energy efficiency, estimated annual operating cost, or other measure of energy consumption.

(9) The term "class of covered products" means a group of covered products, the functions or intended uses of which are similar (as determined by the Administrator).

(10) The term "manufacture" means to manufacture, produce, assemble or import.

(11) The terms "import" and "importation" mean to import into the customs territory of the United States.

(12) The term "manufacturer" means any person who manufactures a consumer product.

(13) The term "retailer" means a person to whom a consumer product is delivered or sold, if such delivery or sale is for purposes of sale or distribution in commerce to purchasers who buy such product for purposes other than resale.

(14) The term "distributor" means a person (other than a manufacturer or retailer) to whom a consumer product is delivered or sold for purposes of distribution in commerce.

(15) (A) The term "private labeler" means an owner of a brand or trademark on the label of a consumer product which bears a private label.

(B) A consumer product bears a private label if (i) such product (or its container) is labeled with the brand or trademark of a person other than a manufacturer of such product, (ii) the person with whose brand or trademark such product (or container) is labeled has authorized or caused such product to be so labeled, and (iii) the brand or trademark of a manufacturer of such product does not appear on such label.

(16) The terms "to distribute in commerce" and "distribution in commerce" mean to sell in commerce, to import, to introduce or deliver for introduction into commerce, or to hold for sale or distribution after introduction into commerce.

(17) The term "commerce" means trade, traffic, commerce, or transportation--

(A) between a place in a State and any place outside thereof, or

(B) which affects trade, traffic, commerce or transportation described in sub-

*Should be "325(j)"--was not changed by NECPA

paragraph (A).

(18) The term "Commission" means the Federal Trade Commission.

COVERAGE

42 USC 6292. SEC. 322. (a) A consumer product is a covered product if it is one of the following types (or is designed to perform a function which is the principal function of any of the following types):

- (1) Refrigerators and refrigerator-freezers.
- (2) Freezers.
- (3) Dishwashers.
- (4) Clothes dryers.
- (5) Water heaters.
- (6) Room air conditioners.
- (7) Home heating equipment, not including furnaces.
- (8) Television sets.
- (9) Kitchen ranges and ovens.
- (10) Clothes washers.
- (11) Humidifiers and dehumidifiers.
- (12) Central air conditioners.
- (13) Furnaces.

(14) Any other type of consumer product which the Administrator classifies as a covered product under subsection (b).

(b)(1) The Administrator may classify a type of consumer product as a covered product if he determines that--

(A) classifying products of such type as covered products is necessary or appropriate to carry out the purposes of this Act, and

(B) average annual per-household energy use by products of such type is likely to exceed 100 kilowatt-hours (or its Btu equivalent) per year.

Definitions.

(2) For purposes of this subsection:

(A) The term "average annual per-household energy use" with respect to a type of product means the estimated aggregate annual energy use (in kilowatt-hours or the Btu equivalent) of consumer products of such type which are used by households in the United States, divided by the number of such households which use products of such type.

(B) The Btu equivalent of one kilowatt-hour is 3,412 British thermal units.

(C) The term "household" shall be defined under the rules of the Administrator.

TEST PROCEDURES

42 USC 6293. SEC. 323. (a)(1) The Administrator shall, during the 30-day period which begins on the date of enactment of this Act, afford interested persons an opportunity to present written data, views, and arguments with respect to test procedures to be developed for covered products of each of the types specified in paragraphs (1) through (13) of section 322(a).

(2) The Administrator shall direct the National Bureau of Standards to develop test procedures for the determination of (A) estimated annual operating costs of covered products of the types specified in paragraphs (1) through (13) of section 322(a), and (B) at least one other useful measure of energy consumption of such products which the Administrator determines is likely to assist consumers in making purchasing decisions.

(3) The Administrator shall publish proposed test procedures with respect to all covered products of each of the types specified in paragraphs (1) through (13) of section 322(a), and shall afford interested persons an opportunity to present oral and written data, views, and arguments with respect to such proposed test procedures. Such comment period shall not be less than 45 days.

(4) The Administrator shall prescribe test procedures for the determination of (i) estimated annual operating costs of all covered products of each of the types specified in paragraph (1) through (13) of section 322(a), and (ii) at least one other measure of energy consumption of such products which the Administrator determines is likely to assist consumers in making purchasing decisions. Except as provided in paragraph (6), such test procedures shall be prescribed not later than January 31, 1978.

(5) If the Administrator has classified a type of product as a covered product under section 322(b), the Administrator may, after affording interested persons an opportunity to comment, direct the National Bureau of Standards to develop, and may publish, proposed test procedures for such type of covered product (or class thereof). The Administrator shall afford interested persons an opportunity to present oral and written data, views,

and arguments with respect to such proposed test procedures. Such comment period shall not be less than 45 days. The Administrator may thereafter prescribe test procedures in accordance with subsection (b) of this section with respect to such type or class of product, if the Administrator or the Commission determines that--

(A) the application of subsection (C) to such type of covered product (or class thereof) will assist consumers in making purchasing decisions, or

(B) labeling in accordance with section 324 will assist purchasers in making purchasing decisions.

(6) (A) The Secretary may delay the prescription of test procedures under paragraph (4) for a type of covered product (or class thereof) if he determines that he cannot, within the applicable time period, prescribe test procedures applicable to such type (or class) which meet the requirement of subsection (b), and he submits to the Congress a report of such determination together with the reasons therefor, and also publishes such determination (and reasons) in the Federal Register. In any such case, he shall prescribe such test procedures as soon as practicable, but in no event later than 90 days after the date specified in paragraph (4).

(B) The Secretary is not required to publish and prescribe test procedures under paragraphs (3) and (4) for a type of covered product (or class thereof) if he determines, by rule, that test procedures cannot be developed which meet the requirements of subsection (b) and publishes such determination in the Federal Register, together with the reasons therefor. For purposes of section 327, a determination under this subparagraph with respect to any type (or class) of covered product, while effective, shall have the same effect as would a standard prescribed for such type (or class) under section 325.

(7) (A) In the case of--

(i) any test procedure prescribed under this subsection; or

(ii) any determination under paragraph (6) that a test procedure cannot be developed which meets the requirements of subsection (b); the Secretary shall, not later than 3 years after the date of the enactment of this paragraph (and from time to time thereafter), conduct a reevaluation and, on the basis of such reevaluation, shall determine if such test procedure should be amended or such determination should be rescinded. In conducting such reevaluation, the Secretary shall take into account such information as he deems relevant, including technological developments relating to the energy efficiency of the type (or class) of covered products involved.

(B) If the Secretary determines under subparagraph (A) that--

(i) a test procedure should be amended, he shall promptly publish in the Federal Register proposed test procedures incorporating such amendments, or

(ii) a determination under paragraph (6) should be rescinded, he shall promptly publish notice thereof in the Federal Register, and afford interested persons an opportunity to present oral and written data, views, and arguments. Such comment period shall not be less than 45 days.

(b) (1) Any test procedures prescribed under this section shall be reasonably designed to produce test results which reflect energy efficiency, energy use, or estimated annual operating cost of a covered product during a representative average use cycle (as determined by the Administrator), and shall not be unduly burdensome to conduct.

(2) If the test procedure is a procedure for determining estimated annual operating costs, such procedure shall provide that such costs shall be calculated from measurements of energy use in a representative average cycle (as determined by the Administrator), and from representative average unit costs of the energy needed to operate such product during such cycle. The Administrator shall provide information to manufacturers respecting representative average unit costs of energy.

(c) (1) Effective 180 days after a test procedure rule applicable to a covered product is prescribed under this section, no manufacturer, distributor, retailer, or private labeler may make any representation--

(A) in writing (including a representation on a label), or

(B) in any broadcast advertisement,

respecting the energy consumption of such product or cost of energy consumed by such product, unless such product has been tested in accordance with such test procedures and such representation fairly discloses the results of such testing.

(2) On the petition of any manufacturer, distributor, retailer, or private labeler, filed not later than the 60th day before the expiration of the period involved, the 180 day period referred to in paragraph (1) may be extended by the Commission with respect to the petitioner (but in no event for more than an additional 180 days) if he finds that the requirements of paragraph (1) would impose on such petitioner an undue hardship (as determined by the Commission).

LABELING

42 USC 6294. SEC.324.(a)(1) The Commission shall prescribe labeling rules under this section applicable to all covered products of each of the types specified in paragraphs (1) through (9) of section 322(a), except to the extent that, with respect to any such type (or class thereof), the Commission determines under the second sentence of subsection (b)(5) that labeling in accordance with this section is not technologically or economically feasible.

(2) The Commission shall prescribe labeling rules under this section applicable to all covered products of each of the types specified in paragraphs (10) through (13) of section 322(a), except to the extent that with respect to any such type (or class thereof), the Commission determines under the second sentence of subsection (b)(5) that labeling in accordance with this section is not technologically or economically feasible or is not likely to assist consumers in making purchasing decisions.

(3) The Commission may prescribe a labeling rule under this section applicable to covered products of a type specified in paragraph (14) of section 322(a) (or a class thereof) if--

(A) the Commission or the Administrator has made a determination with respect to such type (or class thereof) under section 323(a)(5)(B),

(B) the Administrator has prescribed test procedures under section 323(a)(5) for such type (or class thereof), and

(C) the Commission determines with respect to such type (or class thereof) that application of labeling rules under this section to such type (or class thereof) is economically and technologically feasible.

(4) Any determination under this subsection shall be published in the Federal Register.

(b)(1) Not later than 30 days after the date on which a proposed test procedure applicable to a covered product of any of the types specified in paragraph (1) through (14) of section 322(a) (or class thereof) is published under section 323(a), the Commission shall publish a proposed labeling rule applicable to such type (or class thereof).

(2) The Commission shall afford interested persons an opportunity to present written or oral data, views, and comments with respect to the proposed labeling rules published under paragraph (1). The period for such presentations shall not be less than 45 days.

(3) Not earlier than 45 days nor later than 60 days after the date on which test procedures are prescribed under section 323 with respect to covered products of any type (or class thereof) specified in paragraphs (1) through (13) of section 322(a), the Commission shall prescribe labeling rules with respect to covered products of such type (or class thereof). Not earlier than 45 days after the date on which test procedures are prescribed under section 323 with respect to covered products of a type specified in paragraph (14) of section 322(a), the Commission may prescribe labeling rules with respect to covered products of such type (or class thereof).

(4) A labeling rule prescribed under paragraph (3) shall take effect not later than 3 months after the date of prescription of such rule, except that such rules may take effect not later than 6 months after such date of prescription if the Commission determines that such extension is necessary to allow persons subject to such rules adequate time to come into compliance with such rules.

(5) The Commission may delay the publication of a proposed labeling rule, or the prescription of a labeling rule, beyond the dates specified in paragraph (1) or (3), if it determines that it cannot publish proposed labeling rules or prescribe labeling rules which meet the requirements of this section on or prior to the date specified in the applicable paragraph and publishes such determination in the Federal Register, together with the reasons therefor. In any such case, it shall publish proposed labeling rules or prescribe labeling rules for covered products of such type (or class thereof) as soon as practicable unless it determines (A) that labeling in accordance with this section is not economically or technically feasible, or (B) in the case of a type specified in paragraphs (10) through (13) of section 322(a), that labeling in accordance with this section is not likely to assist consumers in purchasing decisions. Any such determination shall be published in the Federal Register, together with the reasons therefor. This paragraph shall not apply to the prescription of a labeling rule with respect to covered products of a type specified in paragraph (14) of section 322(a).

(c)(1) Subject to paragraph (6), a rule prescribed under this section shall require that each covered product in the type or class of covered products to which the rule applies bear a label which discloses--

(A) the estimated annual operating cost of such product (determined in accordance with test procedures prescribed under section 323), except that if--

(i) the Administrator determines that disclosure of estimated annual operating cost is not technologically feasible, or

(ii) the Commission determines that such disclosure is not likely to assist consum-

ers in making purchasing decisions or is not economically feasible, the Commission shall require disclosure of a different useful measure of energy consumption (determined in accordance with test procedures prescribed under section 323); and

(B) information respecting the range of estimated annual operating costs for covered products to which the rule applies; except that if the Commission requires disclosure under subparagraph (A) of a measure of energy consumption different from estimated annual operating cost, then the label shall disclose the range of such measure of energy consumption of covered products to which such rule applies.

(2) A rule under this section shall include the following:

(A) A description of the type or class of covered products to which such rule applies.

(B) Subject to paragraph (6), information respecting the range of estimated annual operating costs or other useful measure of energy consumption (determined in such manner as the rule may prescribe) for such type or class of covered products.

(C) A description of the test procedures under section 323 used in determining the estimated annual operating costs or other measure of energy consumption of the type or class of covered products.

(D) A prototype label and directions for displaying such label.

(3) A rule under this section shall require that the label be displayed in a manner that the Commission determines is likely to assist consumers in making purchasing decisions and is appropriate to carry out this part. The Commission may permit a tag to be used in lieu of a label in any case in which the Commission finds that a tag will carry out the purposes for which the label was intended.

(4) A rule under this section applicable to a covered product may require disclosure, in any printed matter displayed or distributed at the point of sale of such product, of any information which may be required under this section to be disclosed on the label of such product. Requirements under this paragraph shall not apply to any broadcast advertisement or any advertisement in any newspaper, magazine, or other periodical.

(5) The Commission may require that a manufacturer of a covered product to which a rule under this section applies--

(A) include on the label,

(B) separately attach to the product, or

(C) ship with the product,

additional information relating to energy consumption, *including instructions for the maintenance, use, or repair of the covered product*, if the Commission determines that such additional information would assist consumers in making purchasing decisions or in using such product, and that such requirement would not be unduly burdensome to the manufacturers.

(6) The Commission may delay the effective date of the requirement specified in paragraph (1)(B) of this subsection applicable to a type or class of covered product, insofar as it requires the disclosure on the label of information respecting range of a measure of energy consumption, for not more than 12 months after the date on which the rule under this section is first applicable to such type or class, if the Commission determines that such information will not be available within an adequate period of time before such date.

(d) A rule under this section (or an amendment thereto) shall not apply to any covered product the manufacture of which was completed prior to the effective date of such rule or amendment, as the case may be.

(e) The Administrator, in consultation with the Commission, shall study consumer products for which labeling rules under this section have not been proposed, in order to determine (1) the aggregate energy consumption of such products, and (2) whether the imposition of labeling requirements under this section would be feasible and useful to consumers in making purchasing decisions. The Administrator shall include the results of such study in the annual report under section 338.

(f) The Administrator and the Commission shall consult with each other on a continuing basis as may be necessary or appropriate to carry out their respective responsibilities under this part. Before the Commission makes any determination under subsection (a)(1) or (2), it shall obtain the views of the Administrator and shall take such views into account in making such determination.

(g) Until such time as labeling rules under this section take effect with respect to a type or class of covered product, this section shall not affect any authority of the Commission under the Federal Trade Commission Act to require labeling with respect to energy consumption of such type or class of covered product.

ENERGY EFFICIENCY STANDARDS

42 USC 6295. SEC. 325. (a) (1) The Secretary shall, by rule, prescribe an energy efficiency standard for each type (or class) of covered products specified in paragraphs (1) through (13) of section 322(a).

(2) The Secretary may, by rule, prescribe an energy efficiency standard for any type (or class) of covered products of a type specified in paragraph (14) of section 322(a), if he determines, for the purposes of this section, that--

(A) the average per household energy use within the United States by products of such type (or class) exceeded 150 kilowatt-hours (or its Btu equivalent) for any 12 calendar-month period ending before such determination;

(B) the aggregate household energy use within the United States by products of such type (or class) exceeded 4,200,000,000 kilowatt-hours (or its Btu equivalent) for any such 12 calendar-month period;

(C) substantial improvement in the energy efficiency of products of such type (or class) is technologically feasible; and

(D) the application of a labeling rule under section 324 to such type (or class) is not likely to be sufficient to induce manufacturers to produce, and consumers and other persons to purchase, covered products of such type (or class) which achieve the maximum energy efficiency which is technologically feasible to attain and is economically justified.

Not later than 2 years after the date of the enactment of this paragraph, the Secretary shall publish in the Federal Register a list of those types (and classes) of covered products which he considers may be subject to standards authorized to be prescribed under this paragraph. The Secretary may revise such list from time to time thereafter.

(b) No standard for a type (or class) of covered products shall be prescribed pursuant to subsection (a) if--

(1) a test procedure has not been prescribed pursuant to section 323 with respect to that type (or class) of products, or

(2) the Secretary determines, by rule, that the establishment of such standard will not result in significant conservation of energy or that the establishment of such standard is not technologically feasible or economically justified. For purposes of section 327, a determination under paragraph (2) with respect to any type (or class) of covered products shall have the same effect as would a standard prescribed for such type (or class) under this section.

(c) Energy efficiency standards for each type (or class) of covered products prescribed under this section shall be designed to achieve the maximum improvement in energy efficiency which the Secretary determines is technologically feasible and economically justified. Such standards may be phased in over a period not in excess of 5 years through the establishment of intermediate standards, as determined by the Secretary.

(d) Before determining whether a standard is economically justified under subsection (c), the Secretary, after receiving any views and comments furnished with respect to the proposed standard under section 336, shall determine that the benefits of the standard exceed its burdens based, to the greatest extent practicable, on a weighing of the following factors:

(1) the economic impact of the standard on the manufacturers and on the consumers of the products subject to such standard,

(2) the savings in operating costs throughout the estimated average life of the covered products in the type (or class), compared to any increase in the price of, or in the initial charges for, or maintenance expenses of, the covered products which are likely to result from the imposition of the standard,

(3) the total projected amount of energy savings likely to result directly from the imposition of the standard,

(4) any lessening of the utility or the performance of the covered products likely to result from the imposition of the standard,

(5) the impact of any lessening of competition determined in writing by the Attorney General that is likely to result from the imposition of the standard,

(6) the need of the Nation to conserve energy, and

(7) any other factors the Secretary considers relevant.

For purposes of paragraph (5), the Attorney General shall, not later than 60 days after the publication of a proposed rule prescribing an energy efficiency standard, make a determination of the impact, if any, from any lessening of competition likely to result from such standard and transmit such determination in writing to the Secretary, together with an analysis of the nature and extent of such impact. Any such determination and analysis shall be published by the Secretary in the Federal Register.

(e)(1) Subject to paragraph (2), the Secretary may, on application of any manufacturer, exempt such manufacturer from all or part of the requirements of any rule prescribing an energy efficiency standard under this section for any period which does not extend beyond the date which is 24 months after the date such rule is prescribed, if the Secretary finds that the annual gross revenues to such manufacturer for the preceding 12-month period from all its operations (including the manufacture and sale of covered products) does not exceed \$8,000,000. In making such finding in the case of any manufacturer, the Secretary shall take into account the annual gross revenues of any other person who controls, is controlled by, or is under common control with, such manufacturer.

(2) The Secretary may not exercise the authority granted under paragraph (1) with respect to any type (or class) of covered product subject to an energy efficiency standard established under this section unless he makes a finding, after obtaining the written views of the Attorney General, that a failure to allow an exemption under paragraph (1) would likely result in a lessening of competition.

(f)(1) A rule prescribing an energy efficiency standard for a type (or class) of covered products shall specify a level of energy efficiency higher or lower than that which applies (or would apply) for such type (or class) for any group of covered products which have the same function or intended use, if the Secretary, in his discretion, determines that covered products within such group--

(A) consume a different kind of energy from that consumed by other covered products within such type (or class), or

(B) have a capacity or other performance-related feature which other products within such type (or class) do not have, justifying a higher or lower standard from that which applies (or will apply) to other products within such type (or class). In determining under this paragraph whether a performance-related feature justifies the establishment of a higher or lower standard, the Secretary shall consider such factors as the utility to the consumer of such a feature, and such other factors as he deems appropriate.

(2) Any rule prescribing a higher or lower level of energy efficiency under paragraph (1) shall include an explanation of the basis on which such higher or lower level was established.

(g) In prescribing energy efficiency standards under this section, the Secretary shall give priority to the establishment of energy efficiency standards for types of products (or classes thereof) specified in paragraphs (1), (2), (4), (5), (6), (7), (9), (12), and (13) of section 322(a).

(h)(1) Not later than 5 years after prescribing an energy efficiency standard under this section (and from time to time thereafter), the Secretary shall--

(A) conduct a reevaluation in order to determine whether such standard should be amended in any manner, and

(B) make, and publish in the Federal Register, such determination.

In conducting such reevaluation, the Secretary shall take into account such information as he deems relevant, including technological developments with respect to the type (or class) of covered products involved, and the economic impact of the standard.

(2) If the Secretary determines under paragraph (1) that a standard should be amended, he shall promptly publish a proposed rule incorporating such amendments and afford interested persons an opportunity to present oral and written data, views, and arguments. Such comment period shall not be less than 45 days.

(i) Any energy efficiency standard shall be prescribed in accordance with the following procedure:

(1) The Secretary shall (A) publish an advance notice or proposed rulemaking which specifies the type (or class) of covered products to which the rule is likely to apply, and (B) invite interested persons to submit, within 45 days after the date of publication of such advance notice, written presentations of data, views, and arguments relevant to establishing such an energy efficiency standard.

(2) An advance notice of proposed rulemaking under paragraph (1) shall be published by the Secretary--

(A) in the case of types of covered products (or classes thereof) of the types specified in paragraphs (1), (2), (4), (5), (6), (7), (9), (12), and (13) of section 322(a), not later than 30 days after a test procedure with respect to that type of covered products (or class thereof) has been prescribed, or 45 days after the date of the enactment of this subparagraph, whichever is later; and

(B) in the case of types of covered products (or classes thereof) specified in paragraphs (3), (8), (10) and (11), of section 322(a), not later than 30 days after

a test procedure with respect to that type (or class) of covered products has been prescribed, or one year after the date of the enactment of this subparagraph, whichever is later.

(3) A proposed rule which prescribes an energy efficiency standard for a type (or class) of covered products may not be published earlier than 60 days after the date of publication of advance notice of proposed rulemaking for such type (or class). The Secretary shall determine the maximum improvement in energy efficiency that is technologically feasible for each type (or class) of covered products in prescribing such standard and if such standard is not designed to achieve such efficiency, the Secretary shall state in the proposed rule the reasons therefor. After the publication of such proposed rulemaking, the Secretary shall afford interested persons, in accordance with section 336, an opportunity to present oral and written comments (including an opportunity to question those who make such presentations, as provided in such section) on matters relating to such proposed rule, including--

(A) whether the standard to be prescribed is economically justified (taking into account those factors which the Secretary must consider under subsection (d)),

(B) whether the standard will achieve the maximum improvement in energy efficiency which is technologically feasible,

(C) if the standard will not achieve such improvement, whether the reasons for not achieving such improvement are adequate, and

(D) whether such rule should prescribe a level of energy efficiency which is higher or lower than that which would otherwise apply in the case of any group of products within the type (or class) to be subject to such standard.

(4) A rule prescribing an energy efficiency standard for a type (or class) of covered products may not be published earlier than 60 days after the date of publication of the proposed rule under this section for such type (or class). Such rule shall be published as soon as practicable after such 60-day period, but in no event later than 2 years after publication of the advance notice. Such rule shall take effect not earlier than 180 days after the date of its publication in the Federal Register. Such rule (or any amendment thereto) shall not apply to any covered products the manufacture of which was completed before the effective date of the rule or amendment as the case may be.

(j) An energy efficiency standard prescribed under this section shall include test procedures prescribed in accordance with section 323, and may include any requirement which the Secretary determines is necessary to assure that each covered product to which such standard applies meets the required minimum level of energy efficiency specified in such standard.

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