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**Part VIII**

## **Department of Energy**

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**Office of Energy Efficiency and  
Renewable Energy**

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**10 CFR Part 430**

**Energy Conservation Program for  
Consumer Products: Energy Conservation  
Standards for Water Heaters; Final Rule**

**DEPARTMENT OF ENERGY**

**Office of Energy Efficiency and Renewable Energy**

**10 CFR Part 430**

[Docket Number EE-RM-97-900]

RIN 1904-AA76

**Energy Conservation Program for Consumer Products: Energy Conservation Standards for Water Heaters**

**AGENCY:** Office of Energy Efficiency and Renewable Energy, Department of Energy (DOE).

**ACTION:** Final rule.

**SUMMARY:** The Department of Energy (DOE or Department) has determined that revised energy conservation standards for water heaters will result in significant conservation of energy, are technologically feasible, and are economically justified. On this basis, the Department is today amending the existing energy conservation standards for water heaters.

**EFFECTIVE DATES:** The effective date of this rule and standard is January 20, 2004.

**ADDRESSES:** You may read copies of the Technical Support Document (TSD) at the DOE Freedom of Information Reading Room, U.S. Department of Energy, Forrestal Building, 1000 Independence Avenue, S.W., Washington, DC. 20585, (202) 586-3142, between the hours of 9:00 a.m. and 4:00 p.m., Monday through Friday, except Federal holidays. You may obtain copies of the TSD from the Codes and Standards Internet site at: <http://www.eren.doe.gov/buildings/codes-standards/applbrf/waterheater.htm> or from the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Forrestal Building, Mail Station EE-41, 1000 Independence

Avenue, S.W., Washington, D.C. 20585. (202) 586-9127.

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**I. Introduction**

The Energy Policy and Conservation Act, as amended (hereinafter referred to as EPCA or the Act), specifies that any new or amended energy conservation standard the Department of Energy (DOE) prescribes shall be designed to "achieve the maximum improvement in energy efficiency \* \* \* which the Secretary determines is technologically feasible and economically justified." Section 325(o)(2)(A), 42 U.S.C. 6295(o)(2)(A). Furthermore, the amended standard must "result in significant conservation of energy." Section 325(o)(3)(B), 42 U.S.C. 6295(o)(3)(B).

In accordance with the statutory criteria discussed in this notice, DOE is amending the water heater energy efficiency standards, to go into effect on January 20, 2004.

*A. Consumer Overview*

The Table below summarizes the "vital statistics" of today's typical gas and electric water heater, as well as presenting the cost implications for the average consumer of water heaters after the 2004 water heater standards take effect.

**VITAL STATISTICS OF TODAY'S TYPICAL WATER HEATERS**

Current statistics	Gas	Electric
Average Price .....	\$383 .....	\$380
Annual Utility Bill .....	\$160 .....	\$256
Life Expectance .....	9 years .....	14 years
Energy Consumption .....	234 Therms/year .....	3,459 kWh/year
Statistics In Year 2004:		
Average New Water Heater Price* .....	\$501 .....	\$486
Estimated Price Increase (Efficiency Only) .....	\$58 .....	\$101
Annual Utility Bill Savings .....	\$12.74 .....	\$13.05
Simple Payback Period .....	3.6 years .....	7.4 years
Average Net Saving Over Appliance Life .....	\$30 .....	\$23
Energy Saving per Year .....	22 therms .....	188 kWh

\*Includes expected price increases for non-energy efficiency regulations.

Currently, the average typical water heater costs, \$380 for electric and \$383 for gas. The average annual utility bill for an electric water heater is \$256, while a gas water heater costs \$160 a year to operate.

The water heater energy efficiency standards we are adopting today will have a positive impact on consumers. Consumers with electric water heaters would save \$13.05 per year while those with natural gas water heaters would save about \$12.74 per year on average. Of course these savings are not free, consumers will have to pay an average increase of \$101 for electric and \$58 for gas water heaters. Note that the total average increased cost for electric and gas water heaters are \$105 and \$118, respectively, due to the phase out of the current insulating foam blowing agent HCFC-141b and the compliance to resist ignition of flammable vapors on gas water heaters voluntarily agreed to between the manufacturers and the Consumer Product Safety Commission. The simple payback for cost increases due to efficiency standards is 7.4 years for electric and 3.6 years for gas water heaters. The lifetime owning cost or life-cycle costs are lower than life-cycle costs on current water heaters by \$23 for electric and by \$30 for gas water heaters.

The design improvements the Department considered are thicker insulation and heat traps on both gas and electric water heaters and an improved heat exchanger (flue baffle) on gas water heaters. These improvements result in a four percent increase in energy efficiency for electric and an eight percent increase in energy efficiency for gas water heaters. These kinds of improvements are already available on 26 percent of all water heater models. In energy terms, households with electric water heaters will save on average 188 kWh per year and households with gas water heaters will save 22 therms per year of natural gas or propane gas.

The benefits to the nation from this revised energy efficiency standard are also significant with energy savings of 4.6 quads of energy over 26 years. This is equivalent to the total energy consumption of all U.S. homes over a period of 2.8 months. By 2020, the standards will avoid the construction of nine 400 megawatt electric generating plants.

The amended standards in today's rule can be achieved by using HFC-134a, cyclopentane, or HFC-245fa as the blowing agent in the insulation. The 4.6 quads of energy savings will result in cumulative greenhouse gas emission reductions of 152 million metric tons (Mt) of carbon dioxide (CO<sub>2</sub>) equivalent,

or an amount equal to that produced by 3.9 million cars per year. Additionally, there will be a cumulative reduction of 273 thousand metric tons of nitrogen oxides (NO<sub>x</sub>). In total, we estimate the national energy savings to have a positive net present value to American business and industry of \$2.02 billion over 26 years.

#### B. Authority

Part B of Title III of the Energy Policy and Conservation Act, Pub. L. 94-163, as amended by the National Energy Conservation Policy Act, Pub. L. 95-619, the National Appliance Energy Conservation Act, Pub. L. 100-12, the National Appliance Energy Conservation Amendments of 1988, Pub. L. 100-357, and the Energy Policy Act of 1992, Pub. L. 102-486,<sup>1</sup> created the Energy Conservation Program for Consumer Products other than Automobiles. Water heaters are one of the consumer products subject to this program. Section 322(a)(4), 42 U.S.C. 6292(a)(4).

Under the Act, the program consists essentially of three parts: testing, labeling, and Federal energy conservation standards. The Department, with assistance from the National Institute of Standards and Technology (NIST), may amend or establish test procedures for each of the covered products. Section 323(b)(1)(A)-(B), 42 U.S.C. 6293(b)(1)(A)-(B). The test procedures measure the energy efficiency, energy use, or estimated annual operating cost of a covered product during a representative average use cycle or period of use. They must not be unduly burdensome to conduct. Section 323(b)(3), 42 U.S.C. 6293(b)(3). The water heater test procedure appears at Title 10 Code of Federal Regulations (CFR) Part 430, Subpart B, Appendix E. The Federal Trade Commission (FTC) prescribes rules governing the labeling of covered products after DOE publishes test procedures. Section 324(a). At the present time, there are FTC rules requiring labels for water heaters.

The National Appliance Energy Conservation Act of 1987 prescribed Federal energy conservation standards for water heaters. Section 325(e). The Act provides that the Department shall

determine whether amended standards to the existing requirements in Section 325(e) for water heaters are warranted, and issue a Final Rule. Such amendment shall apply to products manufactured three years on or after the date of this Final Rule. Section 325(e)(4)(A).

Any new or amended standard must be designed to achieve the maximum improvement in energy efficiency that is technologically feasible and economically justified. Section 325(o)(2)(A), 42 U.S.C. 6295(o)(2)(A).

Section 325(o)(2)(B)(i), 42 U.S.C. 6295(o)(2)(B)(i) provides that before DOE determines whether a standard is economically justified, it must first ask for comments on a proposed standard. After reviewing comments on the proposal, DOE must determine that the benefits of the standard exceed its burdens, based, to the greatest extent practicable, on a weighing of the following seven factors:

(1) The economic impact of the standard on the manufacturers and on the consumers of the products subject to the standard;

(2) The savings in operating costs throughout the estimated average life of the covered product 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 or water 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, as determined in writing by the Attorney General, that is likely to result from the imposition of the standard;

(6) The need for national energy and water conservation; and

(7) Other factors the Secretary considers relevant.

In addition, Section 325(o)(2)(B)(iii), 42 U.S.C. 6295(o)(2)(b)(iii), establishes a rebuttable presumption of economic justification in instances where the Secretary determines that "the additional cost to the consumer of purchasing a product complying with an energy conservation standard level will be less than three times the value of the energy, and as applicable, water, savings during the first year that the consumer will receive as a result of the standard, as calculated under the applicable test procedure. \* \* \*" The rebuttable presumption test is an

<sup>1</sup> Part B of Title III of the Energy Policy and Conservation Act, as amended by the National Energy Conservation Policy Act, the National Appliance Energy Conservation Act, the National Appliance Energy Conservation Amendments of 1988, and the Energy Policy Act of 1992 is referred to in this notice as the "Act." Part B of title III is codified at 42 U.S.C. 6291 *et seq.* Part B of Title III of the Energy Policy and Conservation Act, as amended by the National Energy Conservation Policy Act only, is referred to in this notice as the National Energy Conservation Policy Act.

alternative path to establishing economic justification.

Section 327 of the Act, 42 U.S.C. 6297, addresses the effect of Federal rules on State laws or regulations concerning testing, labeling, and standards. Generally, all such State laws or regulations are superseded by the Act, unless specifically exempted in Section 327. The Department can grant a waiver of preemption in accordance with the procedures and other provisions of Section 327(d) of the Act. 42 U.S.C. 6297(d).

### C. Background

1. *Current Standards.* The existing water heater efficiency standards have been in effect since 1991. Energy efficiency is measured in terms of an energy factor (EF), which measures overall water heater efficiency and is determined by the DOE test procedure. 10 CFR, Part 430, Subpart B, Appendix E. The current water heater efficiency standards are as follows:

- Electric:  $EF = 0.93 - (0.00132 \times \text{rated volume})$
- Gas-fired:  $EF = 0.62 - (0.0019 \times \text{rated volume})$
- Oil-fired:  $EF = 0.59 - (0.0019 \times \text{rated volume})$

where rated volume is the water storage capacity of a water heater in gallons, as specified by the manufacturer.

2. *History of Previous Rulemakings.* On September 28, 1990, DOE published an Advance Notice of Proposed Rulemaking announcing the Department's intention to revise the existing water heater efficiency standard. 55 FR 39624 (September 28, 1990). On March 4, 1994, DOE proposed a rule to revise the energy conservation standards for water heaters, as well as a variety of other consumer products. 59 FR 10464 (March 4, 1994). On January 31, 1995, we published a determination that we would issue a revised notice of proposed rulemaking (NOPR) for water heaters. 60 FR 5880 (January 31, 1995).

The Department of Interior and Related Agencies Appropriations Act for Fiscal Year 1996 included a moratorium on proposing or issuing Final Rules for appliance efficiency standards for the remainder of Fiscal Year 1996. See Pub. L. 104-134. During the moratorium, the Department examined the appliance standards program and how it was working. Congress advised DOE to correct the standards-setting process and to bring together stakeholders (such as manufacturers and environmentalists) for assistance. Therefore, we consulted with energy efficiency groups, manufacturers, trade associations, state agencies, utilities and other interested parties to provide input

to the process used to develop appliance efficiency standards. As a result, on July 15, 1996, the Department published a Final Rule: Procedures for Consideration of New or Revised Energy Conservation Standards for Consumer Products (referred to as the Process Rule) 61 FR 36974 (July 15, 1996), codified at 10 CFR Part 430, Subpart C, Appendix A.

The Process Rule states that for products, such as water heaters, for which DOE issued a proposed rule prior to August 14, 1996, DOE will conduct a review to decide whether any of the analytical or procedural steps already completed should be repeated. 61 FR 36974, 36982 (July 15, 1996). DOE completed this review and decided to use the Process Rule, to the extent possible, in the development of the revised water heater standards.

We developed an analytical framework for the water heater standards rulemaking for our stakeholders, which we presented during a water heater workshop on June 24, 1997. The analytical framework described the different analyses (e.g., life-cycle costs (LCC), payback, and manufacturing impact analyses (MIA)) to be conducted, the method for conducting them, the use of new LCC and national energy savings (NES) spreadsheets, and the relationship between the various analyses.

We held a workshop on November 9 and 10, 1998, to share the preliminary analysis results. We discussed our methodology for analyzing national energy savings, environmental inputs, consumer sub-group impacts and impacts on utilities including fuel switching. There was also a presentation of the water heater insulation testing by NIST. On July 23, 1999 we held another workshop to present the full results of our engineering and economic analysis. We discussed the comments from the November 1998 workshop and changes we made in our analysis as a result of these comments. On April 28, 2000 we published the notice of proposed rulemaking to amend water heater energy efficiency standards. 65 FR 25042 (April 28, 2000). We held the hearing/workshop to discuss comments to the proposed rule on June 20, 2000.

## II. General Discussion

### A. Test Procedures

The Act does not allow DOE to set energy standards for a product unless there is a test procedure in place for that product. The Department published a test procedure on May 11, 1998, that revised the first-hour rating of storage-type water heaters, added a new rating

for electric and gas-fired instantaneous water heaters and amended the definition of a heat pump water heater. 63 FR 25996 (May 11, 1998). This revision did not change the test method for determining energy efficiency standards.

No one has petitioned DOE indicating the Department's test procedures are inadequate for testing water heaters. Accordingly the Department considers the current Federal test procedures applicable and appropriate for today's Final Rule.<sup>2</sup>

### B. Technological Feasibility

The Act requires the Department, in considering any new or amended standards, to consider those that "shall be designed to achieve the maximum improvement in energy efficiency \* \* \* which the Secretary determines is technologically feasible and economically justified." (Section 325 (o)(2)(A)). Accordingly, for each class of product considered in this rulemaking, a maximum technologically feasible (max tech) design option was identified and considered as discussed in the Proposed Rule. 65 FR 25042, 24045 (April 28, 2000).

However, DOE eliminated the heat pump water heater due to issues concerning the practicability to manufacture, install, and service on the scale necessary to serve the relevant market at the time of the effective date of the standard and product utility of these units. We eliminated heat pump water heaters after careful consideration of the current electric resistance and heat pump water heater markets and manufacturing technology, and after applying the factors to be considered in screening design options contained in the Process Rule. We also eliminated gas condensing water heaters because we determined they are not technologically feasible. 10 CFR 430, Subpart C, Appendix A(4)(a)(4) and (5)(b). There is a complete discussion of these conclusions in the proposed rule. 65 FR 25042, 25047-49 (April 28, 2000).

The Department has determined that the electric and gas water heaters considered in today's notice are technologically feasible as required by Section 325(o)(2)(A) of EPCA, as amended. There are some models of these water heaters in the market that

<sup>2</sup> In August and September 2000, DOE conducted a certification review of high efficiency electric water heaters at five manufacturers. Based on the review of these manufacturers' laboratory procedures, we believe some clarifications to the water heater test procedure may be needed. We are planning to join GAMA and the manufacturers in their water heater test program to determine what needs to be clarified in the water heater test procedure.

meet the new standard levels. Thus, the design options DOE considered are technologically feasible.

### *C. Lessening of Utility or Performance of Products*

This factor is not easily quantified. However, DOE has considered the effect of thicker insulation which might result in smaller capacity water heaters to be used in small existing spaces which could cause a reduction in first hour rating. A loss of first hour rating would reduce consumer utility. The discussion in the comments on size constraints explains how DOE dealt with this issue. Furthermore, if a certain type of water heater would no longer fit in spaces that it was designed for, we have considered a new class of products. We have included a discussion on new product classes to address this.

1. *Size Constraints.* We addressed size constraints in the proposed rule by estimating approximately 32 percent of electric water heating households and 27 percent of gas water heating households would need to remove the closet door for water heaters with 3 inch thick insulation. Then, we added a cost adjustment of \$160 to install new water heaters in these households. Several stakeholders have commented on our estimates of costs and the number of households affected.

The American Gas Association (AGA) requests that DOE address size constraints consistently across electric and gas water heaters. It requested DOE to include the costs shown in the Battelle report that addresses space constraints. (AGA, No. 150 at 5). The Gas Appliance Manufacturers Association (GAMA) supports the Battelle analysis. (GAMA, No. 160 at 4). Battelle provided detailed comments on space constraints associated with larger gas water heaters. Based on a survey of 15 companies, covering areas within 24 states, it determined a range of space impacts on costs and the percentages of homes affected. (Battelle, No. 127 at C-1 to C-5).

Southern Gas Association stated that a survey of its members revealed that 18 percent of single family homes would be unable to fit a 2 inch larger diameter water heater into the existing space. (Southern Gas Association, No. 152 at 4). Alagasco indicated that many of its customers are renters in mid to low-income brackets. The proposed gas water heaters would cause space constraints in many of these homes. (Alagasco, No. 152 at 2). The National Propane Gas Association and Atlanta Gas Light Co. stated that an increase in storage tank size will cause significant and costly installation problems in

water heater replacements. (National Propane Gas Association, No. 165 at 2 and Atlanta Gas Light Co., No. 178 at 1). The Oregon Office of Energy (OOE) claims that after installing tens of thousands of high efficiency water heaters in the Pacific Northwest, physically larger tanks do not impose higher installation costs. Drip pans are sized for the larger tanks and water connections are almost universally made with flexible copper tubing that easily accommodates a wide range of tank heights and alignments. (OOE, No. 174 at 3).

To account for size constraints in our revised analysis, we assume space constraints would only apply in those cases where the water heater is installed in a conditioned space, e.g., not in a garage or an unconditioned basement or attic. We also assume this will only apply to small houses or apartments. Therefore, we have excluded houses or apartments with a floor area of more than 1000 square feet. These assumptions are not intended to accurately identify every individual household that would face space constraints when replacing their water heater. Rather this estimate should roughly identify the number of households affected. Since this is based on the Residential Energy Consumption Survey (RECS) '97 data, we have a representative national sample of households. We believe using the RECS '97 database and the assumptions above will give us the best estimate of the impacts of increased water heater size.

In its comments, Battelle also assumed a large fraction of closets are smaller than 22 x 22 inches. Discussions with installers report this is a rare occurrence; they come upon this situation approximately once per month. We also checked the areas served by the gas utilities in the Battelle survey. We found that although 24 states are represented, usually the area served by the utility covered only a very small part of the state. Therefore, we do not believe that this survey is really representative of the entire United States. Consequently, we did not add any extra costs for small closets for gas water heaters. We assumed extra costs for removing and replacing closet doors and door frames for 32 percent of households with electric and 27 percent of households with gas water heaters with 3 inch insulation. See Chapter 9 of the TSD.

In the proposed rule, DOE asked for comments or suggestions to minimize the effects of smaller tanks either by increasing the electric element size from 4.5 kW to 6 kW or by increasing the thermostat setpoint. Several

stakeholders opposed larger electric elements. There were no comments on increasing the thermostat setpoint.

The Electric Power Research Institute (EPRI) claims using 6 kW elements is not an option for smaller tanks to provide the consumer utility of larger tanks since these elements are only used in commercial water heaters. They state that it is generally not possible to use 6 kW elements in "residential" water heaters because standard household wiring circuits usually used for water heaters cannot carry a 6 kW continuous load with sufficient safety margin as required by the National Electrical Code. (EPRI, No. 104 at 3). Dominion concurs with EPRI, and states further that there are currently only two models listed in the latest GAMA directory with elements above 4.5 kW, and none greater than 5.5 kW. (Dominion, No. 145 at 4). The National Rural Electric Cooperative Association (NRECA) also opposes the use of larger heating elements. (NRECA, No. 126 at 1-2). Southern Co. and Dominion claim that increased element size will increase peak electric demand on electric utilities and could require new wiring and circuit breakers or electric panels in homes. (Southern Co., No. 142 at 3 and Dominion, No. 145 at 3).

We are not including 6 kW elements as a means of compensating for downsized electric water heaters in today's Final Rule. Instead, we have increased the thermostat setpoint to meet the load in those cases where the downsized water heater would be too small to meet the particular requirements of a RECS '97 home. In addition to increasing the thermostat setpoint, we added \$106 for the costs of tempering valves and check valves for about fifteen percent of electric and eight percent of the gas water heaters where we had to increase the thermostat setpoint above 140°F. (Generally, water temperatures above 140°F have the potential to cause scalding.) The detailed computer algorithm we used to determine when a tempering valve is needed can be found in the TSD in Chapter 9.

2. *New Product Classes.* During the hearing and in the comments, several comments claimed that tabletop and lowboy water heaters would be unable to fit into existing spaces if their size increased substantially beyond current dimensions. These comments suggested DOE create separate product classes for these water heaters.

GAMA requests DOE to establish a separate product class for lowboy and tabletop water heaters and not to increase the efficiency standards for these products. GAMA states that

lowboy water heaters must be able to fit under a 36 inch high counter. Therefore, they are 34 inches high or shorter and have a jacket diameter less than 26 inches. GAMA defines tabletop water heaters as having typical dimensions of 36 inches high, 25 inches deep and 24 inches wide. Tabletop water heaters are designed to slide into a kitchen countertop space and provide additional countertop surface area. (GAMA, No. 160 at 4–5). Bradford White supports GAMA's request stating that elimination of these products will cost consumers substantial capital to convert and will impact the replacement market negatively. Lowboy electric models are limited to 34 inches in height and to 26 inches in diameter. (Bradford White, No.175 at 2 and No. 138 at 3). A.O. Smith also recommends a new product class for countertop-type (also known as tabletop) electric water heaters. (A.O. Smith, No.179 at 1). The American Council for an Energy-Efficient Economy (ACEEE) commented that it is not opposed to a new product class for tabletops and lowboys but recommended limiting these classes to a 30 gallon size. (ACEEE, No.170 at 7)

DOE has decided to establish a separate product class for tabletop water heaters due to strict size limitations for these products. However, we have concluded that lowboy water heaters do not have as stringent limitations on geometry as tabletop water heaters. For example, the diameter of the lowboys can be increased. We addressed these size constrained lowboy water heaters by adding extra installation costs, see Section II, General Discussion, Lessening of Utility or Performance of Products, "Size Constraints" in today's rule. GAMA data shows that lowboys make up 18 percent of the electric water heater market and that 38 percent of lowboy shipments are 30 gallon, 48 percent are 40 gallon, and 14 percent are 50 gallon tanks. (GAMA, No. 176 at 3).

In establishing classes of products and accounting for cost increases for a percentage of products which will require space modification, the Department does not believe any model of water heater will become unavailable as a result of thicker insulation. Therefore, DOE has eliminated any degradation of utility or performance in the products in today's Final Rule. In the application for tabletop water heaters, we established a new class with no change in standards because these models cannot be made any larger. In all other applications, we have determined from the GAMA directory, GAMA data on shipments, and from the RECS '97 data that sufficient types and sizes of

water heaters exist in the market to satisfy any size constraints encountered.

#### *D. Impact of Lessening of Competition*

This factor seeks the views of the Attorney General to determine the potential impacts on competition resulting from the imposition of the proposed energy efficiency standards.

In order to assist the Attorney General in making such a determination, the Department provided the Attorney General with copies of the Proposed Rule and the Technical Support Document for review. In a letter responding to the Proposed Rule, the Department of Justice (DOJ) found only one area of concern regarding any lessening of competition. The area of concern involves the blowing agent for the foam insulation and the possibility that only one chemical, HFC–245fa, could be used and that it is a patented product with only one supplier. This situation led DOJ to conclude "that the proposed standards could have an adverse affect on competition because water heater manufacturers may have to use an input that will be produced by only one source." (DOJ, No. 143 at 1). The DOJ letter is printed at the end of today's rule.

To reduce heat loss from the stored reservoir of hot water, water heaters must have insulation. The choice of insulation is critical to achieving high water heater efficiency at a reasonable cost and essentially all water heaters use foam insulation. A blowing agent is needed to produce the foam insulation and currently all manufacturers are using the chemical HCFC–141b. Unfortunately, HCFC–141b is an ozone depleting chemical and will be phased out in January, 2003. Therefore, the water heater industry, like all other industries that use this chemical, must find and use a replacement chemical.

Options for non-ozone depleting blowing agents include HFC–245fa, HFC–134a, carbon dioxide (CO<sub>2</sub>)/Water, pentane/cyclopentane and HFC 365mfc, as well as potential blends, or combinations, of these blowing agents. The U.S. Environmental Protection Agency's (EPA) Clean Air Act guides the U.S. appliance industry on replacement of HCFC/CFC blowing agents. The EPA's Significant New Alternatives Program (SNAP) approves chemicals and technologies that can be used to replace ozone depleting chemicals. Of the options listed above, all except HFC–365mfc have been approved by the EPA/SNAP.

Initially, the appliance industry, including water heater manufacturers, had leaned toward adopting HFC–245fa, which performs similarly to HCFC–141b

but at a much higher material cost. HFC–245fa has a lower manufacturing conversion cost than some of the other alternatives, such as pentane/cyclopentane. Given the likelihood HFC–245fa would be adopted by manufacturers, the Department used the performance characteristics and increased material and manufacturing costs associated with HFC–245fa to estimate the impact the new blowing agent would have on consumers and manufacturers. This was not to imply HFC–245fa was the only path to meeting the standard and DOE believes that at least three alternative blowing agents are available to use in meeting the standards adopted in today's Final Rule. See the following section for the analysis we used to support our conclusion.

*1. Increased Costs Due to a Single Source of Supply for HFC–245fa.* In addition to the Attorney General's letter on the anti-competitive effects of the proposed rule, we received several comments from stakeholders. They were concerned about cost increases due to a single source supplier for HFC–245fa and about the unavailability of the material until July, 2002 or later.

The AGA position is that DOE should only consider water blown foams for its analytical baseline and standard level analysis. AGA pointed out that the blowing agent HFC–245fa has not yet been demonstrated in manufacture of water heaters in the U.S. AGA claimed that, due to uncertainty in availability to manufacturers and a sole source U.S. supplier, DOE should consider only those blowing agents that are available and proven for water heater manufacture. (AGA, No. 150 at 5–7).

To address concerns about the performance of alternative blowing agents, we tested three sets of four electric water heaters with different foam insulations. The purpose of these tests was to compare the performance of the current foam insulation, HCFC–141b, with water blown and HFC–245fa blown foam insulation. The results of the NIST tests showed that water heaters insulated with HFC–245fa had the same energy factors as those insulated with HCFC–141b. Water heaters insulated with water blown foam insulation had energy factors about two percent lower than tanks insulated with HCFC–141b. We believe the results of these tests demonstrate that the blowing agents HFC–245fa and water can be used to insulate water heaters and that the insulation performance is the same with HFC–245fa and only slightly reduced with water blown foam. (Performance Testing of Alternative Blowing Agents for Foam

Insulation of Residential Water Heaters, Fannee et al., Proceedings of the AMC, 1999).

The DOJ urges DOE to account for the impact of a single source supplier on competition, and to consider altering the standard so manufacturers may meet the standard for all affected models using other blowing agents. DOJ further noted that some manufacturers have suggested that DOE underestimated the performance capabilities of alternative blowing agents. If this is true, manufacturers may in fact be able to comply with the proposed standard while using water-based blowing agents. (DOJ, No. 143 at 1–2).

Stepan is concerned that the proposed standards would require foam suppliers to use HFC–245fa as the blowing agent. This raises an issue about relying on a sole source supplier for an efficiency standard, since Honeywell maintains the exclusive North American rights to its manufacture and sale. (Stepan, No. 123 at 1–2). APGA claims the reliance on insulation technology licensed to a single company raises new issues and antitrust concerns and may be contrary to the statute. (APGA, No. 167 at 2).

To address these comments, we conducted additional engineering cost analyses with HFC–245fa, HFC–134a and cyclopentane as the blowing agent

in the insulation. An April 7, 2000, Bayer press release states most appliance manufacturers in North America are considering either HFC–245fa or HFC–134a. Cyclopentane is not considered favorably because of the capital investment required to handle cyclopentane safely (cyclopentane is highly flammable). There are also high costs because the factory cannot produce water heaters while converting factory equipment to a cyclopentane system. However, appliance manufacturers are independently deciding which blowing agent to select. Switching to either HFC–245fa or HFC–134a involves capital costs. According to industry and Bayer research, HFC–245fa exhibits the best insulation value of the two blowing agents—roughly equal to HCFC–141b—though it is more costly per pound. HFC–134a demonstrates an insulation value approximately ten percent lower than HCFC–141b but has a lower per-pound cost than HFC–245fa.

We have examined, through the engineering analysis, the impact on product design and costs using two of the other blowing agent options, HFC–134a and cyclopentane, to achieve a similar energy factor as the proposed levels for HFC–245fa. See Table 1 below. We included the ten percent

performance reduction for HFC–134a and an estimate of \$7 per unit for the capitalization costs of cyclopentane in our engineering analyses. These analyses show that energy factors are the same for the three blowing agents. Costs for all design options are within a few dollars for HFC–245fa, HFC–134a and cyclopentane. While we have not examined every possible blowing agent option, we conclude that at least two additional options to HFC–245fa can be used to achieve similar performance for similar costs. The blowing agent performance characteristics and test results using HFC–245fa, HFC–134a and cyclopentane blown foam to evaluate design options can be found in Chapter 3.4.1 of the TSD.

Table 1 shows the trial standard levels, design options, energy factor and installed costs for the three alternative blowing agents, HFC–245fa, HFC–134a and cyclopentane. Note the energy factors are the same for all trial standard levels and all blowing agents. There are small differences in costs; HFC–245fa is the cheapest blowing agent, HFC–134a costs about \$2/unit more than HFC–245fa, while cyclopentane is the most expensive blowing agent costing about \$9 more per installed electric and \$11 more per installed gas water heater.

TABLE 1.—ENGINEERING RESULTS FOR ALTERNATIVE BLOWING AGENTS

Trial standard level	Design options	Energy factor	Installed costs
<b>HFC–245fa:</b>			
1	Electric: Heat Traps + Tank Bottom Insulation	0.88	367.52
	Natural Gas: Heat Traps + Flue Baffles (78% RE) + 2 Inch Insulation	0.59	431.57
2	Electric: Heat Traps + Tank Bottom Insulation + 2 Inch Insulation	0.89	403.69
	Gas: Heat Traps + Flue Baffles (78% RE) + 2.5 Inch Insulation	0.60	456.79
3	Electric: Heat Traps + Tank Bottom Insulation + 2.5 Inch Insulation	0.90	440.69
	Gas: Heat Traps + Flue Baffles (78% RE) + 2 Inch Insulation	0.59	431.57
4	Electric: Heat Traps + 3 Inch Insulation + Plastic Tank	0.91	547.04
	Gas: Heat Traps + Flue Baffles (80% RE) + 3 Inch Insulation + Side Arm Heater + Plastic Tank + IID.	0.71	751.31
<b>HFC–134a:</b>			
1	Electric: Heat Traps + Tank Bottom Insulation	0.87	363.06
	Natural Gas: Heat Traps + Flue Baffles (78% RE) + 2 Inch Insulation	0.59	428.65
2	Electric: Heat Traps + Tank Bottom Insulation + 2 Inch Insulation	0.89	391.60
	Gas: Heat Traps + Flue Baffles (78% RE) + 2.5 Inch Insulation	0.60	454.39
3	Electric: Heat Traps + Tank Bottom Insulation + 2.5 Inch Insulation	0.90	428.01
	Gas: Heat Traps + Flue Baffles (78% RE) + 2 Inch Insulation	0.59	428.65
4	Electric: Heat Traps + 3 Inch Insulation + Plastic Tank	0.91	531.45
	Gas: Heat Traps + Flue Baffles (80% RE) + 3 Inch Insulation + Side Arm Heater + Plastic Tank + IID.	0.71	749.41
<b>Cyclopentane:</b>			
1	Electric: Heat Traps + Tank Bottom Insulation	0.88	368.11
	Natural Gas: Heat Traps + Flue Baffles (78% RE) + 2 Inch Insulation	0.59	432.14
2	Electric: Heat Traps + Tank Bottom Insulation + 2 Inch Insulation	0.89	394.70
	Gas: Heat Traps + Flue Baffles (78% RE) + 2.5 Inch Insulation	0.60	456.10
3	Electric: Heat Traps + Tank Bottom Insulation + 2.5 Inch Insulation	0.90	428.79
	Gas: Heat Traps + Flue Baffles (78% RE) + 2 Inch Insulation	0.59	432.14
4	Electric: Heat Traps + 3 Inch Insulation + Plastic Tank	0.91	529.79
	Gas: Heat Traps + Flue Baffles (80% RE) + 3 Inch Insulation + Side Arm Heater + Plastic Tank + IID.	0.72	749.25

2. *Availability of HFC-245fa.* Bradford White said it has given careful consideration to all of the options available for blowing agents. However, since HCFC-141b may be in limited supply early in 2002 because of facility phase-outs and with the uncertainty in availability of HFC-245fa, Bradford White has no alternative but to pursue water blown insulation. (Bradford White, No. 175 at 1-2). Stepan has concerns about the overall availability of HFC-245fa. (Stepan, No. 123 at 1-2).

Honeywell indicated that over six years and \$30 million has been invested in the development of HFC-245a. Honeywell has received all the necessary U.S. regulatory approvals and is constructing a commercial manufacturing facility at its Geismar, Louisiana location. The facility is expected to be online by July 1, 2002. Honeywell expects ample capacity to be available to water heater manufacturers. (Honeywell, No. 114 at 2).

The OOE claims adequate quantities of HFC-245fa are available now for optimizing production processes. (OOE, No. 174 at 3). The ACEEE states DOE has previously decided, in the refrigerator standard rulemaking, that HFC-245fa will be available and can be an energy-efficient and cost effective blowing agent. DOE should make the same decision here. ACEEE suggests DOE provide for manufacturers to petition for relief if HFC-245fa does not become available. (ACEEE, No. 170 at 8). Southern Company also asks why DOE made no provisions for an alternative if the blowing agent does not become available. (Southern Company, No. 142 at 3).

DOE has investigated the issue of the availability of HFC-245fa. Announcements in *The Advocate*, a Baton Rouge, LA newspaper (May 11, 2000 and October 6, 2000), indicate that Honeywell is proceeding to secure the necessary permits to build the HFC-245fa plant. Furthermore, Vulcan Chemicals is also planning to build a plant in Geismar, LA to make pentachloropropane, one of the chemicals used in the manufacture of HFC-245fa. DOE concludes that HFC-245fa will be available as planned and therefore does not believe it needs to make any provision in today's rule in the event of HFC-245fa unavailability. If Honeywell does not build its plant or if the plant is delayed, DOE believes there are still three or more alternative blowing agents for water heater manufacturers to use, *i.e.*, water, cyclopentane, HFC-134a or blends of these three.

### *E. Economic Justification*

As noted earlier, Section 325(o)(2)(B)(i) of the Act provides seven factors to be evaluated in determining whether an energy conservation standard is economically justified. Since there were significant comments from the June 20, 2000, hearing, and new data from RECS '97 and AEO 2000, DOE has developed a revised water heater analysis. Specific revisions to our analysis methods are discussed in Section III, Methodology.

### *F. Other Factors*

This provision allows the Secretary of Energy, in determining whether a standard is economically justified, to consider any other factors that the Secretary deems to be relevant. Section 325(o)(2)(B)(i)(VI), 42 U.S.C. 6295(o)(2)(B)(i)(VI). The Secretary has decided that no other factors need to be considered in this rulemaking.

### **III. Methodology**

DOE has made some minor changes to the engineering and LCC analysis for this Final Rule. We discuss these changes below in response to the comments on markup, the WATSIM computer model, blowing agents and blended fuel prices. Additionally, the household characteristics data used in the analysis were updated from the 1993 RECS data to the 1997 RECS data (except for oil-fired water heaters). We used the energy price projections from the AEO 2000 as well.

#### *A. Engineering*

DOE is continuing to use the WATSIM and TANK computer models in its analysis to evaluate the energy factor of water heaters with various design options. These models were discussed in the engineering methodology section of the proposed rule. 65 FR 25042, 25052-53 (April 28, 2000). We adjusted the manufacturers' costs and the installation costs to account for comments to the proposed rule. These changes resulted in reduced manufacturers' costs for gas water heaters and slightly higher retail costs for electric water heaters.

Further testing at NIST and reverse engineering of a water heater at the Lawrence Berkeley National Laboratory (LBNL) allowed DOE to fully validate WATSIM. These tests revealed that WATSIM and NIST results for the energy factor of a high efficiency electric water heater were the same. See the TSD, Chapter 8.2.4

1. *Water Heater Markup.* DOE's calculation of gas water heater markup was a major concern to stakeholders. There was wide spread criticism that

the markup for gas water heaters we derived in the proposed rule was too low to support any manufacturer's production of that product.

The AGA claims DOE's approach to calculating markups has been roundly criticized by stakeholders throughout the development of the TSD and supporting analysis, and is unaware of any comments supporting DOE's analysis. AGA claims that DOE has provided no consistency checks for this and other markups to determine their validity, in spite of criticism it has received on its analytical results, and has failed to postulate a market mechanism or economic model to justify its numbers. Furthermore, AGA commented that manufactured cost and retail price are not independent random variables, and that DOE did not correlate its cost and price data. This resulted in 21 percent of the RECS '93 households being constrained to 0 markup. AGA believes DOE should adopt the Battelle markups. (AGA, No. 150 at 8-9). Laclede Gas claims DOE should not limit the markup algorithm to prevent negative markups. (Laclede Gas, No. 148 at 9).

To address the comments about correlating prices and costs, DOE has changed its LCC analysis to use correlated retail prices and manufacturer costs, *i.e.*, high prices correlate with high costs. This has eliminated the negative values of markup which occurred in the analysis for the proposed rule.

GAMA and Bradford White claim the markup for gas water heaters combines 4-inch flue model costs with 3-inch flue model prices. According to GAMA, using the DOE database and only 4-inch flue models, the markup increases from 1.22 to 1.5. (GAMA, No. 117 at 2-3 and Bradford White, No. 108 at 7). Dominion Virginia Power states that the DOE gas water heater base line assumes a 4 inch flue yet the typical 40 gallon gas water heater uses a 3 inch flue. (Dominion Virginia Power, No. 145 at 6).

We separated the retail prices for 3 inch and 4-inch flues on gas water heaters. We had our consultant estimate the incremental cost difference between manufacturing water heaters with 3 inch and 4 inch flues. We then subtracted this cost from the manufacturer cost supplied by GAMA for water heaters with 4 inch flues. Our analysis now accounts for these price and cost differences as recommended. Since the retail prices were not changed, this increased the markup on the baseline units in the LCC, as well as the markup applied to the various design options.

Southern Company and the Energy Market and Policy Analysis group claim



the price database is too limited for the type of analysis conducted by DOE. Specifically, Southern Company claims the database has a geographic bias, citing the high number of sample points from Washington and Oregon. It claims that over 23 percent of the sample points are from these two states, which represent slightly more than three percent of the U.S. population. Southern Company suggests using a combined markup for gas and electric water heaters. (Southern Company, No. 142 at 1–2 and Energy Market and Policy Analysis, No.151, at 5–6).

DOE's retail price database uses data points broadly distributed over the 10 Census regions of the U.S., and DOE does not believe the database has a geographic bias. Only 10.9 percent of the water heaters in the database are from the Pacific Region (see Table 5.3 in the TSD). The Department used a slightly higher proportion of water heaters from the northwest to ensure an adequate representation of high-efficiency units. DOE will not be using a combined markup, since each fuel type must be evaluated individually. The design option approach requires distinct costs for each fuel type.

Battelle estimated the cost of materials and labor for the design options under consideration and applied standard industry markup factors to determine the cost to the consumer. Battelle assumed standard industry markup factors were 1.5 for the manufacturer, 1.2 for the distributor, and 1.4 for the retailer. Thus, the overall markup factor is 2.52 ( $1.5 \times 1.2 \times 1.4 = 2.52$ ). Therefore, to determine the cost to the consumer, the manufacturer's materials and labor costs for a design option are multiplied by 2.52.

To validate this standard approach for gas water heaters, Battelle conducted a tear down analysis on six water heaters varying in size among 30, 40, 50, and 75-gallon capacities. BDI Design for Manufacture software was used to catalog the components and estimate materials and labor costs for each water heater. The materials and labor costs for the 30, 40, 50, and 75-gallon baseline gas water heaters were \$80.83, \$86.06, \$90.95, and \$139.77, respectively. The 40-gallon gas water heater cost of \$86.06 is in excellent agreement with the value of \$87.51 supplied by GAMA to DOE. (Battelle, No. 106 at 1–2).

DOE compared its manufacturer markup to Battelle's standard markup factor. This is the total manufacturer cost divided by the sum of the materials and labor costs for 40 gallon gas-fired water heaters.

Battelle:  $\$133.78/\$86.06 = 1.55$

DOE:  $\$133.78/(\$75.07 + \$10.74) = 1.56$

Therefore the manufacturing markup is essentially identical.

The ACEEE claims the Battelle markups applied to the GAMA manufacturing costs yield incredibly high retail prices. ACEEE concludes the manufacturers' costs are too high and the markups may be too low on some water heaters. (ACEEE, No. 170 at 9). The OOE and the Northwest Power Planning Council (NWPPC) do not accept GAMA's manufacturing costs because the typical margins in the Pacific Northwest are \$30–\$40 for high efficiency water heaters. (OOE, No.174, at 2 and NWPPC, No.163, at 2).

In order to address the concerns about manufacturers' costs, DOE adjusted the higher range of the manufacturer's cost distribution, to match the average of the low range of the manufacturers' cost distribution. We also applied this correction to the incremental manufacturer costs for heat traps and increased insulation. We did this to bring manufacturers' costs in line with known appliance manufacturing costs, derived from publicly available SEC reports. It also ensures consistency within the data. Since the overall retail prices remain constant, the change eliminates the occurrences of unreasonably low markups on the baseline gas and electric water heaters. This reduced the average values of baseline costs for electric and gas water heaters by \$9.55 and \$6.22 respectively.

Battelle claims that when its baseline materials and labor costs were used in conjunction with the DOE database of retail water heater prices, the average overall markup factor for gas water heaters came out to be 2.44. This is in excellent agreement with the assumed standard markup factor of 2.52 stated previously. (Battelle, No. 106 at 1–2). Southern California Gas Co. agrees with Battelle's markup factor of 2.52. (Southern California Gas, No. 181, at 2). The American Public Gas Association (APGA) claims there is an obvious problem with the markup analysis. It suggests DOE approach this matter with real-world prices and manufacturers' costs. (APGA, No. 167 at 2).

In the DOE analysis, the overall markup factor consists of manufacturer markup and distributor/retailer markup. From the LCC analysis, we have an overall markup of 1.59 for gas and 1.94 for electric water heaters. These markups differ from the Battelle markups in an important respect. Battelle assumes that the water heater market is characterized by large distributors selling to retailers or plumbers. DOE has determined that less

than 50 percent of the water heater market operates that way. Many water heaters are sold directly to retail by large cash and carry distributors or they are sold to builders or large plumbing companies by large distributors. Therefore, the standard markup factors are not correct for the residential water heater market.

2. *WATSIM Computer Model for Electric Water Heaters.* DOE received several comments about the WATSIM computer model for electric water heaters. Most comments stated that WATSIM does not predict the energy factor of electric water heaters accurately. Other comments asserted that DOE needed to test water heaters to compare actual performance to WATSIM predictions.

GAMA claims it has no confidence that WATSIM is properly predicting the energy factors resulting from the various insulation options. (GAMA, No.160 at 1–3). Dominion states that DOE should verify the accuracy of calculated energy factors for design options with results from commercially available products. (Dominion, No. 145 at 3). EPRI claims WATSIM can predict energy consumption of electric water heaters typically within 3–6 percent accuracy. For the type of analysis represented by DOE energy factor tests, the accuracy would typically be around the 3–4 percent range. (EPRI, No.104 at 1). Southern Company supports EPRI's remarks. (Southern Company, No. 142 at 2).

At the June 2, 1997, Water Heater Workshop, the Department sought comments on the selection of appropriate engineering models such as WATSIM and TANK to use in the Engineering Analysis. Most of the stakeholders' comments indicated no objections related to the use of the simulation models for the analysis. The following participants supported the use of WATSIM and TANK: C. Hiller (EPRI), J. Ranfone (AGA), J. Langmead (Water Heater Consortium), S. Nadel (ACEEE), R. Hemphill (Gas Technology Institute (GTI)). There were no comments that indicated WATSIM and TANK were incorrect to use.

Bradford White says DOE must test products to understand the actual performance of cavity increases and new blowing agents. (Bradford White, No.108 at 2–6). GAMA concurs, saying DOE has relied too heavily on computer modeling to establish insulation performance when actual testing of water heaters would have provided more precise results. GAMA further states that, "DOE is expected to test water heaters to exclude the energy-saving benefits of design options when

the agency can do so at reasonable cost," rather than rely on computer modeling," 998 F. 2d 1041 (D.C. Cir. 1993). Bradford White further comments that DOE must test at least three storage capacities affected by the standard. (Bradford White, No.138 at 1).

We reviewed the court case that GAMA cited in its comments. The Court acknowledges that computer modeling is "a useful and often essential tool for performing the 'Herculean labors'" imposed by Congress. *Gas Appliance Manufacturers Association v. Department of Energy*, 998 F. 2d 1041, 1045 (D.C. Cir. 1993). The Court also stated that when computer modeling is used, an agency must sufficiently explain the assumptions and methodology so that there is a rational connection between the factual inputs, modeling assumptions, modeling results and conclusions drawn from these results. *Id.* at 1046. (GAMA, No. 160 at 1)

DOE provided a detailed explanation of the model, its assumptions, and its results in the proposed rule and accompanying Technical Support document. In the proposed rule, we stated that comparisons of the WATSIM prediction to the NIST test result for an electric water heater with an efficiency at the level proposed was within 0.002 EF. 65 FR 25042, 25053 (April 28, 2000). The detailed description of the WATSIM model and the assumptions DOE used to model electric water heaters are provided in the TSD for the proposed rule in Chapter 8.2.4.1.

In response to these comments on the proposed rule, LBNL tore down (reverse engineered) one of the American Water Heater Company's (American) 0.93 EF products to assess what design options were used. In addition, NIST tested the two units of the American model that LBNL tore down. Using the reverse engineering data in the WATSIM model and comparing to the NIST test results, we obtained results from WATSIM that were within 0.006 EF of the NIST results. Therefore, WATSIM has been validated at the efficiency levels and with the types of design options that our analysis is using. See Chapter 8.2.4.1 in the TSD. Consequently, we believe WATSIM correctly predicts the efficiency of electric water heaters.

DOE did not rely on computer modeling alone to demonstrate the performance of higher efficiency electric water heaters. In the fall of 1999, NIST tested five higher efficiency electric water heaters, one model from each manufacturer. In the fall of 2000, NIST tested six tanks, a sample of two tanks of three models of electric water heaters. None of these models achieved their

rated efficiency as shown in the GAMA directory. However, several of these models performed at or above the standard level adopted in today's rule. Therefore, at this time, and while we are still examining this issue, we have concluded that the WATSIM model correctly accounts for the maximum technically feasible design options for electric resistance water heaters and continue to use it, without modification for this rulemaking. Furthermore, we believe we have performed sufficient testing to demonstrate that the minimum efficiency levels can be met.

3. *Pipe Insulation.* In our proposed rule, the Department did not consider insulation on water heater inlet and outlet pipes. In recent visits to the five water heater manufacturers, we discovered that four manufacturers ship the tanks with pipe insulation for their high efficiency water heaters. The DOE water heater test procedure allows water heaters to be tested with pipe insulation if the manufacturer ships the tank with pipe insulation. To determine the impact of pipe insulation on our analysis, we modeled water heaters with and without pipe insulation in WATSIM. These results showed that pipe insulation in combination with heat traps improves the energy factor by 0.005 EF. We performed tests at NIST with and without pipe insulation on three different models of electric water heaters equipped with heat traps, and the average increase in the energy factor with pipe insulation was 0.007. Since both the WATSIM computer model and NIST testing indicate the effects of pipe insulation combined with heat traps is small, we have not included the effects of pipe insulation in our analysis. Furthermore, since pipe insulation must be applied during water heater installation, we are not sure how often it is used. Information from a small survey of installers indicated that about 50 percent do not install the pipe insulation.

4. *Blowing Agent Conductivity.* Stepan believes HFC-245fa may not achieve the energy performance results predicted in the proposed rule, and that water blown foams may actually exceed modeled predictions. Stepan claims it measured initial k-factors for water blown foam as low as 0.175 BTU/hr-°F-in. (Stepan, No. 123 at 2-3). The NWPPC suggests DOE recalculate the LCC using the water blown foam k-factors given at the workshop. (NWPPC, No. 163 at 3-4).

For cost information, Honeywell, the licensee to manufacture HFC-245fa in the U.S., provided estimates of HFC-245fa costs. For efficiency data, we used published laboratory measurements of physical parameters but we derated

these conductivities by eleven percent to account for losses of insulation effectiveness due to the foaming process and modeling assumptions. In order to keep the baseline efficiency (those with HCFC-141b insulation) and the energy use characteristics of water heaters with HFC-245fa insulation the same, we modeled them with appropriately thicker insulation. We also increased the amount and cost of steel used for the water heater jacket in addition to adding the extra volume and cost of insulation.

5. *Analytic Baseline.* The current baseline is for water heaters insulated with HCFC-141b and without any design to prevent the ignition of flammable vapors on gas water heaters. In order to analyze separately the effects of energy efficiency standards from the effects of EPA actions to phase out the HCFC-141b blowing agent or of the CPSC actions to make gas water heaters more resistant to ignition of flammable vapors, DOE has developed an "analytic baseline" concept. This concept assumes that by 2003 and before the energy efficiency standards become effective, the actions of these other Federal agencies will have taken effect. To meet these other agency's requirements, manufacturers will have created new designs and made other changes to the production of water heaters. The cost estimates of these production and design changes are included in the analytic baseline. Several comments state that DOE should have included different designs or production changes in its analytic baseline. The analytic baseline is used in the engineering and LCC analyses.

APGA claims manufacturers would use heat traps to meet the baseline standards in 2003. Furthermore, the DOE analytic baseline overstates the value of raising the standard. (APGA, No. 21 at 2 and No. 167 at 2). AGA suggests DOE should only consider water blown foam for its analytical baseline. AGA suggests that manufacturers will use heat traps to add the 0.01 EF needed to meet the current standards with water blown insulation after 2003. (AGA, No. 150 at 5). GTI claims DOE has defined a virtual baseline water heater that makes it easier to justify added insulation. (GTI, No. 141 at 4). The Southern Gas Association's experience with noisy heat traps led them to discontinue using heat traps when installers began removing the heat traps during water heater installation. (Southern Gas Association, No. 152 at 3).

DOE does not believe heat traps would be the only design option manufacturers might use to meet the current standard when the HCFC

blowing agent is phased out. When asked, during the manufacturer interviews, none of the manufacturers indicated they were limited to heat traps as the only design option.

DOE also does not know what blowing agent any particular manufacturer would use. We believe that manufacturers will likely choose different blowing agents or use mixtures of blowing agents based on what they believe to be the best business decisions for them.

#### B. Life-Cycle Costs

As discussed in the proposed rule, DOE used new analytical tools in this rulemaking. We used a spreadsheet model to calculate LCC and payback. 65 FR 25042, 25059–64 (April 28, 2000). In the LCC spreadsheet model, we use Microsoft Excel for Windows 95, combined with Crystal Ball (a commercially available software program) so we can use actual distributions of input variables. The LCC outputs from this program are a range of LCCs and the fraction of the population that will benefit from energy efficiency standards.

1. *Blended Natural Gas and Propane Fuel Costs.* In the LCC analysis for the proposed rule, DOE used a gas price composed of approximately ten percent propane and 90 percent natural gas. Many gas utilities and a gas utility association objected to this approach.

AGA and GTI insist that we use natural gas costs when evaluating gas water heaters, not the blended fuel costs, because our blended fuel costs make natural gas prices ten percent higher. (AGA, No. 150 at 7 and GTI, No. 141 at 4). ACEEE claims a blended price is appropriate if the standard applies equally to both fuels. (ACEEE, No. 170 at 10). Dominion stated that a blended propane and natural gas price will artificially increase savings for natural gas equipment because propane has a higher price. (Dominion, No. 145 at 7).

DOE agrees that use of blended fuel costs is inappropriate when calculating gas water heater life-cycle-costs and national net present value, therefore, DOE has separated natural gas and propane water heaters and has considered each of these fuels separately in the LCC. To do this, DOE asked its consultant to develop a manufacturing cost for propane water heaters from the GAMA manufacturing cost data for natural gas water heaters. We estimated the retail price distribution for liquid petroleum gas water heaters from the manufacturers' costs and the markup for natural gas since there were not enough propane

gas water heater prices in the price database.

During the time from the water heater hearing/workshop on the proposed rule until publication of this Final Rule, natural gas prices have risen dramatically for many consumers. DOE has investigated this increase to determine if these price increases might continue into the near future because increased gas prices would mean larger LCC savings and earlier paybacks for more energy efficient water heaters. The EIA has determined natural gas demand has increased in 2000 due to several factors including new gas-fired electric generators and new home construction. Natural gas prices will continue at higher levels than recent years but will return to more normal levels after the winter of 2000–2001 because the new gas wells should be in production by then. The AEO 2000 does not forecast any long term increase in gas prices.

2. *Percent of Consumers Benefitting from Standards.* EEI and Dominion claim the fraction of consumers benefitting from the standard level (74 percent for electric, 87 percent for natural gas) is too low for minimum efficiency standards. EEI and Dominion recommend DOE accept only those standard levels that will provide benefits to at least 90 percent of the population. (EEI, No. 124 at 2 and Dominion, No. 145 at 2). Energy Market and Policy Analysis states that DOE overestimates the percentage of winners and underestimates the losers because it ignores some costs, uses high estimates of future electricity prices, and uses low discount rates. (Energy Market and Policy Analysis, No. 151 at 2).

Although ACEEE admits the two percent band of insignificance is arbitrary, it claims this is a very useful concept. ACEEE claims that life cycle costs probably must differ by \$100 or \$10/year before they are significant. (ACEEE, No. 170 at 11).

The Act requires the Department to consider life-cycle-cost as one of the seven factors in determining economic justification. In determining economic justification, the Secretary shall determine whether the benefits of a standard exceed the burdens. Life-cycle-cost is just one of the factors to be considered and there is no mathematical formula for weighing the benefits and burdens of the various factors. There are also no mathematical thresholds for life cycle cost as implied by EEI and the Energy Market and Policy Analysis. Furthermore, it can be argued that the Act, in requiring DOE to set national standards that maximize energy savings for appliances where there will obviously be regional differences in

usage and energy costs, expected there would be some consumers with higher life cycle costs. Based on these arguments, the Department strongly disagrees with EEI and the Energy Market and Policy Analysis comments.

The Department has used the two percent band of insignificance as an indicator of the levels of LCC savings or costs where consumers could appreciate savings or suffer real loss. DOE uses the percent of households benefitting and the band of insignificance to help it weigh the LCC effects and in its consideration of the benefits and burdens of these amended standards.

#### C. Manufacturing Impact

We use the Government Regulatory Impact Model (GRIM) to determine the manufacturing impacts. The analysis methodology is discussed in the proposed rule and the TSD. 65 FR 25045, 25069–71 (April 28, 2000). The manufacturing impact analysis estimates the financial impact of standards on manufacturers, as well as the impacts on competition, employment, and manufacturing capacity. We used the GRIM spreadsheet model to perform an industry cash flow analysis.

#### D. Energy Savings and Net Present Value

DOE uses a variant of the Energy Information Administration (EIA)'s National Energy Modeling System, the National Energy Modeling System-Building Research and Standards, called NEMS-BRS, for the utility and environmental analyses, together with some scaling and interpolation calculations.<sup>3</sup> The NEMS-BRS permits the modeling of interactions among the various energy supply and demand sectors and the economy as a whole, so it produces a sophisticated picture of the effects of appliance standards. EEI claimed that DOE does not account for the effects of electricity deregulation in its analysis. (EEI, No. 124 at 2). The effects of deregulation are built into the NEMS-BRS 2000 model.

#### IV. Discussion of Comments

We received numerous comments from gas utilities and other gas

<sup>3</sup> For more information on NEMS, please refer to the National Energy Modeling System: An Overview 1998. DOE/EIA-0581 (98), February, 1998. DOE/EIA approves use of the name NEMS to describe only an official version of the model without any modification to code or data. Because our analysis entails some minor code modifications and the model is run under various policy scenarios that are variations on DOE/EIA assumptions, the name NEMS-BRS refers to the model as used here. BRs is DOE's Building Research and Standards office.

consumers, supporting the AGA position and the Battelle analyses. We appreciate these comments and we believe we have covered their concerns in our responses to the comments from the Gas Technology Institute (GTI; formerly GRI), AGA, Battelle, and others in our responses to comments on markups, venting, and size constraints.

#### A. Venting of Gas Water Heaters

Venting of gas water heaters has been an issue throughout the water heater rulemaking. In our proposed rule, we advocated a standard level that included an increase in the recovery efficiency (RE) to 78 percent from the current 76 percent. Most gas utilities and manufacturers are concerned about the reduction in the margin of safety regarding venting system corrosion with this two percent increase in RE. To make this discussion about venting easier to follow, we have separated the issue into the following subtopics: safety, the National Fuel Gas Code (NFGC) venting tables, Type B vent connectors, costs, and direct vent applications.

1. *Safety*. AGA believes DOE is incorrect in its analysis concerning venting systems for water heaters with RE above 76 percent. AGA states DOE can resolve this issue of vent system modification by one of the following:

- By fully accounting for the vent system costs as reflected in the Battelle analysis;
- By determining that the comments concerning venting integrity and safety beyond its current analysis approach are without merit; and
- By determining that safety concerns are insignificant or the expected benefits of the standard outweigh this safety consideration as required under the process rule.

AGA further requests DOE to explicitly state its determination and its underlying rationale if the second or third option is chosen. AGA reiterates its position that DOE should not promulgate a standard that subjects consumers to a potential increase in safety risk. (AGA, No. 150 at 3–5). AGA and the Atlanta Gas Light Co. believe that DOE has not considered the retail cash and carry market where needed vent system upgrades are unlikely to occur. (AGA, No. 150 at 4 and Atlanta Gas Light Co., No. 178 at 2).

Alagasco stated that the ability of gas water heaters to deliver outstanding economy, performance and environmental benefits is dependent on adequate margins of error in critical subsystems like venting, gas piping, combustion air and clearances. The overall utility of gas water heating is a

function of proper installation. (Alagasco, No. 162 at 1). The New England Gas Association and Atlanta Gas Light Co. believe increased gas water heater efficiency from improved flue loss efficiency can lead to increased condensation and chimney degradation. (New England Gas Association, No. 139 at 2–3 and Atlanta Gas Light Co., No. 178 at 2). The NYSEB, National Propane Gas Association, Atlanta Gas Light Co, and Southern California Gas Co. state that DOE's proposal reduces the margin of error for installations of gas water heaters in retrofits. The National Propane Gas Association adds that existing vent systems are more likely to develop condensate problems and vent failures. (NYSEB, No. 164 at 1, National Propane Gas Association, No. 165 at 2, Atlanta Gas Light Co., No. 178 at 1; and Southern California Gas Co., No. 181 at 2).

ACEEE and OOE claim that there should be no safety concern at 78 percent RE because the Talbert study for GTI found that a single walled vent connector is acceptable at flue-loss efficiencies (FLE) up to 80 percent and 78 percent RE is equivalent to 79.75 percent FLE. (ACEEE, No. 170 at 3 and OOE, No. 174 at 2).

DOE did not raise the RE enough to create a safety concern if the venting system is correctly installed. DOE used the data from the GTI reports to estimate the impacts of 78 percent RE gas water heaters on venting systems. At 78 percent RE the flue loss efficiency is still below 80 percent, the level at which condensation begins. Since the increased RE may reduce the margin of error, DOE's analysis accounts for the cost of Type B vent connectors in eleven percent of households and for chimney relining in eight percent of households. Type B vent connector is a double walled vent connector that reduces cooling of the flue gasses and is more corrosion resistant than steel vent pipe.

Additionally, the California Energy Commission (CEC) in its comments, provided data about the number of models of gas water heaters that have energy factors at 76 percent RE and above that would comply with the gas water heater standards in the proposed rule. (The CEC maintains its own database of gas water heaters.) There are 170 distinct models of gas water heaters in the CEC database. A distinct model is a "discreet combination of manufacturer, input, volume, energy factor and recovery efficiency." Of these, 51 models or 30 percent of all distinct models have a RE of 76 or 77 percent. Furthermore, there are nearly an equal number of natural gas and propane gas water heaters in this

category. (CEC, No. 171 at 3 and Attachment A). Since gas water heaters with a RE below 78 percent do not pose any safety threat and 30 percent of the models that can meet the standard are in this group, installers will have choices among lower RE models in those applications where there may be safety concerns. Therefore, DOE does not believe there is any application that will have a safety problem if the correct type of water heater and the proper installation procedures are followed.

2. *NFGC Venting Tables*. Bradford White claims the venting tables were developed around water heaters with a RE of approximately 75 percent. (Bradford White, No. 108 at 1–2). Southern Gas Association believes increasing RE to 78 percent would require retesting water heaters and rewriting the current venting tables because it claims the tables were based on 76 percent RE. (Southern Gas Association, No. 152 at 4). Battelle claims increasing RE to 78 percent will require a revision to the current venting tables. (Battelle, No. 127 at 26–27). GTI and Southern California Gas Company believe that DOE cannot make accurate cost estimates until venting codes are revised. (GTI, No. 141 at 3 and Southern California Gas Company, No. 181 at 2).

The NFGC does not limit its venting tables to any specific gas water heater recovery efficiency. The NFGC venting tables are based on specific conditions for each application such as water heater location and common venting with a furnace. We do agree with Battelle that the NFGC should revisit its venting tables and make whatever revisions are necessary to account for potential increases in recovery efficiencies. We also note that there are 37 models of gas water heaters with a recovery efficiency of 76 percent listed in the GAMA directory which can meet the standard levels adopted in today's rule. On that basis, we conclude there will be designs which can meet the new standard with 76 percent RE.

3. *Type B Vent Connectors*. GAMA and Bradford White claim each water heater manufacturer will change the installation instructions to require Type B vent connectors for all installations. Bradford White claims manufacturers will design to 80 percent RE in order to satisfy a 78 percent RE level. (GAMA, No. 117 at 2 and Bradford White, No. 108 at 1–2). Dominion claims DOE does not completely incorporate the additional cost for Type B vent connectors. (Dominion, No. 145 at 6). GTI states that DOE relied too heavily on data from an area of the country with atypical weather conditions. (GTI, No. 141 at 3) Battelle claims that increasing

RE to 78 percent will require Type B vent connectors in the 75 percent of installations that currently do not have them, which will add to the installed cost. (Battelle, No. 127 at 26–27) The New England Gas Association claims a majority of homes in New England are older with masonry chimneys which could require Type B vent connectors and chimney relining costing as much as \$800. (New England Gas Association, No. 139 at 2–3).

ACEEE claims DOE overestimated the number of homes needing Type B vents at 78 percent RE because the AVISTA data applies to climates with 7000 heating degree days (HDDs) and the NFGC requires Type B vents in unconditioned spaces. (ACEEE, No. 170 at 2). The CEC summarizes its database of gas water heaters to show the number of models of gas water heaters with recovery efficiencies from 76 percent to 85 percent. There are 170 models which currently meet the standards. CEC also shows whether a vent connection modification or masonry chimney relining is needed. This data summary shows that a Type B vent connector is not needed until RE gets above 83 percent, and chimney relining is sometimes needed when RE gets above 78 percent. It is interesting to note there are 66 models or 39 percent of gas water heaters with recovery efficiencies at or below 78 percent which currently meet the standard and which do not need Type B vent connectors or chimney relining. (CEC, No. 171 at 3).

DOE does not agree manufacturers will specify that all installations with 78 percent RE gas water heaters will require Type B vent connectors. This is not current practice with gas water heaters with RE greater than 76 percent. Manufacturers have relied on the NFGC venting tables, and we believe they will continue to do so. We believe manufacturers should advise installers to use Type B vent connectors in climates where there are more than 5,000 HDD or some reasonably conservative level of heating degree days, and otherwise follow local codes and the NFGC requirements.

DOE uses HDD as an indicator for determining where venting systems may be subject to damage from the amount of time vent connectors may have condensate on their inside surfaces. This indicator considers both the effect of time and temperature. We use 5,000 HDD as a conservative approach since no incidence of vent system failures is associated with the installation of high efficiency gas water heaters in the Northwest, even in climates as cold as or colder than 7,000 HDD.

Given that there are 66 models of gas water heaters with RE at or below 78 percent, DOE believes a consumer has a choice between a lower RE and a higher RE with a Type B vent connector. At the lower RE, the consumer can continue to use a single wall vent connector whereas, at the higher RE levels, a consumer would be advised to use a Type B vent connector and/or chimney relining in those climate areas where condensation in the venting system is a concern.

4. *Vent System Costs.* AGA commented that DOE has underestimated the frequency of needed venting system upgrades. (AGA, No. 150 at 3). APGA claims DOE has underestimated venting costs. (APGA, No. 167 at 2). ACEEE claims DOE's cost for vent installations should not include a factor for the fraction of homes with gas water heaters. (ACEEE, No. 170 at 2).

DOE believes we have accounted for the installation costs associated with higher RE gas water heaters. We used installers' estimates to calculate the cost of installing Type-B vent connectors and to determine the cost to reline masonry chimneys. These estimates are slightly higher than the GTI estimates. Using information from comments and from an AGA survey in a GTI report, we estimated that eleven percent of households with gas-fired water heaters in regions with over 5,000 HDDs would need Type-B vent connectors for 78 percent RE gas-fired water heaters. (GRI-91/0298). DOE determined a cost of \$134 for Type-B vent connectors based on the replacement market and installers' cost estimates for a typical installation. We also estimated that masonry chimney relining would cost \$795 for eight percent of the households. This is nearly the same cost (\$800) for chimney relining given by the New England Gas Association in its comments. See Appendix D-3 in the TSD.

DOE did not include a factor for the fraction of homes with gas water heaters in the vent installation cost calculation. The factor used in the vent installation cost calculation included the fraction of all homes with gas water heaters in the U.S. that are in the Northeast or Midwest. DOE was not double counting the number of gas water heaters as ACEEE states.

5. *Direct Vent Applications.* Dominion claims DOE does not account for the decreased vent length a 78 percent RE gas water heater will have for direct vent equipment. (Dominion, No. 145 at 6).

Dominion is correct; however, DOE notes this equipment accounts for less than two percent of the market. Only a

small fraction of this market would be installed at the maximum length of vent allowed. This tiny fraction of the market could be served by a product that has not used the improved flue baffle to meet the standard or by a power vented unit.

#### B. *Electric Water Heater Ratings*

Issues concerning the efficiency ratings of electric water heaters with energy factors greater than 0.91 were raised in the workshops that the Department conducted prior to the proposed rule. Based on the Department's review of the GAMA certification test program, the Department noted the possibility that high efficiency electric water heaters, *i.e.*, with manufacturer rated energy factors greater than 0.91 EF, were overrated. Several stakeholders have requested that DOE take specific actions to avoid any future overrating.

ACEEE is concerned that manufacturers may be overrating electric water heaters and if this practice continues, some of the energy savings of the new standard will be lost. ACEEE stated that the apparent overrating affects not only the standards program, but also the efficacy of utility demand side management programs. (ACEEE, No. 170 at 1).

DOE has conducted a certification review of the five major water heater manufacturers and has found that there are incorrect energy factor ratings reported in the GAMA directory. All five major manufacturers use GAMA as their third party representative. Therefore, the GAMA directory contains manufacturers' certified ratings. We also found violations of DOE's record keeping requirements at several manufacturers. The Department has requested these manufacturers correct their ratings on these high efficiency electric water heaters, and the manufacturers have agreed. The corrected ratings will be published in the December, 2000 GAMA directory.

Some manufacturers' testing appears to show that some 50 gallon electric water heaters reach a 0.93 EF level. DOE acknowledges that recent tests of high efficiency electric water heaters at Intertek Testing Services (ITS) have shown several models with 0.92 or 0.93 EF. This testing was ordered by GAMA on a sample of four electric water heaters for each model. However, NIST has tested several of these models and has not been able to replicate the ITS test results.

Testing of 11 high efficiency electric water heaters at NIST has not demonstrated that electric water heaters can achieve a 0.93 EF. The difference

between efficiency ratings listed in the GAMA Directory and NIST measured efficiencies ranged from 0.012 EF to 0.052 EF for an average difference of 0.029 EF. In other words, the average of the 11 tanks NIST tested was nearly 0.03 EF below the rated values from the manufacturer. We are continuing to evaluate additional units and the testing performed to understand why the NIST and ITS test results do not agree.

There may be numerous reasons why we cannot confirm the higher ratings. There could be an improper application of the DOE test procedure due to differences in interpretation of the requirements or due to selection of a different option for making some of the measurements. There could be problems in the sampling procedures used by GAMA or the manufacturers to obtain their sample tanks for testing. (The test procedure requires tanks for testing be representative of production.) There could be some design improvements in some of these high efficiency models that DOE did not consider in its analysis. Therefore, at this time we cannot determine if the difference in our testing and the manufacturers' rating is real or not.

#### C. Measured vs. Rated Volume

CEC, NWPPC, and ACEEE commented that DOE should use the measured volume of water heaters because manufacturers, by using the rated volume, can gain a 0.01 EF improvement by maximizing the tolerances allowed by UL (+/- 10 percent for electric) or by ANSI Z21.10.1 (+/- 5 percent for gas). (CEC, No. 171 at 4-5; NWPPC, No. 163 at 3; and ACEEE, No. 170 at 16-17). GAMA referred to its July 18, 1994, comments on the 1994 proposed rule, where it addressed this same issue, and suggested that DOE should continue to use rated volume because that is the basis of the extant standards set by NAECA. (GAMA, No. 160 at 5).

EPCA, as amended, by the 1987 NAECA amendment, uses the rated volume as the coefficient in the standard levels. Our analysis uses the rated tank volume to determine the performance of the design options. Therefore, DOE will continue to use the rated volume in its water heater standards.

#### D. Effective Date of Standards

Several stakeholders have taken the position that the effective date of today's rule should be five years from its publication. EPCA prescribes efficiency standards for water heaters manufactured on or after January 1, 1990, and requires two subsequent

rulemakings to consider amendments to the water heater efficiency standards. The statute provides in effect that any amendment to the standards that results from the first rulemaking shall be effective three years after publication. For the second rulemaking cycle, to amend the standards then in effect, the statute provides an effective date five years after publication.

GAMA claims today's Final Rule should be effective 5 years after publication. GAMA believes the three year lead-time for the effective date applies only to a Final Rule published by January 1, 1992. (GAMA, No.113 at 2). Southern Co. and Dominion state that NAECA requires a 5 year implementation time. Southern Co. also suggests that refrigerant availability will become more manageable with two additional years. (Southern Co., No. 142 at 3 and Dominion, No. 145 at 3). On the other hand, ACEEE asserts the first revision has a three year effective date and since today's rule is the first amended standard, the three year effective date applies. ACEEE states this is the way the NAECA revisions have been interpreted. (ACEEE, No. 170 at 10-11).

DOE interprets the language in EPCA at 42 U.S.C. 6295(e)(4)(A) to mean that, where the schedule specified in the statute for the two required rulemakings has not been met, the first amendment to the standards should be effective three years after publication, and the second amendment to the standards, five years after publication. We believe that this interpretation is the one most consistent with the statutory scheme. DOE has the authority and responsibility to complete the two cycles of rulemakings mandated by Congress in the statute. We recognize that DOE has failed to implement the rulemaking schedule in EPCA, but we see no reason why such failure would justify a departure from the time periods the statute contemplates for an amendment to the standards to become effective. We believe we are adhering to the statutory scheme by making the effective date of today's rule, the first amended standard, conform to the amount of time the statute designates for the effective date after publication of the final rule. As ACEEE pointed out at the public hearing on June 20, 2000, in all the rulemakings where DOE has missed dates, it has used such an approach. (Transcript, No. 120FF at 295-296).

Moreover, the statute contemplated that the original efficiency standards specified in EPCA could be in effect for only five years before an amended standard would take effect. To date, the original standards have been in effect

for 11 years. By making today's new standards effective in three years, it will be 14 years, not 5 years, before amended standards become effective. A five-year effective date would lengthen this period to 16 years, further delaying the benefits new standards will provide to consumers and the nation. Furthermore, the water heater industry never had an expectation that the original standards would be in effect so long. The original standards will have been in place 9 years longer than envisioned by the statute. For these reasons as well, a three-year effective date for today's rule is more consistent with the statutory scheme than the five-year period advocated by some commenters.

Accordingly, today's rule will become effective three years after the date of publication as originally proposed.

#### E. Water Heater Models Affected

GAMA commented that if the proposed standard levels were adopted, few current models listed in the GAMA directory would survive, and only a small percentage of current residential water heater shipments meet the proposed levels. (GAMA, No. 160 at 5). GAMA stated that 26 percent of the current models of gas and electric water heaters can meet the proposed standard. This number drops to 18 percent if only 30, 40 and 50 gallon models are considered. (GAMA, No. 176 at 1). Dominion suggests DOE should identify existing equipment that will meet the revised standards and designs it uses. Additionally, Dominion claims DOE should evaluate these models and provide data verifying the achievability of the proposed minimum efficiency standards using design options identified for the recommended standard level. (Dominion, No.145 at 3). The CEC claims that, based on its directory of certified water heaters, of the 170 models of gas water heaters listed, 51 meet the proposed standard. (CEC, No. 171 at 2). DOE's review of the April, 2000 GAMA Directory shows 37 gas-fired water heater models that could meet the proposed standards.

DOE recognizes that standards will eliminate current manufacturers' offerings which would affect the individual firms and industry's net present value. These effects are captured in the Manufacturer Impact Analysis. Furthermore, DOE rejects Dominion's comment that the Department should identify technologies that can be used to meet the standard. The standard is a performance standard, not a design standard. DOE's analysis identified a path, with different insulation blowing agents, which could be used to meet the standard. However, DOE believes there

are a number of approaches individual manufacturers may elect to pursue to meet the standard. It is not up to the Department to mandate any one approach.

#### *F. Instantaneous Water Heaters*

Controlled Energy Corporation (Controlled Energy) claims instantaneous water heaters should not be included in the Final Rule without further analysis. (Controlled Energy, No. 125 at 1). The CEC claims NAECA clearly includes both storage and instantaneous water heaters, and DOE does not have any option to exempt this type of water heater since that would be equivalent to a reduction of energy efficiency. (CEC, No. 171 at 4). GAMA claims DOE should clearly state the proposed standards do not apply to instantaneous water heaters. GAMA claims the minimum energy factor for instantaneous water heaters has been inadvertently raised without any discussion or any analysis. Currently, instantaneous water heaters must meet a minimum of 0.62 EF. (GAMA, Transcript, No. 120 at 38 and 177–178.).

Since instantaneous water heaters make up a very small fraction of one percent of the water heater shipments, DOE did not include them in its analysis. Although the statutory definition includes instantaneous water heaters within the general definition of water heater, the statute does distinguish between storage and instantaneous water heaters based on input rate. The DOE regulations at 10 CFR 430 Subpart B, Appendix E(1.7), distinguish between the definition of storage water heaters and instantaneous gas water heaters by BTU input rates and storage capacity. However, EPCA, as amended, provides the same standards for instantaneous and storage water heaters. There is, moreover, a provision in EPCA, as amended, in Section 325(q), 42 U.S.C. 6295(q) for establishing a new class if the capacity or performance related features of a product justifies it. The volume ranges of storage water heaters are much larger and do not include the volumes of instantaneous water heaters as defined in DOE's regulation. Since DOE's current regulations use the capacity and input rate to define instantaneous water heaters, DOE is establishing a new class for instantaneous gas and electric water heaters and we will leave the standards at the current levels.

#### *G. Fuel Switching*

The New England Gas Association (NEGA) and Laclede Gas claim higher first costs for gas water heaters will encourage builders in new homes and

consumers replacing gas water heaters to switch to electric water heaters. Laclede claims this is especially true when a consumer faces a \$433 chimney relining cost. (NEGA, No. 139 at 3 and Laclede Gas, No. 148 at 3). AGA claims DOE needs to include a detailed analysis of fuel switching among gas and electric utilities in the environmental impacts analysis. (AGA, No. 150 at 10). OOE claims that the incremental costs for a 0.62 EF gas water heater are trivial compared to the costs of acquiring natural gas service where it does not exist, to buy a gas furnace, and in some cases to install a duct system where one does not exist. (OOE, No. 174 at 2).

The LCC analysis is one of the seven factors DOE is required by statute to consider when it makes its decision on standard levels. Included in the LCC analysis are the installed costs of electric and gas water heaters. These costs provide an indication of whether a particular standard level would cause fuel switching. Furthermore, in the NES, DOE estimates the shipments of each fuel type. These results are shown in Chapter 11 of the TSD. For example, DOE estimates that the standards adopted today will increase the total shipments of gas water heaters by 8 million and decrease the total shipments of electric water heaters by 7 million over the next 26 years. DOE has taken fuel switching into account in reaching its final decision. No further analysis is required.

#### **V. Analytical Results and Conclusion**

The choice of insulation blowing agent is critical to achieving high water heater efficiency at a reasonable cost. In the proposed rule, DOE based its analysis on HFC-245fa and water blown insulation. There were many comments from manufacturers, utilities and the DOJ that a standard based on HFC-245fa alone could be anti-competitive due to its single source of supply. There were also issues about venting system margin of error, size constraints for water heaters with thicker insulation, and the energy factor overrating of high efficiency electric water heaters. To determine whether there are alternative approaches to meet the standard level adopted by today's Final Rule, we evaluated two other blowing agents, HFC-134a and cyclopentane, that the proposed rule identified as potential alternatives for the HCFC-141.65 FR 25042, 25049–50 (April 28, 2000). This issue is briefly described in Section II, General Discussion, "Impact of Lessening of Competition" in today's rule.

We performed an engineering analysis on both of these alternative insulation blowing agents to determine if the standard could be met with these blowing agents and to estimate the relative manufacturer and consumer cost impacts. HFC-134a is a blowing agent that is less expensive per pound than HFC-245fa, but it also is ten percent less effective as an insulation material. Cyclopentane is a very inexpensive blowing agent, has similar insulation effectiveness to HFC-245fa, but it is flammable and would require expensive modifications to production facilities to meet the OSHA safety regulations. The engineering analyses for HFC-134a and cyclopentane show that water heater cost and performance is within two percent of the results for HFC-245fa. See Table 1 in Section II, General Discussion, "Impact of Lessening of Competition." Therefore, DOE believes that manufacturers have a choice among at least three blowing agents, water, HFC-134a and cyclopentane. When designing products to meet the new standard, manufacturers will be faced with a range of choices to consider. For example, water heaters with cyclopentane-blown foam insulation have lower material costs, as compared to HFC-245fa, however, the capital investment is significantly greater. In this scenario, they may weigh the investment costs and material costs to determine the approach that is cost-effective for them. Similarly, they may weigh either HFC-245fa and HFC-134a with water-blown foam. The HFC-blown foams have higher material costs, compared to water, but better insulation performance. Alternatively, at the standard levels adopted today, some manufacturers may find a design using other blowing agents or blends of these materials to be more cost effective. In summary, DOE believes there are a number of insulation blowing agents to meet today's standards. Manufacturers will, DOE believes, weigh the cost and efficiency trade-offs, as well as other factors, in selecting the insulation blowing material to use.

#### *A. Economic Impacts on Consumers*

1. *Life-Cycle-Cost.* To evaluate the economic impact on consumers, we conducted an LCC analysis for gas and electric water heaters. We included data and information from comments pertaining to installation costs for size constraints on fourteen percent of electric water heaters. This accounts for extra costs that consumers in small apartments and homes may have to pay for water heaters with thicker insulation. We also included

information and costs for drip pans from the comments on gas water heaters. Table 2 shows the average LCC savings and percent of households benefitting for each of the trial standard levels for each fuel class. The average LCC savings for trial standard levels one, two and

three are positive for gas-fired and electric water heaters with the HFC-245fa blowing agent. We do not show oil-fired water heaters because we are not making any revisions to the standards for that class. Where LCC savings are positive for electric and gas-fired water heaters, the

percent of households benefitting ranges from 59 percent to 90 percent for the trial standard levels analyzed. At trial standard level four, where the LCC savings are negative, 18-26 percent of households with electric or gas-fired water heaters will benefit.

TABLE 2.—LIFE-CYCLE-COST SAVINGS AND PERCENT BENEFITTING [HFC-245fa blown insulation]

Trial standard level	Design options	Percent benefitting	Life-cycle cost savings (\$)
1	Electric: Heat Traps + Tank Bottom Insulation	90	36
	Natural Gas: Heat Traps + Flue Baffles (78 % RE) + 2 Inch Insulation	78	30
	LP Gas: Heat Traps + Flue Baffles (78 % RE) + 2 Inch Insulation	89	97
2	Electric: Heat Traps + Tank Bottom Insulation + 2 Inch Insulation	68	32
	Natural Gas: Heat Traps + Flue Baffles (78 % RE) + 2.5 Inch Insulation	64	11
	LP Gas: Heat Traps + Flue Baffles (78 % RE) + 2.5 Inch Insulation	78	77
3	Electric: Heat Traps + Tank Bottom Insulation + 2.5 Inch Insulation	59	23
	Natural Gas: Heat Traps + Flue Baffles (78 % RE) + 2 Inch Insulation	78	30
	LP Gas: Heat Traps + Flue Baffles (78 % RE) + 2 Inch Insulation	89	97
4	Electric: Heat Traps + 3 Inch Insulation + Plastic Tank	26	-82
	Natural Gas: Heat Traps + Flue Baffles (80 % RE) + 3 Inch Insulation + Side Arm Heater + Plastic Tank + IID.	18	-244
	LP Gas: Heat Traps + Flue Baffles (80 % RE) + 3 Inch Insulation + Side Arm Heater + Plastic Tank + IID.	37	-122

Another LCC analysis we conducted is the Consumer Subgroup analysis. This analysis examines the economic impacts on different groups of consumers by estimating the average

change in LCC and by calculating the fraction of households that would benefit. We analyzed the potential effect of standards for households with low income levels and for senior-only

households, two consumer subgroups of interest identified by DOE and supported by stakeholders. We present the results of the analysis in Table 3.

TABLE 3.—CONSUMER SUBGROUP LCC SAVINGS AND PERCENT OF HOUSEHOLDS BENEFITTING

Product class	Trial standard level	Total sample Delta LCC		Low-income Delta LCC		Senior-only Delta LCC	
		Ave. (1998\$)	Fraction of population benefitting (%)	Ave. (1998\$)	Fraction of population benefitting (%)	Ave. (1998\$)	Fraction of population benefitting (%)
Electric	1	36	90	35	90	39	92
	2	32	68	28	67	39	72
	3	23	59	7	54	33	64
	4	-82	26	-105	22	-60	31
Natural Gas	1	30	78	30	78	34	82
	2	11	64	-1	55	17	68
	3	30	78	30	78	34	82
	4	-244	18	-268	15	-194	20
LPG	1	97	89	110	93	108	92
	2	77	78	88	80	87	80
	3	97	89	110	93	108	92
	4	-122	37	-53	37	-34	38

The two consumer subgroups show a similar trend in average LCC savings and percent of sample households benefitting as the total sample of households. In the case of electric water heaters, the low income consumer group has less benefit at all trial standard levels than the total sample of households while the senior-only consumer group has greater benefit at all trial standard levels than the total

sample of households. In households with natural gas-fired water heaters, low income households have the same benefit for trial standard levels 1 and 3 and less benefit for trial standard levels 2 and 4 than the total sample of households. The senior-only households with natural gas water heaters have greater benefits at all trial standard levels than the total sample of households. Both low income and

senior-only households have greater benefits at all trial standard levels with propane gas. We have noted the LCC savings for the senior-only subgroup are similar to those of the general population. Since the elderly use 30 percent less hot water on average than the general population, one would expect their costs to be lower, and as a result, the LCC effect to be different. However, the standby



losses of water heaters, which are not affected by hot water usage, are the same for the elderly and the general population. Therefore, since most of the design options considered affect standby losses and not water heating efficiency, we expect the distribution of

LCC impacts for the elderly to be similar to the general population, which they were.

2. *Median Payback.* A part of the LCC analysis is the payback analysis. The LCC payback analysis considers all of the design option combinations for each fuel type and calculates a payback for

each RECS household. We report the median payback from the distribution of paybacks for each trial standard level in Table 4. The median payback is the median number of years required to recover, in energy savings, the increased costs of the efficiency improvements.

TABLE 4.—MEDIAN AND TEST PROCEDURE PAYBACK (YEARS)  
[HFC—245fa blown insulation]

Trial standard level	Design options	Median payback	Test procedure payback <sup>1</sup>
1	Electric: Heat Traps + Tank Bottom Insulation .....	2.9	1.5
	Natural Gas: Heat Traps + Flue Baffles (78 % RE) + 2 Inch Insulation .....	3.6	3.4
2	LP Gas: Heat Traps + Flue Baffles (78 % RE) + 2 Inch Insulation .....	2.8	
	Electric: Heat Traps + Tank Bottom Insulation + 2 Inch Insulation .....	6.5	3.7
3	Natural Gas: Heat Traps + Flue Baffles (78 % RE) + 2.5 Inch Insulation .....	5.0	4.9
	LP Gas: Heat Traps + Flue Baffles (78 % RE) + 2.5 Inch Insulation .....	4.0	
4	Electric: Heat Traps + Tank Bottom Insulation + 2.5 Inch Insulation .....	7.4	5.2
	Natural Gas: Heat Traps + Flue Baffles (78 % RE) + 2 Inch Insulation .....	3.6	3.4
4	LP Gas: Heat Traps + Flue Baffles (78 % RE) + 2 Inch Insulation .....	2.8	
	Electric: Heat Traps + 3 Inch Insulation + Plastic Tank .....	14.4	9.8
	Natural Gas: Heat Traps + Flue Baffles (80 % RE) + 3 Inch Insulation + Side Arm Heater + Plastic Tank + IID.	12.1	10.5
	LP Gas: Heat Traps + Flue Baffles (80 % RE) + 3 Inch Insulation + Side Arm Heater + Plastic Tank + IID ..	8.3	

<sup>1</sup>Electric—50 gallon; Gas—40 gallon

3. *Rebuttable Presumption.* The Act states that if the Department determines that the payback period is less than three years, as calculated with the DOE test procedure, there shall be a rebuttable presumption that such trial standard level is economically justified. In Table 4, we list the payback periods by fuel type (product class) and trial standard levels. The Act further states that if this three year payback is not met, this determination shall not be taken into consideration in deciding whether a standard is economically justified. Section 325(o)(2)(B)(iii), 42 U.S.C. 6295(o)(2)(B)(iii).

Only electric water heaters at trial standard level one satisfy the rebuttable presumption. Electric water heaters with heat traps and insulated tank bottoms have a 1.9 year payback calculated under the test procedure. There are no trial standard levels for natural gas water heaters that have a payback of three years or less.

4. *Economic Impact on Manufacturers.* We performed an MIA to determine the impact of standards on manufacturers. The complete analysis is in Chapter 13 of the TSD. In general, manufacturers stated they would be able to manufacture any of the design options with heat traps, thicker

insulation, tank bottom insulation on electric and improved flue baffles on gas-fired water heaters. None of the manufacturers indicated they would leave the industry or go out of business as a result of standard levels that would require energy factors below plastic tanks or side-arm heaters (*i.e.*, trial standard levels one through three).

We conducted detailed interviews with four of the five major water heater manufacturers. (The fifth manufacturer declined to participate in our second interviews.) The five together supply more than 99 percent of the U.S. residential water heater market. The interviews provided valuable information used to evaluate the impacts of an amended standard on manufacturers' cash flows, manufacturing capacities and employment levels.

We analyzed the water heater industry using two business scenarios. The standards scenario represents the investments needed to meet the energy efficiency level of a trial standard level. The cumulative scenario includes the investments required for energy efficiency improvement, changes to a new blowing agent and the development and manufacture of a gas-fired water heater resistant to ignition of flammable

vapors. Additionally, we examined the ability of manufacturers to recover the investments required for each of the scenarios and trial standard levels.

The potential value of the water heater industry, represented by the Industry Net Present Value (INPV) (\$325 million in 1998 dollars), is directly related to the manufacturers' price to the dealer/distributor. Since all five of the major manufacturers produce both gas-fired and electric water heaters, the industry is highly competitive in terms of manufacturer's pricing. Manufacturer prices are expected to increase from the current average cost to the dealer/distributor of \$157 to a range of \$187–292 for trial standard levels one through four. Based on comments from the interviews, we assume manufacturers will raise prices enough to recover the costs of materials, labor and transportation and 75 percent of their investment. If manufacturers increased water heater distributor prices slightly more, from \$0.13 for trial standard level one to \$2.00 for trial standard level four, they would recover all of their investment. Table 5 shows the results of the cash flow analysis with these assumptions.

TABLE 5.—MANUFACTURER IMPACT ANALYSIS

Trial std level	INPV (\$ mil- lions)	Change in INPV		Investment re- quired (\$ mil- lions)
		(%)	(\$ millions)	
<b>Standard Scenario, HFC-245fa blown insulation</b>				
Base Case .....	325	0	0	0
1 .....	317	-3	-8	33
2 .....	310	-5	-15	60
3 .....	310	-5	-15	59
4 .....	268	-18	-57	229
<b>Cumulative Scenario, HFC-245fa blown insulation</b>				
Base Case .....	325	0	0	0
1 .....	288	-12	-37	149
2 .....	281	-14	-44	176
3 .....	281	-14	-44	176
4 .....	239	-27	-86	345

From Table 5, we note energy efficiency standards could result in losses of industry net present value from about \$8 million to \$57 million (3–18%), while requiring investments of \$33 million to \$229 million. However, even if DOE did not revise energy efficiency standards, other Federal regulatory actions that will take effect on or before January 1, 2003, will result in a \$29 million loss (9%) in industry NPV. This loss exceeds any of DOE’s trial standard levels except level four. As required by the Process Rule, 10 CFR Part 430, Subpart C, Appendix A 10(g)(1), DOE considered the cumulative impacts of other Federal regulatory actions on the trial standard levels, including the phase out of HCFC-141b and the CPSC initiative to prevent the ignition of flammable vapors on gas-fired water heaters. These cumulative losses range from \$37 million to 86 million. The investments to prevent ignition of flammable vapors and for new blowing agents are \$116 million. The investments for cumulative regulations are potentially large given the current after tax profitability of the water heater industry, estimated to be \$45 million (1998) on revenues of \$1.5 billion.

Based on DOE’s interviews, manufacturers expect little impact on manufacturing capacity and expect to meet future demand since the revised standards are not based on side-arm gas-fired water heaters and plastic tank

electric units. Currently, the U.S. industry has far more manufacturing capacity than the domestic market can absorb. Manufacturers estimated the industry is operating at approximately 80 percent of total capacity. Due to the phase-out of HCFC-141b insulation blowing agent and a requirement for a gas-fired water heater resistant to ignition of flammable vapors, it is likely that nearly every product line would have to be redesigned, retested and recertified. Several manufacturers indicated a preference to retool for new blowing agents, energy-efficiency standards and flammable vapor-resistant designs at the same time, to avoid redundant efforts and limit costs.

We also used the manufacturers’ interviews to assess employment impacts due to an amended energy efficiency standard. Manufacturers expected the impact of new blowing agents and flammable vapor resistant designs on labor to be minimal, neither increasing nor reducing employment levels by more than a few employees. Since the revised efficiency levels do not require the adoption of side arm heaters or plastic tanks, manufacturers do not anticipate significant changes in employment levels or training requirements. Additionally, we believe market growth of 2.5 percent per year for new homes and modest productivity gains ensure current employment levels for the foreseeable future. In our analysis, yearly water heater shipments

range from 9.7 million in 2000 to 19.2 in 2030. Furthermore, a replacement market that increases by about 1/10th of the new home market each year ensures future demand.

*B. Significance of Energy Savings*

The Act prohibits the Department from adopting a standard for a product if that standard would not result in “significant” energy savings. Section 325(o)(3)(B), 42 U.S.C. 6295(o)(3)(B). While the term “significant” is not defined in the Act, the U.S. Court of Appeals, in *Natural Resources Defense Council v. Herrington*, 768 F.2d 1355, 1373 (D.C. Cir. 1985), concluded that Congressional intent in using the word “significant” was to mean “non-trivial.” The energy savings for all of the trial standard levels considered in this rulemaking are non-trivial and therefore we consider them “significant” within the meaning of Section 325 of the Act.

1. *National Energy Savings.* To estimate the energy savings through the year 2030 due to amended standards, we compared the energy consumption of water heaters in the 2004 base case to the energy consumption of water heaters complying with the trial standard levels. DOE calculates these energy savings at the source using the NEMS-BRS distribution and generation losses. Table 6 shows these results for water heaters with HFC-245fa blown insulation.

TABLE 6.—SOURCE ENERGY SAVINGS WITH HFC-245FA BLOWN INSULATION (QUADS)

	Trial std 1	Trial std 2	Trial std 3	Trial std 4
Total quads saved .....	3.33	4.47	4.61	11.46
Total exajoules saved .....	3.51	4.72	4.86	12.09

All of the trial standard levels considered in this rulemaking have significant energy savings, ranging from 3.3 quads (3.5 Exajoules (EJ)) to 11.5 quads (12.1 EJ), depending on the trial standard level.

2. *National Net Present Value (NPV).* Additionally, we analyzed the economic impact on the nation to the year 2030. This is an NPV analysis using the AEO 2000 reference energy prices. Table 7 lists the NPV for HFC-245fa blown insulation. The NPV considers the

combined discounted energy savings minus increased consumer costs of the four fuel types of equipment at a particular trial standard level. We base this calculation on all expenses and savings occurring between 2004 and 2030.

TABLE 7.—NATIONAL NET PRESENT VALUE

Trial standard level	NPV—HFC-245fa (\$ billions)
1	1.20
2	-0.13
3	2.02
4	-24.94

The national NPV is positive for trial standard levels one and three and essentially 0 for trial standard level 2. In this analysis, a positive NPV means that the estimated energy savings are greater than the increased costs due to standards. Among the trial standard levels analyzed, trial standard level three has the highest NPV.

*C. Lessening of Utility or Performance of Products*

None of the trial standard levels reduces the performance of water heaters. Generally, the trial standard levels reduce heat losses and improve heat exchanger effectiveness. These changes improve energy and water heating performance and may increase the amount of water available in one hour, *i.e.*, the first hour rating.

However, to reduce heat losses, it may be necessary to use thicker insulation. At the trial standard level adopted in today's rule, DOE contemplates insulation thicknesses of 2–2.5 inches versus the 1–2 inches in common use today. This extra thickness of insulation will make water heaters larger and more difficult to squeeze into tight spaces when replacing a water heater. DOE added costs for tempering valves for a number of gas and electric water heaters where we believed there could be some loss of utility due to the need to downsize a water heater. Tempering valves allow the consumer to increase the setpoint, thus increasing the amount of cold water used to provide a comfortable and safe usable water temperature. The addition of cold water increases the first hour rating.

Therefore, the consumer will not lose any utility or performance.

To eliminate the possibility of any water heater models becoming unavailable as a result of thicker insulation, we created a new class for tabletop water heaters based on the criteria in Section 325(q), 42 U.S.C. 6295(q) in the Act. These issues are discussed in Section II. General Discussion, "Lessening of Utility or Performance of Products."

*D. Impact of Lessening of Competition*

The Act directs the Department to consider any lessening of competition that is likely to result from standards. It further directs the Attorney General to determine the impact, if any, on competition likely to result from such standard and transmit such determination, not later than 60 days after the publication of a proposed rule to the Secretary, together with an analysis of the nature and extent of such impact. Section 325(o)(2)(B)(i)(V), 42 U.S.C. 6295(o)(2)(B)(i)(V).

In order to assist the Attorney General in making such a determination, the Department provided the Attorney General with copies of the Proposed Rule and the Technical Support Document for review. In a letter responding to the Proposed Rule, the Department of Justice (DOJ) found only one area of concern regarding any lessening of competition. The area of concern involves the blowing agent for the foam insulation and the possibility that only one blowing agent, HFC-245fa, could be used and that it is a patented product with only one supplier. This situation led DOJ to

conclude "that the proposed standards could have an adverse affect on competition because water heater manufacturers may have to use an input that will be produced by only one source." (DOJ, No. 143 at 1).

DOE examined other possible blowing agents and concluded that at least four blowing agents are available to use in meeting the standards adopted in today's Final Rule. Therefore, the Department concludes there will be little to no impact on competition. See Section II, General Discussion, "Impact of Lessening of Competition" for the complete discussion of this topic.

*E. Need of the Nation to Save Energy and Net National Employment*

1. *Environmental Impacts.* Enhanced energy efficiency improves the Nation's energy security, strengthens the economy and reduces the environmental impacts of energy production. The energy savings from water heater standards result in reduced emissions of CO<sub>2</sub> and NO<sub>x</sub> and aids in addressing global climate change and reducing air pollution. At the standard levels analyzed, the actual cumulative emission reductions to 2030 range from 149–354 Mt for carbon equivalent, 175–459 thousand metric tons (kt) for NO<sub>x</sub>, and -3 to -64 kt for SO<sub>2</sub>. The large reductions in CO<sub>2</sub> and NO<sub>x</sub> at all standard levels are a positive benefit to the nation. The small increases (negative reductions) in SO<sub>2</sub> are due to small increases in the number of oil-fired water heaters from our shipment forecasts. We show actual cumulative emissions savings from 2004–2030 in Table 8.

TABLE 8.—ACTUAL CUMULATIVE EMISSIONS REDUCTIONS THROUGH 2030

Emission	Trial std level 1	Trial std level 2	Trial std level 3	Trial std level 4
Carbon (Mt)	149	139	152	354

TABLE 8.—ACTUAL CUMULATIVE EMISSIONS REDUCTIONS THROUGH 2030—Continued

Emission	Trial std level 1	Trial std level 2	Trial std level 3	Trial std level 4
NO <sub>x</sub> (kt) .....	175	215	273	459
SO <sub>2</sub> (kt) .....	** -3	** -11	** -13	** -64

\*\* Results only include household SO<sub>2</sub> emissions reductions because SO<sub>2</sub> emissions from power plants are capped by clean air legislation. Thus, SO<sub>2</sub> emissions will only be negligibly affected by water heater standards.

The Department makes no effort to monetize the benefits of the actual emission reductions, but there may be time-related differences in the perceived value of the emissions depending on when they occur, as with monetized benefits that accumulate over time. Emission reductions that occur sooner are often more desirable than equivalent reductions that occur later. Like monetary benefits, the health, recreational and ecosystem benefits that result from emission reductions are

often perceived to have a greater value if they occur sooner, rather than later. To the extent that the different trial standard levels have slightly different shipment distributions over time, some trial standard levels might have a slightly higher proportion of earlier emission reductions than another trial standard level.

To show the possible effect of the different timing patterns of the emissions, the Department is also presenting discounted emissions. We

used the same seven percent discount rate for these calculations that we used for discounting monetized benefits. Since the discounted emission reductions in carbon shift slightly from trial standard level 3 to trial standard level 1, this indicates trial standard level 1 has a slight timing improvement in emission reductions. There is no similar shift in either the NO<sub>x</sub> or SO<sub>2</sub> levels. We show the discounted cumulative emission savings from 2004–2030 in Table 9.

TABLE 9.—DISCOUNTED CUMULATIVE EMISSIONS REDUCTIONS THROUGH 2030

Emission	Trial std level 1	Trial std level 2	Trial std level 3	Trial std level 4
Carbon (Mt) .....	51	46	50	118
NO <sub>x</sub> (kt) .....	53	67	90	131
SO <sub>2</sub> (kt) .....	** -1	** -3	** -4	** -17

\*\* Results only include household SO<sub>2</sub> emissions reductions because SO<sub>2</sub> emissions from power plants are capped by clean air legislation. Thus, SO<sub>2</sub> emissions will only be negligibly affected by water heater standards.

2. *Net National Employment.* In the Process Rule, DOE committed to develop estimates of the employment impacts of revised standards in the economy in general. The standard adopted in today’s rule will have a positive impact on employment. The results of the Department’s analysis are shown in Chapter 15 of the TSD.

While both this input/output model and the direct use of Bureau of Labor Statistics (BLS) employment data suggest the revised water heater standards could increase the net demand for labor in the economy, the gains would most likely be very small relative to total national employment. For several reasons, however, even these modest benefits for national employment are in doubt:

- Unemployment is now at the lowest rate in 30 years. If unemployment remains very low during the period when the revised standards are put into effect, it is unlikely that the standards could result in any net increase in national employment levels.

- Neither the BLS data nor the input-output model used by DOE include the quality or wage level of the jobs. One reason that the demand for labor increases in the model may be that the jobs expected to be created pay less than

the jobs being lost. The benefits from any potential employment gains would be reduced if job quality and pay are reduced.

- The net benefits from potential employment changes are a result of the estimated net present value of benefits or losses likely to result from the revised standards; it may not be appropriate to separately identify and consider any employment impacts beyond the calculation of net present value.

Taking into consideration these legitimate concerns regarding the interpretation and use of the employment impacts analysis, the Department concludes only that the proposed water heater standards are likely to produce employment benefits that are sufficient to offset fully any adverse impacts on employment in the water heater or energy industries.

*F. Conclusion*

1. *Comments on Standard Levels.* Several stakeholders made specific recommendations for standard levels during the workshops held prior to publication of the proposed rule or after publication of the proposed rule. We list these below to show the range of standard levels stakeholders believe are economically justified and technically

feasible. In the formula for water heater standards, the letter “V” stands for rated volume as given in the statute.

The American Gas Association recommended EF =0.64—0.0019V for gas water heaters. (AGA, No. 110 at 2) ACEEE recommended EF =0.98—0.00132V for electric and EF =0.69—0.0019V for gas water heaters. (ACEEE, No. 71 at 9). The water heater manufacturer Bradford White recommended EF =0.94—0.0013V for electric, EF =0.65—0.0019V for gas and no change for oil-fired water heaters. (Bradford White, No. 108 at 7) The City of Palo Alto recommended EF =0.64—0.0019V for gas water heaters. (City of Palo Alto, No. 136 at 2) The Edison Electric Institute recommended EF =0.66—0.0019V for gas water heaters. (EEI, No. 105 at 3). The Electric Power Research Institute recommended EF =0.95—0.00132V for electric water heaters. (EPRI, No. 104 at 3). GAMA recommended EF =0.95—0.00132V for electric and EF =0.65—0.0019V for gas water heaters. (GAMA, No. 71 at 3 & 4). The Northwest Power Planning Council recommended EF =0.97—0.00132V for electric and EF =0.68—0.0019V for gas water heaters. (NWPPC, No. 163 at 4). The efficiency standards recommended in these comments are based on the

analysis for the proposed rule and other information available to these organizations making recommendations.

2. Proposed Revised Standard.

Section 325(o)(2)(A), 42 U.S.C. 6295(o)(2)(A), of the Act specifies that any new or amended energy conservation standard for any type (or class) of covered product shall be designed to achieve the maximum improvement in energy efficiency which the Secretary determines is technologically feasible and economically justified. In determining whether a standard is economically justified, the Secretary must determine whether the benefits of the standard exceed its burdens. Section 325(o)(2)(B)(i), 42 U.S.C. 6295(o)(2)(B)(i). The amended standard must “result in significant conservation

of energy.” Section 325(o)(2)(B)(iii)(3)(B), 42 U.S.C. 6295(o)(B)(iii)(3)(B). The Secretary has eliminated the maximum technologically feasible levels for electric and gas-fired water heaters and has eliminated any revised standard levels for oil-fired water heaters based on the analysis in the proposed rule. All of the design options included in our analysis are technologically feasible since they are commercially available.

We consider the impacts of standards on gas and electric water heaters at each of four standard levels, beginning with the most efficient level, *i.e.*, standard level four. We then consider less efficient levels. Standard levels two and three are different combinations of efficiency levels for electric and gas water heater classes. For gas-fired water heaters, standard levels one and three

are the same, though at lower efficiency than that found in standard level two. For electric water heaters, no standard levels are repeated and the efficiency of each succeeding standard level is higher. For oil fired water heaters, there are no changes from the current levels so this class is not shown but they were included in the analysis. By combining efficiency levels in this way, the Department is able to evaluate the impacts of different combinations of standard levels to make an informed decision on the merits of different efficiency combinations.

To aid the reader as we discuss the benefits or burdens of the trial standard levels we have included a summary of the analysis results in Table 10.

TABLE 10.—SUMMARY ANALYSIS RESULTS BASED ON HFC-245FA BLOWN INSULATION

	Trial Std 1	Trial Std 2	Trial Std 3	Trial Std 4
Total Quads Saved .....	3.	4.5	4.6	11.5
NPV (\$Billion) .....	1.2	-0.1	2.0	-24.9
Emissions:				
Carbon Equivalent (Mt) .....	149	139	152	354
NO <sub>x</sub> (kt) .....	175	215	273	459
SO <sub>2</sub> (kt) .....	** -3	** -11	** -13	** -64
Cumulative Change in INPV (\$ Million) .....	-8	-15	-15	-57
Life Cycle Cost (\$):				
Electric .....	36	32	23	-82
Natural Gas .....	30	11	30	-244
Propane Gas .....	97	77	97	-122

\*\* Results only include household SO<sub>2</sub> emissions reductions because SO<sub>2</sub> emissions from power plants are capped by clean air legislation. Thus, SO<sub>2</sub> emissions will only be negligibly affected by possible water heater standards.

We first considered trial standard level four, the most efficient level for the two classes. Trial standard level four saves about 11.5 quads of energy, a significant amount. The emissions reductions of 354 Mt of carbon equivalent and 459 kt of NO<sub>x</sub> are significant. There is a 64 kt increase in household emissions of SO<sub>2</sub> due to increased shipments of oil-fired water heaters. However, at this level, consumers experience negative LCC impacts. They would lose \$82 with electric water heaters, \$244 with natural gas water heaters and \$122 with propane gas water heaters. Furthermore, the water heater industry would lose 27 percent of its value and the nation would have a loss in NPV of nearly \$25 billion. The Department concludes the resulting energy savings and emission reductions at this level are outweighed by the negative economic impacts on the nation, consumers and manufacturers. Consequently, the Department concludes trial standard level four is not economically justified.

Next, we considered trial standard level three. This trial standard level saves about 4.6 quads of energy, a significant amount. The emissions reductions are significant: 152 Mt of carbon equivalent and 273 kt of NO<sub>x</sub>. There is a 13 kt increase in household emissions of SO<sub>2</sub> due to a slight increase in shipments of oil-fired water heaters. The national NPV of trial standard level three is \$2.0 billion from 2004–2030.

The economic benefits to consumers are significant. The average LCC savings for consumers with electric, natural gas and propane gas water heaters are \$23, \$30 and \$97, respectively. In trial standard level three, 78 percent of households with natural gas-fired water heaters have LCC savings, for an average savings of \$55, while 22 percent experience LCC losses, for an average loss of \$54. In households with propane gas water heaters, the average LCC savings are \$117 for 89 percent of the households while only eleven percent experience an average loss of \$61. For households with electric water heaters, 59 percent have average LCC savings of

\$80, while 41 percent experience an average LCC loss of \$59.

For electric water heaters, the analysis predicts that 41 percent of all consumers would experience no change or some net cost with more efficient electric water heaters. However, we believe that there are costs or savings near the point of zero change in LCC that consumers would be unable to distinguish in their yearly expenses. We have chosen ±2 percent of average baseline LCC as the band of no consumer impact. We believe this small percentage, regardless of the actual total LCC, is insignificant to the consumer because these LCC costs or savings are spread over monthly utility bills for the life of the water heater. By applying a two percent band of average LCC, we can clearly show the significant net savings and net costs associated with a trial standard level. This permits a more informed decision based on weighing the significant benefits and burdens in terms of consumer impact. The resulting ranges are shown in Figure 9.6.2 in the TSD.

We will use  $\pm 2$  percent of baseline LCC to indicate no impact, positively or negatively, on consumers. Therefore, only fifteen percent of consumers with electric water heaters or twelve percent of consumers with natural gas water heaters or five percent of consumers with propane gas water heaters sustain any significant net costs under standard level 3. Similarly, 30 percent of consumers with electric water heaters or 52 percent of consumers with natural gas water heaters or 69 percent of consumers with propane gas water heaters have significant net savings.

Two percent of average baseline LCC equals \$56 for electric water heaters. Over the average life of 14 years for an electric water heater, this is less than \$4 per year. For consumers with natural gas and propane gas water heaters, two percent of average baseline LCC is \$31 and \$47, respectively. Over the average life of 9 years for gas water heaters, this is less than \$4 per year for natural gas and less than \$6 per year for propane gas. We believe this is a small amount in terms of yearly expenditures and will not adversely impact consumers' purchase decisions about water heaters, or their financial positions.

Additionally, low-income and senior-only consumer subgroups exhibit similar distributions of costs and savings. A similar small percentage of low-income or senior only consumers are affected by higher costs.

The industry will lose about five percent (\$15 million) of its INPV due to energy efficiency standards. These losses are more than balanced by NPV gains to the nation of \$2.0 billion, or 135 times the industry losses. Industry losses for trial standard level three due to all Federal actions (CPSC, EPA and DOE) are fourteen percent of its INP, or \$44 million. Even this level of losses is offset by gains to the nation that are 46 times the industry losses.<sup>4</sup> Based on the manufacturer interviews, DOE believes there will not be any plant closures or employee layoffs.

In determining the economic justification of trial standard level three, the Department has weighed the benefits of energy savings, reduced average consumer LCC, significant and positive NPV, and emissions reductions and the burdens of a loss in manufacturer net present value, and consumer LCC increases for some households. After carefully considering the results of the analysis, DOE has

determined the benefits of trial standard level three outweigh its burdens and is economically justified. The Department also concludes trial standard level three saves a significant amount of energy and is technologically feasible.<sup>5</sup> Therefore, the Department today adopts amended energy conservation standards for water heaters at trial standard level three.

## VI. Procedural Issues and Regulatory Reviews

### A. Review Under the National Environmental Policy Act

In issuing the March 4, 1994, Proposed Rule for energy efficiency standards for eight products, one of which was water heaters, the Department prepared an Environmental Assessment (DOE/EA-0819) that was published within the TSD for that Proposed Rule. (DOE/EE-0009, November 1993). We found the environmental effects associated with various standard levels for water heaters, as well as the other seven products, to be not significant, and we published a Finding of No Significant Impact (FONSI). 59 FR 15868 (April 5, 1994).

In conducting the analysis for the Proposed Rule upon which today's Final Rule is based, the DOE evaluated several design options suggested in comments to the screening document. As a result, the energy savings estimates and resulting environmental effects from revised energy efficiency standards for water heaters in that analysis differ somewhat from those presented for water heaters in the 1994 Proposed Rule. Nevertheless, the environmental effects expected from today's Final Rule fall within the ranges of environmental impacts from the revised energy efficiency standards for water heaters that DOE found in the 1994 FONSI not to be significant.

### B. Review Under Executive Order 12866, "Regulatory Planning and Review's"

The Department has determined today's regulatory action is an "economically significant regulatory action" under Executive Order 12866, "Regulatory Planning and Review." 58 FR 51735 (October 4, 1993). Accordingly, today's action was subject

<sup>5</sup> The final standard is based on insulation blown with HFC-245fa. We also compared the engineering cost and performance for two alternative blowing agents, HFC-134a and cyclopentane. All three blowing agents are EPA-SNAP approved but there are concerns about availability and a single source supplier with HFC-245fa. However, since engineering results are within two percent of HFC-245fa, we conclude that the use of either of these alternative blowing agents would not change our decision.

to review under the Executive Order by the Office of Information and Regulatory Affairs (OIRA) of the Office of Management and Budget.

There were no substantive changes between the draft we submitted to OIRA and today's action. The draft and other documents we submitted to OIRA for review are a part of the rulemaking record and are available for public review in the Department's Freedom of Information Reading Room, 1000 Independence Avenue, SW, Washington, DC 20585, between the hours of 9:00 a.m. and 4:00 p.m., Monday through Friday, except Federal holidays, telephone (202) 586-3142.

The proposed rule contained a summary of the Regulatory Impact Analysis (RIA), which focused on the major alternatives considered in arriving at the approach to improving the energy efficiency of consumer products. The reader is referred to the complete RIA, which is contained in the TSD, available as indicated at the beginning of this notice. It consists of: (1) a statement of the problem addressed by this regulation, and the mandate for government action; (2) a description and analysis of the feasible policy alternatives to this regulation; (3) a quantitative comparison of the impacts of the alternatives; and (4) the economic impact of the proposed standard.

The RIA calculates the effects of feasible policy alternatives to water heater energy efficiency standards, and provides a quantitative comparison of the impacts of the alternatives. We evaluate each alternative in terms of its ability to achieve significant energy savings at reasonable costs, and we compare it to the effectiveness of trial standard level 3 adopted by today's Final Rule.

We created the RIA using a series of regulatory scenarios (with various assumptions), which we used as input to the shipments model for water heaters. We used the results from the shipments model as inputs to the NES spreadsheet calculations.

DOE identified the following seven major policy alternatives for achieving consumer product energy efficiency. These alternatives include:

- No New Regulatory Action.
- Informational Action.
- Product Labeling.
- Consumer Education.
- Prescriptive Standards.
- Financial Incentives.
- Tax credits
- Rebates
- Low income and seniors subsidy
  - Voluntary Energy Efficiency Targets (5 Years, 10 Years).
  - Mass Government Purchases.

<sup>4</sup> As DOE has determined, the benefits of today's final rule outweigh the \$15 million loss to the industry. To review the support for this determination, see the TSD at Chapters 12.5 and Table 12.1, 13.3.3.5 and Table 13.8, 13.3.4, and 13.3.5.

• The Proposed Approach (Performance Standards).

We have evaluated each alternative in terms of its ability to achieve significant energy savings at reasonable costs

(Table 11), and have compared it to the effectiveness of this Final Rule.

TABLE 11.—ALTERNATIVES CONSIDERED

Policy alternatives	NPV \$ in billions	Energy savings quads
Consumer Product Labeling .....	-\$0.003	0.08
Consumer Education .....	0.40	0.49
Prescriptive Standards .....	0.99	0.74
Consumer Tax Credits .....	0.18	0.14
Consumer Rebates High Efficiency .....	0.18	0.14
Consumer Rebates Heat Pump .....	0.85	0.50
Low Income and Seniors Subsidy .....	0.05	0.37
Manufacturer Tax Credits .....	0.04	0.03
Voluntary Efficiency Target (5 year delay) .....	0.92	2.8
Voluntary Efficiency Target (10 year delay) .....	0.47	2.1
Mass Government Purchases .....	0.01	0.06
Performance Standards .....	2.0	4.6

NPV = Net Present Value (2003–2030, in billion 1998 \$) (does not include government expenses)  
Savings = Energy Savings (Source Quads)

For a complete discussion of the assumptions used to develop the alternative regulatory impacts, see the proposed rule. 65 FR 25042, 25080–25081 (April 28, 2000). All of these alternatives must be gauged against the performance standards in this Final Rule. The results in Table 11 above show that none of the alternative regulatory approaches meet or exceed the estimated national cost and energy savings from revised energy efficiency standards. Additionally, several of the alternatives would require new enabling legislation, since authority to carry out those alternatives does not exist presently.

*C. Review Under the Regulatory Flexibility Act*

The Regulatory Flexibility Act of 1980, 5 U.S.C. 601–612 requires an assessment of the impact of regulations on small businesses. The Small Business Administration’s definition for a small business in the water heater industry is one that employs 500 or fewer employees.

The water heater industry is characterized by five firms accounting for nearly 99 percent of sales. Smaller businesses and firms, which make specialty water heaters and supply niche markets, share one percent of the market. We are aware of three small firms: Bock Water Heaters, Heat Transfer Products, and Vaughn.

Of the three small firms, Bock manufactures oil-fired water heaters that have not been affected by this rule. Therefore, Bock will not suffer any adverse impacts due to the rule. The other two firms, Heat Transfer and Vaughn, both make electric water heaters that are affected by this rule. In

the GAMA directory, these firms only list electric water heaters that meet or exceed the standard level in this rule. Although the rule raises the standard level enough to impact their niche market for high efficiency electric water heaters, these manufacturers also manufacture very long life products that incorporate other features which will help them preserve their niche market. The Department has taken this into consideration in this rulemaking.

The Department prepared a manufacturing impact analysis that it shared with all the water heater manufacturers. The smaller manufacturers did not choose to discuss the impacts of the trial standard levels on their firms.

In view of the information discussed above, the Department has determined and hereby certifies pursuant to Section 605(b) of the Regulatory Flexibility Act that, for this particular industry, the standard levels in today’s Final Rule will not “have a significant economic impact on a substantial number of small entities,” and it is not necessary to prepare a regulatory flexibility analysis.

*D. Review Under the Paperwork Reduction Act*

No new information or record keeping requirements are imposed by this rulemaking that would require Office of Management and Budget clearance under the Paperwork Reduction Act. 44 U.S.C. 3501 *et seq.*

*E. Review Under Executive Order 12988, “Civil Justice Reform”*

With respect to the review of existing regulations and the promulgation of new regulations, Section 3(a) of Executive Order 12988, “Civil Justice

Reform,” 61 FR 4729 (February 7, 1996), imposes on Executive agencies the general duty to adhere to the following requirements: (1) Eliminate drafting errors and ambiguity; (2) write regulations to minimize litigation; (3) provide a clear legal standard for affected conduct rather than a general standard; and (4) promote simplification and burden reduction.

With regard to the review required by Section 3(a), Section 3(b) of Executive Order 12988 specifically requires that Executive agencies make every reasonable effort to ensure that the regulation: (1) Clearly specifies the preemptive effect, if any; (2) clearly specifies any effect on existing Federal law or regulation; (3) provides a clear legal standard for affected conduct while promoting simplification and burden reduction; (4) specifies the retroactive effect, if any; (5) adequately defines key terms; and (6) addresses other important issues affecting clarity and general draftsmanship under any guidelines issued by the Attorney General. Section 3(c) of Executive Order 12988 requires Executive agencies to review regulations in light of applicable standards in Section 3(a) and Section 3(b) to determine whether they are met or it is unreasonable to meet one or more of them. DOE reviewed today’s Final Rule under the standards of Section 3 of the Executive Order and determined that, to the extent permitted by law, the final regulations meet the relevant standards.

*F. “Takings” Assessment Review*

The Department has determined pursuant to Executive Order 12630, “Governmental Actions and Interference with Constitutionally Protected Property

Rights," 53 FR 8859 (March 18, 1988) that this regulation would not result in any takings that might require compensation under the Fifth Amendment to the United States Constitution.

#### G. Review Under Executive Order 13132, "Federalism"

Executive Order 13132, 64 FR 43255 (August 4, 1999) requires agencies to develop an accountable process to ensure meaningful and timely input by State and local officials in the development of regulatory policies that have "federalism implications." Policies that have federalism implications are defined in the Executive Order to include regulations that have "substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government." Under Executive Order 13132, DOE may not issue a regulation that has federalism implications, that imposes substantial direct costs, and that is not required by statute, unless the Federal government provides the funds necessary to pay the direct compliance costs incurred by the State and local governments, or DOE consults with State and local officials early in the process of developing the proposed regulation. DOE also may not issue a regulation that has federalism implications and that preempts State law unless it consults with State and local officials early in the process of developing the proposed regulations.

The statutory authority under which this Final Rule is being promulgated specifically addresses the effect of Federal rules on State laws or regulations concerning testing, labeling and standards. Section 327 of EPCA, as amended, 42 U.S.C. 6297. Generally all such State laws or regulations are superceded by EPCA, unless specifically exempted in Section 327. The Department can grant a waiver of preemption in accordance with the procedures and other provisions of Section 327(d) of the Act, as amended. 42 U.S.C. 6297(d). States can file petitions for exemption from preemption with the Secretary and have their request reviewed on a case-by-case basis.

DOE has examined today's Final Rule and has determined that although revised water heater standards would preempt State laws in this area, they would not have a substantial direct effect on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the

various levels of government. No further action is required by Executive Order 13132.

#### H. Review Under the Unfunded Mandates Reform Act of 1995

With respect to a proposed regulatory action that may result in the expenditure by State, local, and tribal governments, in the aggregate, or by the private sector, of \$100 million or more (adjusted annually for inflation) in any one year, Section 202(a) of the Unfunded Mandates Reform Act of 1995 (UMRA), 2 U.S.C. 1531 *et seq.*, requires a Federal agency to publish a written statement concerning estimates of the resulting costs, benefits and other effects on the national economy. 2 U.S.C. 1532(a), (b). UMRA also requires each Federal agency to develop an effective process to permit timely input by state, local, and tribal governments on a proposed significant intergovernmental mandate. The Department's consultation process is described in a notice published in the **Federal Register**. 62 FR 12820 (March 18, 1997). Today's Final Rule may impose expenditures of \$100 million or more in a year in the private sector. It does not contain a Federal intergovernmental mandate.

Section 202 of UMRA authorizes an agency to respond to the content requirements of UMRA in any other statement or analysis that accompanies this Final Rule. 2 U.S.C. 1532(c). The content requirements of Section 202(b) of UMRA relevant to the private sector mandate substantially overlap the economic analysis requirements that apply under Section 325(o) of EPCA, as amended, and Executive Order 12866. The Supplementary Information section of the Notice of Final Rulemaking and the analysis contained in the "Regulatory Impact Analysis" section of the TSD for this Final Rule respond to those requirements.

DOE is obligated by Section 205 of UMRA, 2 U.S.C. 1535, to identify and consider a reasonable number of regulatory alternatives before promulgating a rule for which a written statement under Section 202 is required. From those alternatives, DOE must select the least costly, most cost-effective or least burdensome alternative that achieves the objectives of the rule, unless DOE publishes an explanation of why a different alternative is selected or the selection of such an alternative is inconsistent with law. As required by Section 325(o) of EPCA, as amended, 42 U.S.C. 6295(o), today's Final Rule establishes energy conservation standards for water heaters that are designed to achieve the maximum improvement in energy efficiency that

DOE has determined is both technologically feasible and economically justified. A full discussion of the alternatives considered by DOE is presented in the "Regulatory Impact Analysis" section of the TSD for this Final Rule.

#### I. Review Under the Treasury and General Government Appropriations Act of 1999

Section 654 of the Treasury and General Government Appropriations Act, 1999 (Pub. L. No. 105-277) requires Federal agencies to issue a Family Policymaking Assessment for any proposed rule or policy that may affect family well-being. Today's Final Rule would not have any impact on the autonomy or integrity of the family as an institution. Accordingly, DOE has concluded that it is not necessary to prepare a Family Policymaking Assessment.

#### J. Review Under the Plain Language Directives

Section 1(b)(12) of Executive Order 12866 requires that each agency draft its regulations so that they are simple and easy to understand, with the goal of minimizing the potential for uncertainty and litigation arising from such uncertainty. Similarly, the Presidential memorandum directs the heads of executive departments and agencies to use plain language in all proposed and Final Rulemaking documents published in the **Federal Register**. 63 FR 31883 (June 1, 1998).

Today's rule uses the following general techniques to abide by Section 1(b)(12) of Executive Order 12866 and the Presidential memorandum. 63 FR 31883 (June 1, 1998):

- Organization of the material to serve the needs of the readers (stakeholders).
- Use of common, everyday words.
- Shorter sentences and sections.

#### K. Congressional Notification

As required by 5 U.S.C. 801, DOE will submit to Congress a report regarding the issuance of today's Final Rule prior to the effective date set forth at the outset of this notice. DOE also will submit the supporting analyses to the Comptroller General (GAO) and make them available to each House of Congress. The report will state that it has been determined that the rule is a "major rule" as defined by 5 U.S.C. 804(2).

#### List of Subjects in 10 CFR Part 430

Administrative practice and procedure, Energy conservation, Household appliances.



Issued in Washington, DC, on December 26, 2000.

**Dan Reicher,**  
Assistant Secretary, Energy Efficiency and Renewable Energy.

For the reasons set forth in the preamble, Part 430 of Title 10, Code of Federal Regulations, is amended as set forth below.

**PART 430—ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS**

1. The authority citation for Part 430 continues to read as follows:

**Authority:** 42 U.S.C. 6291–6309, 28 U.S.C. 2461 note.

2. Section 430, Appendix E to Subpart B of Part 430 is amended in Section 1 by adding paragraph 1.16 to read as follows:

**Appendix E to subpart B of Part 430—Uniform Test Method for Measuring the Energy Consumption of Water Heaters**

1. Definitions  
\* \* \* \* \*

1.16 *Tabletop water heater* means a water heater in a rectangular box enclosure designed to slide into a kitchen countertop space with typical

dimensions of 36 inches high, 25 inches deep and 24 inches wide.

\* \* \* \* \*

3. Section 430.32(d) of subpart C is amended by revising paragraph (d) to read as follows:

§ 430.32 Energy and water conservation standards and effective dates.

\* \* \* \* \*

(d) *Water heaters.*

The energy factor of water heaters shall not be less than the following for products manufactured on or after the indicated dates.

Product class	Energy factor as of January 1, 1990	Energy factor as of of April 15, 1991	Energy factor as of January 20, 2004
1. Gas-fired Water Heater .....	0.62 – (.0019 × Rated Storage Volume in gallons).	0.62 – (.0019 × Rated Storage Volume in gallons).	0.67 – (0.0019 × Rated Storage Volume in gallons).
2. Oil-fired Water Heater .....	0.59 – (.0019 × Rated Storage Volume in gallons).	0.59 – (.0019 × rated Storage Volume in gallons).	0.59 – (0.0019 × Rated Storage Volume in gallons).
3. Electric Water Heater .....	0.95 – (0.00132 × Rated Storage Volume in gallons).	0.93 – (0.00132 × Rated Storage Volume in gallons).	0.97 – (0.00132 × Rated Storage Volume in gallons).
4. Tabletop Water Heater .....	0.95 – (0.00132 × Rated Storage Volume in gallons).	0.93 – (0.00132 × Rated Storage Volume in gallons).	0.93 – (0.00132 × Rated Storage Volume in gallons).
5. Instantaneous Gas-fire Water Heater.	0.62 – (0.0019 × Rated Storage Volume in gallons).	0.62 – (0.0019 × Rated Storage Volume in gallons).	0.62 – (0.0019 × Rated Storage Volume in gallons).
6. Instantaneous Electric Water Heater.	0.95 – (0.00132 × Rated Storage Volume in gallons).	0.93 – (0.00132 × Rated Storage Volume in gallons).	0.93 – (0.00132 × Rated Storage Volume in gallons).

**Note:** The Rated Storage Volume equals the water storage capacity of a water heater, in gallons, as specified by the manufacturer.

\* \* \* \* \*

**Appendix**

[The following letter from the Department of Justice will not appear in the Code of Federal Regulations.]

Department of Justice,  
Antitrust Division, Joel I. Klein Assistant Attorney General

Main Justice Building, 950 Pennsylvania Avenue, NW, Washington, DC 20530–0001, (202) 514–2401/(202) 616–2645 (f), Antitrust@justice.usdoj.gov

July 10, 2000.

Mary Anne Sullivan,  
General Counsel, Department of Energy,  
Washington, DC 20585

Dear General Counsel Sullivan: I am responding to your May 10, 2000 letter seeking the views of the Attorney General about the potential impact on competition of the proposed energy efficiency standards for water heaters, Docket No. EE–RM–97–900. Your request was submitted pursuant to Section 325(o)(2)(B)(i) of the Energy Policy and Conservation Act, 42 U.S.C. 6291, 6295, which requires the Attorney General to make a determination of the impact of any lessening of competition that is likely to result from the imposition of proposed energy efficiency standards. The Attorney General’s responsibility for responding to requests from other departments about the effect of a program on competition has been

delegated to the Assistant Attorney General for the Antitrust Division in 28 CFR 0.40 (g).

We have reviewed the proposed standards, the supplementary information published in the **Federal Register** notice, the Technical Support Document, and information from water heater manufacturers, their suppliers, and other interested parties. The Antitrust Division has concluded that the proposed standards could have an adverse effect on competition because water heater manufacturers may have to use an input that will be produced by only one source. We do not anticipate that the proposed standard will affect competition among water heater manufacturers. Rather, competition to provide heater manufacturers with blowing agents could be adversely affected, with resulting cost increases to consumers.

In the analysis of the proposed standard that the Department of Energy published in the **Federal Register**, the only design options for affected electric water heaters that meet the DOE’s proposed standard require use of HFC–245fa as a blowing agent for insulation. Insulation is an essential part of a water heater, and HFC–245fa is a patented product that has only one supplier. DOE’s published analysis further concludes that gas-fired water heaters have design options that would eliminate the need for HFC–245fa, but at significant added costs.

Water heater manufacturers have objected to the proposed standard on the grounds that their need to rely on a sole source will make

them vulnerable to supply disruptions and monopoly pricing. Based on the analysis that DOE published, the concerns of water heater manufacturers regarding HFC–245fa, and our interviews with industry participants, the Antitrust Division has concluded that competition could be adversely affected by the adoption of the proposed standard.<sup>1</sup> The Department urges the Department of Energy to take into account this impact on competition in determining its final energy efficiency standard for water heaters and to consider altering the standard so that manufacturers may meet the standard for all affected models using blowing agents for insulation other than HFC–245fa without adding significantly to the costs of manufacturing water heaters.

Sincerely,

Joel I. Klein

[FR Doc. 01–1081 Filed 1–16–01; 8:45 am]

**BILLING CODE 6450–01–P**

<sup>1</sup> We note that some manufacturers have suggested that DOE underestimated the performance capabilities of alternative blowing agents. If these suggestions prove correct, water heater manufacturers may in fact be able to comply with the proposed standard for more models, while using water-based blowing agents. We also note that it’s possible that manufacturers may in fact be able to engineer design options using water-based blowing agents with a greater performance capability or lower cost than they now anticipate.