19. Public Comment.
20. Consider and Act on Other Business.

CONTACT PERSON FOR INFORMATION: Patricia Batie, (202) 336–8800.

Upon request, meeting notices will be made available in alternate formats to accommodate visual and hearing impairments.

Individuals who have a disability and need an accommodation to attend the meeting may notify Patricia Batie at (202) 336–8800.

Date Issued: March 1, 1994.

Patricia D. Batie,

Corporate Secretary.

[FR Doc. 94–5075 Filed 3–1–94; 4:46 pm]

BILLING CODE 7050–01–M

LEGAL SERVICES CORPORATION BOARD OF DIRECTORS

Operations and Regulations Committee Meeting

TIME AND DATE: The Legal Services Corporation Board of Directors Operations and Regulations Committee will meet on March 11, 1994. The meeting will commence at 9 a.m. It is anticipated the substantive portion of the open session (i.e., deliberation of agenda item number 5) will commence at approximately 10 a.m.

PLACE: San Francisco Hilton and Towers, 333 O'Farrell Street, Imperial "A" Ballroom, San Francisco, CA 94102, (415) 771–1400.

STATUS OF MEETING: Open, except that part of the meeting may be closed pursuant to a vote, to be solicited prior to the meeting, of a majority of the Board of Directors. Should the aforementioned majority vote to close all or a portion of the meeting be obtained, the Committee will hear the report of the General Counsel on litigation to which the Corporation is or may become a party. In addition, the Committee will consider and act on internal personnel and operational matters related to the Executive Office, the Office of the General Counsel, the Office of Administration, and the Office of Human Resources/Equal Opportunity, the four offices of the Corporation under the Committee's purview. Finally, the Committee will consider for approval the minutes of the executive session(s) held on January 27, 1994. The closing will be authorized by the relevant sections of the Government in the Sunshine Act [5 U.S.C. Sections 552b(c) (2), (6), and (10)], and the corresponding regulation of the Legal Services Corporation [45 CFR Section 1622.5 (a), (e), and (h)].[1] The closing will be certified by the Corporation's General Counsel as authorized by the above-cited provisions of law. A copy of the General Counsel's certification will be posted for public inspection at the Corporation's headquarters, located at 750 First Street, NE., Washington, DC 20002, in its eleventh floor reception area, and will otherwise be available upon request.

MATTERS TO BE CONSIDERED:

Open Session:

1. Approval of Agenda.

Closed Session:

2. Approval of Minutes of January 27, 1994 Executive Session.
3. Consider and Act on General Counsel's Report on Litigation to Which the Corporation is or May Become a Party.
4. Consider and Act on Internal Personnel and Operational Matters.

Open Session: (Resumed)

5. Approval of Minutes of January 27, 1994 Meeting.
6. Develop, Consider and Act on Plans Related to Reauthorization of the Corporation.
7. Consider and Act on Proposed Changes to the Corporation's Bylaws.
8. Consider and Act on Status Report on the Regulation Reform Effort.
9. President's Report.
10. Consider and Act on Other Business.

CONTACT PERSON FOR INFORMATION: Patricia Batie, (202) 336–8800.

Upon request, meeting notices will be made available in alternate formats to accommodate visual and hearing impairments.

Individuals who have a disability and need an accommodation to attend the meeting may notify Patricia Batie at (202) 336–8800.

Date Issued: March 1, 1994.

Patricia D. Batie,

Corporate Secretary.

[FR Doc. 94–5076 Filed 3–1–94; 4:46 pm]

BILLING CODE 7050–01–M

LEGAL SERVICES CORPORATION BOARD OF DIRECTORS

Presidential Search Committee Meeting

TIME AND DATE: A meeting of the Legal Services Corporation Board of Directors Presidential Search Committee will be held on March 12, 1994. The meeting will commence at 9 a.m.

PLACE: San Francisco Hilton and Towers, 333 O'Farrell Street, Imperial "A" Ballroom, San Francisco, CA 94102, (415) 771–1400.

STATUS OF MEETING: Open, except that part of the meeting may be closed pursuant to a vote, to be solicited prior to the meeting, of a majority of the Board of Directors. Should the aforementioned majority vote to close all or a portion of the meeting be obtained, the Committee will, with its Advisory Committee, consider prospective candidates for the position of President of the Corporation. In addition, the Committee will consider for approval the minutes of the executive session(s) held on January 28, 1994.[1] The closing will be authorized by the relevant sections of the Government in the Sunshine Act [5 U.S.C. Sections 552b(c) (2) and (6)], and the corresponding regulation of the Legal Services Corporation [45 CFR Section 1622.5 (a) and (e)]. The closing will be certified by the Corporation's General Counsel as authorized by the above-cited provisions of law. A copy of the General Counsel's certification will be posted for public inspection at the Corporation's headquarters, located at 750 First Street, NE., Washington, DC 20002, in its eleventh floor reception area, and will otherwise be available upon request.

MATTERS TO BE CONSIDERED:

Open Session:

1. Approval of Agenda.
2. Approval of Minutes of January 28, 1994 Meeting.

Closed Session:

3. Approval of Minutes of January 28, 1994 Execution Session.
4. Consider, With Advisory Committee, Candidates for the Position of President of the Corporation.

Open Session:

5. Consider and Act on Other Business.

CONTACT PERSON FOR INFORMATION: Patricia D. Batie, Executive Office, (202) 336–8800.

Upon request, meeting notices will be made available in alternate formats to accommodate visual and hearing impairments.

Individuals who have a disability and need an accommodation to attend the meeting may notify Patricia Batie at (202) 336–8800.

Date Issued: March 1, 1994.

Patricia D. Batie,

Corporate Secretary.

[FR Doc. 94–5077 Filed 3–1–94; 4:46 pm]

BILLING CODE 7050–01–M

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[1] As to the Committee's consideration and approval of the draft minutes of the executive session(s) held on the above-noted date(s), the closing is authorized as noted in the **Federal Register** notice(s) corresponding to that/those Committee meeting(s).

[1] As to the Committee's consideration and approval of the draft minutes of the executive session(s) held on the above-noted date(s), the closing is authorized as noted in the **Federal Register** notice(s) corresponding to that/those Committee meeting(s).

NATIONAL CREDIT UNION ADMINISTRATION

TIME AND DATE: 1 p.m., Wednesday, March 9, 1994.

PLACE: Board Room, 7th Floor, Room 7047, 1775 Duke Street, Alexandria, Virginia 22314–3428.

STATUS: Open.

BOARD BRIEFINGS:

1. Central Liquidity Facility Report and Report on CLF Lending Rate.
2. Insurance Fund Report.

MATTERS TO BE CONSIDERED:

1. Approval of Minutes of Previous Open Meeting.
2. Proposed Rule: Request for Comment: Section 701.21, NCUA's Rules and Regulations: Prohibited Fees.

FOR FURTHER INFORMATION CONTACT: Becky Baker, Secretary of the Board, Telephone (703) 518–6304.

Becky Baker,

Secretary of the Board.

[FR Doc. 94–5091 Filed 3–2–94; 10:04 am]

BILLING CODE 7535–01–M

PENNSYLVANIA AVENUE DEVELOPMENT CORPORATION

Board of Directors' Meeting

ACTION: The Pennsylvania Avenue Development Corporation announces the date of their forthcoming meeting of the Board of Directors.

DATES: The meeting will be held Wednesday, March 23, 1994, at 10 a.m.

ADDRESS: The meeting will be held at the Pennsylvania Avenue Development Corporation, Suite 1220 North, 1331 Pennsylvania Avenue NW., Washington, DC.

SUPPLEMENTARY INFORMATION: This meeting is held in accordance with 36 Code of Federal Regulations Part 901, and is open to the public.

Dated: February 28, 1994.

Lester M. Hunkele III,

Executive Director.

[FR Doc. 94–5162 Filed 3–2–94; 3:30 pm]

BILLING CODE 7630–01–M

SECURITIES AND EXCHANGE COMMISSION

Notice is hereby given, pursuant to the provisions of the Government in the Sunshine Act, Public Law 94–409, that the Securities and Exchange Commission will hold the following open meeting during the week of March 7, 1994.

An open meeting will be held on Wednesday, March 9, 1994, at 9 a.m., in Room 1C30.

The subject matter of the open meeting scheduled for Wednesday, March 9, 1994, at 9 a.m., will be:

1. Consideration of a proposed release regarding the application of the antifraud provisions of the federal securities laws to municipal securities issuers and other market participants in connection with both primary offerings and continuing disclosure to the secondary market. For further information, please contact Ann D. Wallace at (202) 272–7282, Amy Meltzer Starr at (202) 272–3654, Vincent W. Mathis at (202) 272–3968, Division of Corporation Finance; Janet W. Russell-Hunter at (202) 504–2418, Division of Market Regulation.

2. Consideration of whether to propose amendments to Rule 15c2–12, which would make it unlawful for a broker, dealer, or municipal securities dealer (a) to act as an underwriter of an issue of municipal securities unless the issuer has agreed to provide annual financial information and notices of material events to a nationally recognized municipal securities information repository and (b) to recommend the purchase or sale of such a municipal security without having previously reviewed that information. For further information, please contact Catherine McGuire, Janet W. Russell-Hunter at (202) 504–2418, Division of Market Regulation; Amy Meltzer Starr at (202) 272–3654, Division of Corporation Finance.

3. Consideration of a proposed release amending Rule 10b–10 to require confirmation disclosure of: (a) The mark-up and mark-down in connection with a riskless principal transaction in debt securities, other than U.S. savings bonds and municipal securities; (b) the unrated status of a debt security; (c) the mark-up and mark-down in connection with a transaction in a small-cap NASDAQ or regional exchange-listed security; (d) the fact that a broker-dealer is not a member of SIPC; and (e) enhanced yield information with respect to collateralized debt securities.

In addition, consideration will be given to a proposed rule requiring confirmation disclosure of: (a) The mark-up and mark-down in connection with riskless principal transactions in municipal securities; and (b) the unrated status of a municipal security. For further information, please contact C. Dirk Peterson at (202) 504–2418, Division of Market Regulation.

At times, changes in Commission priorities require alterations in the scheduling of meeting items. For further information and to ascertain what, if any, matters have been added, deleted or postponed, please contact: Bruce Rosenblum at (202) 272–2300.

Dated: March 2, 1994.

Jonathan G. Katz,

Secretary.

[FR Doc. 94–5180 Filed 3–2–94; 3:49 pm]

BILLING CODE 8010–01–M

Corrections

Federal Register
Vol. 59, No. 43
Friday, March 4, 1994

This section of the FEDERAL REGISTER contains editorial corrections of previously published Presidential, Rule, Proposed Rule, and Notice documents. These corrections are prepared by the Office of the Federal Register. Agency prepared corrections are issued as signed documents and appear in the appropriate document categories elsewhere in the issue.

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 63

[AD-FRL-4834-5]

National Emission Standards for Hazardous Air Pollutants for Source Category: Gasoline Distribution (Stage I)

Correction

In proposed rule document 94-2695 beginning on page 5868 in the issue of Tuesday, February 8, 1994 make the following corrections:

§§ 63.422 and 63.423 [Corrected]

1. On page 5889, in the first column, in § 63.422(b), in the third line, and in § 63.423 in the last line, "February 8, 1997." should read (3 years after date of publication of the final rule in the **Federal Register**)".

§ 63.424 [Corrected]

2. On the same page, in the second column, in § 623.424(b)(2), in the last line, "August 8, 1994." should read "(180 days after date of publishing of final rule in the **Federal Register**.)"

BILLING CODE 1505-01-D

ENVIRONMENTAL PROTECTION AGENCY

[AD-FRL-4808-8]

National Emission Standards for Hazardous Air Pollutants Schedule for the Promulgation of Emission Standards Under Section 112 (e) of the Clean Air Act Amendments of 1990

Correction

In notice document 93-29513 beginning on page 63941 in the issue of Friday, December 3, 1993 make the following correction:

On page 63941, in the second column, in the **EFFECTIVE DATE:**, "December 3, 1994." should read "December 3, 1993."

BILLING CODE 1505-01-D

DEPARTMENT OF HEALTH AND HUMAN SERVICES

Food and Drug Administration

[Docket No. 93F-0428]

PPG Industries, Inc.; Filing of Food Additive Petition

Correction

In notice document 94-60 appearing on page 590 in the issue of Wednesday, January 5, 1994 make the following corrections:

On page 590:

1. In the first column, the docket heading should read as set forth above.

2. In the second column, under the heading **ADDRESSES:**, in the fourth line, "rm. 10023," should read " rm. 1-23,".

3. In the same column, under the heading **FOR FURTHER INFORMATION CONTACT:**, in the second line, "(HFS09216)," should read "(HFS-216)," and the last line, should read "202-254-9500."

4. In the same column, under the heading **SUPPLEMENTARY INFORMATION:**, in the 9th line, "§ 1A176.200" should read "§ 176.200" and in the 11th line, "§ 1A176.210" should read "§ 176.210".

BILLING CODE 1505-01-D

DEPARTMENT OF TRANSPORTATION

Coast Guard

46 CFR Part 25

[CGD 87-016b]

RIN 2115-AC69

Emergency Position Indicating Radio Beacons and Visual Distress Signals for Uninspected Vessels

Correction

In proposed rule document 94-3519 beginning on page 8100 in the issue of Thursday, February 17, 1994 make the following corrections:

1. On page 8101, in the first column, in the first line, "EPIR" should read "EPIRB".

§ 25.26-10 [Corrected]

2. On page 8104, in the first column, in § 25.26-10(c)(1), in the second line, "minutes" should read "miles".

BILLING CODE 1505-01-D

federal register

Friday
March 4, 1994

Part II

Department of Energy

Office of Energy Efficiency and Renewable Energy

10 CFR Part 430

Energy Conservation Program for Consumer Products; Proposed Rule

DEPARTMENT OF ENERGY

Office of Energy Efficiency and Renewable Energy

10 CFR Part 430

[Docket No. EE–RM–90–201]

Energy Conservation Program for Consumer Products

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

ACTION: Notice of Proposed Rulemaking and Public Hearing.

SUMMARY: The Energy Policy and Conservation Act, as amended, prescribes energy conservation standards for certain major household appliances, and requires the Department of Energy (DOE or Department) to administer an energy conservation program for these products. The National Appliance Energy Conservation Act amendments require DOE to consider amending the energy conservation standards for room air conditioners, water heaters, direct heating equipment, mobile home furnaces, kitchen ranges and ovens, pool heaters and fluorescent lamp ballasts; and to consider establishing energy conservation standards for television sets.

DATES: Written comments on the proposed rule must be received by the Department by May 18, 1994. The Department requests 10 copies of the written comments and, if possible, a computer disk.

Oral views, data, and arguments may be presented at the public hearing to be held in Washington, DC, beginning at 9:30 a.m. on April 5, 6 and 7, 1994.

Requests to speak at the hearing must be received by the Department no later than 4 p.m., March 25, 1994. Copies of statements to be given at the public hearing must be received by the Department no later than 4 p.m., March 29, 1994. The DOE panel will read the statements in advance of the hearing and would appreciate the oral presentations to be limited to a summary of the statement. The length of each oral presentation is limited to 15 minutes.

ADDRESSES: The hearing will be held at the U.S. Department of Energy, Forrestal Building, Room 1E–245, 1000 Independence Avenue, SW., Washington, DC. Written comments, oral statements, and requests to speak at the hearing are to be submitted to U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, EE–431, Energy Conservation Program for Consumer Products, Docket No. EE–RM–90–201, room 5E–066, Forrestal Building, 1000 Independence Avenue, SW., Washington, DC, 20585, (202) 586–7140.

Copies of the transcript of the public hearing and public comments received may be read at the DOE Freedom of Information Reading Room, U.S. Department of Energy, Forrestal Building, room 1E–190, 1000 Independence Avenue, SW., Washington, DC 20585, (202) 586–6020 between the hours of 8 a.m. and 4 p.m., Monday through Friday, except Federal holidays.

For more information concerning public participation in this rulemaking proceeding see Section VI, "Public Comment Procedures," of this notice.

FOR FURTHER INFORMATION CONTACT:

Michael J. McCabe, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Forrestal Building, Mail Station EE–43, 1000 Independence Avenue, SW., Washington, DC 20585, (202) 586–9127

Eugene Margolis, Esq., U.S. Department of Energy, Office of General Counsel, Forrestal Building, Mail Station GC–72, 1000 Independence Avenue, SW., Washington, DC 20585, (202) 586–9507

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I. Introduction

a. Authority

Part B of Title III of the Energy Policy and Conservation Act, Public Law 94–163, as amended by the National Energy Conservation Policy Act, Public Law 95–619, by the National Appliance Energy Conservation Act, Public Law 100–12, by the National Appliance Energy Conservation Amendments of 1988, Public Law 100–357, and the Energy Policy Act of 1992, Public Law 102–486 [1] created the Energy Conservation Program for Consumer Products other than Automobiles. The consumer products subject to this program (often referred to hereafter as "covered products") are: Refrigerators, refrigerator-freezers and freezers; dishwashers; clothes dryers; water heaters; central air conditioners and central air conditioning heat pumps; furnaces; direct heating equipment; television sets; kitchen ranges and ovens; clothes washers; room air conditioners; fluorescent lamp ballasts; and pool heaters; as well as any other consumer product classified by the Secretary of Energy. Section 322. To date, the Secretary has not so classified any additional products.

Under the Act, the program consists essentially of three parts: testing, labeling, and Federal energy conservation standards. The Department, in consultation with the National Institute of Standards and Technology, is required to amend or establish new test procedures as appropriate for each of the covered products. Section 323. The purpose of the test procedures is to produce test results that 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 and shall not be unduly burdensome to conduct. Section 323 (b)(3). A test procedure is not required if DOE determines by rule that one cannot be developed. Section 323 (d)(1). Test procedures appear at 10 CFR part 430, subpart B.

The Federal Trade Commission is required by the Act to prescribe rules governing the labeling of covered products for which test procedures have been prescribed by DOE. Section 324(a). These rules are to require that each particular model of a covered product bears a label that indicates its annual operating cost and the range of estimated annual operating costs for other models of that product. Section 324(c)(1). Disclosure of estimated operating cost is not required under section 324 if the Federal Trade Commission determines that such disclosure is not likely to assist consumers in making purchasing decisions, or is not economically feasible. In such a case, the Federal Trade Commission must require a different useful measure of energy consumption. Section 324(c). At the present time there are Federal Trade Commission rules requiring labels for the following products: room air conditioners, furnaces, clothes washers, dishwashers, water heaters, refrigerators, refrigerator-freezers and freezers, central air conditioners and central air conditioning heat pumps, and fluorescent lamp ballasts. 44 FR 66475, November 19, 1979, 52 FR 46888, December 10, 1987, and 54 FR 28031, July 5, 1989.

For each of the 12 covered products, the Act prescribes an initial Federal energy conservation standard. Section 325(b)-(h). The Act establishes dates of applicability for the standards in 1988, 1990, 1992 or 1993, depending on the product, and specifies that the standards are to be reviewed by the Department within 3 to 10 years, also depending on the product. Section 325(b)-(h). After the specified period, DOE may promulgate new standards for each product; however, the Secretary may not prescribe any amended standard which increases the maximum allowable energy use, or decreases the minimum required energy efficiency of a covered product. Section 325(l)(1). The Department's current review of standards is for room air conditioners, water heaters, direct heating equipment, mobile home furnaces, kitchen ranges and ovens, pool heaters and fluorescent lamp ballasts and is considering establishing energy conservation standards for television sets. Section 325(g)(4)(A).

Any new or amended standard is required to be designed so as to achieve the maximum improvement in energy efficiency that is technologically feasible and economically justified. Section 325(l)(2)(A).

Section 325(l)(2)(B)(i) provides that before DOE determines whether a standard is economically justified, it must first solicit comments on a proposed standard. After reviewing comments on the proposal, DOE must then 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 such 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 savings likely to result directly from the imposition of the standard;

(4) Any lessening of the utility or the performance of the covered products

[1] 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.

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 conservation; and

(7) Other factors the Secretary considers relevant.

In addition, section 325(l)(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 savings during the first year that the consumer will receive as a result of the standard, as calculated under the applicable test procedure* * *."

Section 327 of the Act 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. Section 327(a)-(c). Exemptions to this general rule include: (1) State standards prescribed or enacted before January 8, 1987, and applicable to appliances produced before January 3, 1988 (section 327(b)(1)); (2) State procurement standards which are more stringent than the applicable Federal standard (Section 327(b)(3) and (f)(1)-(4)); (3) State regulations banning constant burning pilot lights in pool heaters (Section 327(b)(4)); and (4) State standards for television sets effective on or after January 1, 1992, may remain in effect in the absence of a Federal standard for such product (Section 327(b)(6) and 327(c)).

b. Background

The National Energy Conservation Policy Act required DOE to establish mandatory energy efficiency standards for each of the 13 covered products.[2] These standards were to be designed to achieve the maximum improvement in energy efficiency that was technologically feasible and economically justified.

The National Energy Conservation Policy Act provided, however, that no standard for a product be established if there were no test procedure for the product, or if DOE determined by rule either that a standard would not result in significant conservation of energy, or that a standard was not technologically feasible or economically justified. In determining whether a standard was economically justified, the Department was directed to determine whether the benefits of the standard exceeded its burdens by weighing the seven factors discussed above.

The National Appliance Energy Conservation Act, which became law on March 17, 1987, amended the Energy Policy and Conservation Act in part by: redefining "covered products" (specifically, refrigerators, refrigerator-freezers, and freezers were combined into one product type from two; humidifiers and dehumidifiers were deleted; and pool heaters were added); establishing Federal energy conservation standards for 11 of the 12 covered products; and creating a schedule, according to which each standard is to be reviewed to determine if an amended standard is required.

The National Appliance Energy Conservation Amendments of 1988, which became law on June 28, 1988, established Federal energy conservation standards for fluorescent lamp ballasts. These amendments also created a review schedule for DOE to determine if any amended standard for fluorescent lamp ballasts is required.

The Energy Policy Act of 1992, which became law on October 24, 1992, addressed various commercial appliances and equipment.

As directed by the Act, DOE published an advance notice of proposed rulemaking with a 75-day comment period that ended December 12, 1990, for the eight products subject to today's rulemaking. 55 FR 39624, September 28, 1990. (Hereafter referred to as the September 1990 advance notice). The September 1990 advance notice presented the product classes that DOE planned to analyze, and provided a detailed discussion of the analytical methodology and analytical models that the Department expected to use in performing the analysis to support this rulemaking. The Department invited comments and data on the accuracy and feasibility of the planned methodology and encouraged interested persons to recommend improvements or alternatives to the Department's approach. The comments in response to the advance notice are addressed in Sections II and III of this notice.

II. General Discussion

a. Energy Descriptors

As discussed above, the Act established initial energy conservation standards for all of the covered products except television sets. Some of these standards were of a prescriptive form, such as the requirement of a no heat dry option for dishwashers, and others were performance standards, stated in terms of an energy descriptor, such as seasonal energy efficiency ratio for central air conditioners, annual fuel utilization factor for furnaces, etc. The intent of these standards, and the subsequent required DOE analyses and rulemaking regarding amending the standards, is to save energy. In conducting rulemakings and analyses required by the Act to determine if standards should be amended, the Department previously determined that the form of a standard may need to change in order to evaluate the efficiency standards. For example, the final rule issued for dishwashers changed the standard from the initial prescriptive standard to a performance standard based on an energy descriptor. 56 FR 22250, May 14, 1991. Additionally, the Department has determined in this rulemaking that energy descriptors may need to be changed when it is found they do not account for all of the energy or all types of energy consumed by an appliance. Not to change these energy descriptors would result in an incomplete analysis and could lead to standards being met by utilizing unaccounted energy resulting in products that might satisfy the energy descriptor but result in little or no total energy savings. Examples of unaccounted energy are the pilot light energy of a pool heater which is not accounted for by the current energy descriptor of Thermal Efficiency or the electrical fan energy of a gas furnace which is not accounted for by the current energy descriptor of the annual fuel utilization factor. Accordingly, the Department is proposing in today's notice to change the energy descriptors of the initial standards for direct heating equipment, mobile home furnaces, and pool heaters.

b. Test Procedures

For each product discussed in today's proposed rulemaking there is an applicable DOE test procedure to evaluate its energy efficiency.

A Notice of Proposed Rulemaking that would amend the test procedures for mobile home furnaces, direct heating equipment, and pool heaters was published in the **Federal Register** on August 23, 1993 (58 FR 44538); in addition, another Notice of Proposed

[2] The consumer products covered by the National Energy Conservation Policy Act included: Refrigerators and refrigerator-freezers; freezers; dishwashers; clothes dryers; water heaters; room air conditioners; home heating equipment not including furnaces; television sets; kitchen ranges and ovens; clothes washers; humidifiers and dehumidifiers; central air conditioners; and furnaces.

Rulemaking which includes amendments to the test procedures for clothes washers, water heaters, ranges and ovens is being published.

c. Technological Feasibility

1. General

For those products and classes of products discussed in today's notice, DOE believes that the efficiency levels analyzed, while not necessarily being realized in production, are technologically possible. The technological feasibility of the design options are addressed in the product-specific discussion. The Department's criteria for evaluating design options for technological feasibility are that the design options are already in use by the respective industry, or that research has progressed to the development of a prototype.

2. Maximum Technologically Feasible Levels

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 (l)(2)(A)). Accordingly, for each class of product under consideration in this rulemaking, a maximum technologically feasible (max tech) design option was identified. The max tech level is one that can be carried out by the addition of design options, both commercially feasible and prototypes, to the baseline units.[3] The Department believes that in identifying the max tech level a unit must be capable of being assembled, but not necessarily mass produced, by the effective date of the amended standards. Manufacturing ability is determined under economic justification. For example, in the November 1989 Final Rule, DOE concluded that evacuated panels for refrigerators was a technically feasible design option since refrigerators had been produced on a limited scale with this technology included. However, DOE concluded that this technology was not economically justified because the chemical industry would not be able to make sufficient quantities of the raw materials commercially available by the effective date of the standard.

The max tech levels were derived by adding energy-conserving engineering design options to the respective classes in order of decreasing consumer payback. For example, the max tech level for room air conditioners includes higher efficiency fan motors, which were added early, and variable speed compressors, which were added later because of their slower payback. A complete discussion of each max tech level, and the design options included in each, is found in the *Engineering Analysis*. See Technical Support Document, Chapter 3.

Tables 2–1 through 2–8 present the Department's max tech performance levels for all classes of the subject products:

TABLE 2–1.—ROOM AIR CONDITIONER MAXIMUM TECHNOLOGICALLY FEASIBLE LEVELS

Product class	Energy efficiency ratio
With louvered sides less than 6,000 Btu	13.0
With louvered sides 6,000 to 7,999 Btu	12.1
With louvered sides 8,000 to 13,999 Btu	13.5
With louvered sides 14,000 to 19,999 Btu	13.6
With louvered sides 20,000 and more Btu	11.4
Without louvered sides less than 6,000 Btu	12.6
Without louvered sides 6,000 to 7,999 Btu	11.7
Without louvered sides 8,000 to 13,999 Btu	13.0
Without louvered sides 14,000 to 19,000 Btu	13.1
Without louvered sides 20,000 and more Btu	11.0
With reverse cycle, and with louvered sides	13.2
With reverse cycle, without louvered sides	12.7

TABLE 2–2.—WATER HEATER MAXIMUM TECHNOLOGICALLY FEASIBLE LEVELS

Product class	Energy factor
Gas	.687 − (.001707 × Measured Storage Volume (in gals.)).
Oil	.835 − (.001707 × Measured Storage Volume (in gals.)).
Electric	2.597 − (.001172 × Measured Storage Volume (in gals.)).
Gas instantaneous.	.897.

TABLE 2–3.—DIRECT HEATING EQUIPMENT MAXIMUM TECHNOLOGICALLY FEASIBLE LEVELS

Product class	Annual efficiency
Gas wall fan type up to 42,000 Btu/hour	89.2
Gas wall fan type over 42,000 Btu/hour	89.9
Gas wall gravity type up to 10,000 Btu/hour	81.0
Gas wall gravity type over 10,000 Btu/hour up to 12,000 Btu/hour	81.7
Gas wall gravity type over 12,000 Btu/hour up to 15,000 Btu/hour	82.1
Gas wall gravity type over 15,000 Btu/hour up to 19,000 Btu/hour	82.9
Gas wall gravity type over 19,000 Btu/hour up to 27,000 Btu/hour	83.3
Gas wall gravity type over 27,000 Btu/hour up to 46,000 Btu/hour	83.8
Gas wall gravity type over 46,000 Btu/hour	84.4
Gas floor type up to 37,000 Btu/hour	88.6
Gas floor type over 37,000 Btu/hour	90.0
Gas room type up to 18,000 Btu/hour	85.9
Gas room type over 18,000 Btu/hour up to 20,000 Btu/hour	87.3
Gas room type over 20,000 Btu/hour up to 27,000 Btu/hour	88.1
Gas room type over 27,000 Btu/hour up to 46,000 Btu/hour	88.9
Gas room type over 46,000 Btu/hour	89.7

TABLE 2–4.—MOBILE HOME FURNACE MAXIMUM TECHNOLOGICALLY FEASIBLE LEVELS

Product class	Annual efficiency
Gas-fired	89.5
Oil-fired	85.8

TABLE 2–5.—KITCHEN RANGE AND OVEN MAXIMUM TECHNOLOGICALLY FEASIBLE LEVELS

Product class	Annual energy use
Electric oven, self-cleaning	209.2 kWh.
Electric oven, non-self-cleaning	157.3 kWh.
Gas oven, self-cleaning	1.42 MMBtu.
Gas oven, non-self-cleaning	1.07 MMBtu.
Microwave oven	228.2 kWh.
Electric cooktop, coil element	257.7 kWh.

[3] The baseline unit is the most commonly used combination of engineering design options which are found in appliances that meet the existing National Appliance Energy Conservation Act standards except for television sets where no National Appliance Energy Conservation Act standard exists. In the case of television sets, the baseline is represented by the typical 19/20" television with electronic tuning and remote control.

TABLE 2–5.—KITCHEN RANGE AND OVEN MAXIMUM TECHNOLOGICALLY FEASIBLE LEVELS—Continued

Product class	Annual energy use
Electric cooktop, smooth element	258.5 kWh.
Gas cooktop	1.6274 MMBtu.

TABLE 2–6.—POOL HEATER MAXIMUM TECHNOLOGICALLY FEASIBLE LEVEL

Product class	Annual efficiency
Gas-fired	95.7

TABLE 2–7.—FLUORESCENT LAMP BALLAST MAXIMUM TECHNOLOGICALLY FEASIBLE LEVELS

Product class	Efficacy factor
One F40 lamp	2.50
Two F40 lamp	1.28
Two F96 lamp	0.72
Two F96HO lamps	0.50
Three F40 lamps	0.87
Four F40 lamps	0.67
One F32T8 lamp	3.17
Two F32T8 lamps	1.58
Three F32T8 lamps	1.06
Four F32T8 lamps	0.76

TABLE 2–8.—TELEVISION SET MAXIMUM TECHNOLOGICALLY FEASIBLE LEVEL

Product class	Annual energy use (kWh/yr.)
Color 19″–20″ electronically tuned	138.5

The Department believes that these are the max tech levels from an engineering analysis standpoint. Each of the levels was evaluated in accordance with the economic justification factors specified in the Act to determine economic justification.

The Department evaluated each max tech level to determine if it would be economically justified at the time the standards would become effective. The Department rejected energy conservation standards that had unacceptable impacts on consumers or manufacturers (e.g., unusually long payback periods and substantially adverse impacts on manufacturers' returns on equity).

d. Energy Savings

1. Determination of Savings

The Department forecasted energy consumption through the use of the Lawrence Berkeley Laboratory Residential Energy Model, which forecasted energy consumption over the period of analysis for candidate standards and the base case. The Department quantified the energy savings that would be attributable to a standard as the difference in energy consumption between the candidate standard's case and the base case. The base case represents the forecasts of outputs, e.g., prices, operating expenses, energy consumption, shipments, and manufacturer impacts in the absence of new or amended standards.

The Lawrence Berkeley Laboratory Residential Energy Model was used by DOE in previous standards rulemakings. The Lawrence Berkeley Laboratory Residential Energy Model is explained in the Technical Support Document accompanying this notice. (See Appendix B to that document for a detailed discussion of the Lawrence Berkeley Laboratory Residential Energy Model.) The Lawrence Berkeley Laboratory Residential Energy Model contains algorithms to project average efficiencies, usage behavior, and market shares for each product.

COMMEND is the Commercial Energy End-Use Model. It was developed by the Electric Power Research Institute, to characterize energy end-use in the commercial sector. For this rulemaking, the Commercial Energy End-Use Model is being used to evaluate more stringent standards on fluorescent lamp ballasts, which are found principally in the commercial sector of the economy.

The market share calculations contain the following steps: potential purchasers may purchase any competing technology within an end-use, or none. For room air conditioners, fluorescent lamp ballasts, and television sets, the decision to purchase or not is modeled, and the fraction of the total that chooses each class, e.g., F40T12 lamps, F96T12 lamps, etc., is specified exogenously. For the other products, along with the considerations above, the choice of fuel is modeled. Long-term market share elasticities have been assumed with respect to equipment price, operating expense, and income. The effects of standards are expected to be lower operating expense and increased equipment price. The percentage changes in these quantities are used, together with the elasticities, to determine changes in sales volumes resulting from standards. Higher equipment prices will decrease sales volumes, while lower operating expenses will increase them. The net result depends on the standard level selected, and associated equipment prices and operating expenses.

The Lawrence Berkeley Laboratory Residential Energy Model and the Commercial Energy End-Use Model (for ballasts only) are used to project energy use over the relevant time periods for seven of these products with and without amended standards, and, in the case of televisions, with and without standards. By comparing the energy consumption projection at alternative standard levels with the legislated standards, the Department estimated the amount of energy projected to be saved during the period 1996–2030.[4] The energy saved is expressed in quads, i.e., quadrillions of British thermal units (Btu). With respect to electricity, the savings are quads of source or primary energy, which is the energy necessary to generate and transmit electricity. The Act defines "energy use" as the quantity of energy directly consumed by a consumer product at point of use. This is generally called "site" energy, as opposed to "source" energy. There are major differences between these types of energy. From data that remains rather constant over the years, the amount of electrical energy consumed at the site is less than one-third of the amount of source energy that is required to generate and transmit the site electrical energy.[5] Therefore, it is important to identify whether the electricity involved is site or source energy.

The Lawrence Berkeley Laboratory Residential Energy Model projections are dependent on many assumptions. Among the most important are responsiveness of household appliance purchasers to changes in residential energy prices and consumer income, future energy prices, future levels of housing construction, and options that exist for improving the energy efficiency of appliances. The Commercial Energy End-Use Model projections are dependent upon changes in commercial energy prices, future construction of

[4] Lawrence Berkeley-Laboratory Residential Energy Model and the Commercial Energy End-Use Model were programmed to analyze a single standard level or alternate standard levels over the entire period. That is, the fact that a standard might be revised during subsequent rulemakings was not considered by the model. The Department believes that it is not possible to predict what result such reviews may have, and therefore it would be speculative to model any particular result. Therefore, for purposes of this rulemaking, each standard level that was analyzed was projected to have been in place from the time of implementation to the year 2030.

[5] Energy Information Administration, Electric Power Annual 1987, Tables 25 and 82, DOE/EIA 0348(87), 1987.

commercial floorspace, responsiveness of building owners to future energy and equipment prices and to utility demand-side management programs, and options for improving the energy efficiency of lighting. As is the case with any complicated computer model simulation, the validity of the outputs is critically dependent on the inputs.

2. Significance of Savings.

Under section 325(l)(3)(B) of the Act, the Department is prohibited from adopting a standard for a product if that standard would not result in "significant" energy savings. While the term "significant" has never been defined in the Act, the U.S. Court of Appeals, in *Natural Resources Defense Council* v. *Herrington*, 768 F.2d 1355, 1406 (DC Cir. 1985), concluded that Congressional intent in using the word "significant" was to mean "non-trivial." *Id.* at 1373.

e. Rebuttable Presumption

The National Appliance Energy Conservation Act established new criteria for determining whether a standard level is economically justified. Section 325(l)(2)(B)(iii) states:

"If the Secretary finds 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 savings during the first year that the consumer will receive as a result of the standard, as calculated under the applicable test procedure, there shall be a rebuttable presumption that such standard level is economically justified. A determination by the Secretary that such criterion is not met shall not be taken into consideration in the Secretary's determination of whether a standard is economically justified."

If the increase in initial price of an appliance due to a conservation standard would repay itself to the consumer in energy savings in less than three years, then it is presumed that such standard is economically justified.[6] This presumption of economic justification can be rebutted upon a proper showing.

f. Economic Justification

As noted earlier, Section 325(l)(2)(B)(i) of the Act provides seven factors to be evaluated in determining whether a conservation standard is economically justified.

[6] For this calculation, the Department calculated cost-of-operation based on the DOE test procedures. Therefore, the consumer is assumed to be an "average" consumer as defined by the DOE test procedures. Consumers that use the products less than the test procedure assumes will experience a longer payback while those that use them more than the test procedure assumes will have a shorter payback.

1. Economic Impact on Manufacturers and Consumers

The engineering analysis identified improvements in efficiency along with the associated costs to manufacturers for each class of product. For each design option, these costs constitute the increased per-unit cost to manufacturers to achieve the indicated energy efficiency levels. Manufacturer, wholesaler, and retailer markups will result in a consumer purchase price higher than the manufacturer cost.

To assess the likely impacts of standards on manufacturers, and to determine the effects of standards on different-sized firms, the Department used a computer model that simulated hypothetical firms in the eight industries under consideration. This model, the Lawrence Berkeley Laboratory Manufacturer Impact Model, is explained in the Technical Support Document. *See* Technical Support Document, Appendix C. The Lawrence Berkeley Laboratory Manufacturer Impact Model provides a broad array of outputs, including shipments, price, revenue, net income, and short- and long-run returns on equity. An "Output Table" lists values for all these outputs in the base case and in each of the standards cases under consideration. It also gives a range for each of these estimates. A "Sensitivity Chart" shows how returns on equity would be affected by a change in any one of the model's nine control variables.

For consumers, measures of economic impact are the changes in purchase price and annual energy expense. The purchase price and annual energy expense, i.e., life-cycle cost, of each standard level are presented in Chapter 6 of the Technical Support Document. Under section 325 of the Act, the life-cycle cost analysis is a separate factor to be considered in determining economic justification.

2. Life-cycle Costs.

One measure of the effect of proposed standards on consumers is the change in operating expense as compared to the change in purchase price, both resulting from standards. This is quantified by the difference in the life-cycle costs between the base and standards cases for the appliance classes analyzed. The life-cycle cost is the sum of the purchase price and the operating expense, including installation and maintenance expenditures, discounted over the lifetime of the appliance.

The life-cycle cost was calculated for the range of efficiencies in the Engineering Analysis for each class in the year standards are imposed, using real consumer discount rates of 2, 6, and 10 percent. The purchase price is based on the factory costs in the Engineering Analysis and includes a factory markup plus a distributor and retailer markup. Energy price forecasts are taken from the 1991 Annual Energy Outlook of the Energy Information Administration. (DOE/Energy Information Administration—0383(91)). Appliance usage inputs are taken from the relevant test procedures.

3. Energy Savings

While the significant conservation of energy is a separate statutory requirement for imposing an energy conservation standard, the Act requires DOE, in determining the economic justification of a standard, to consider the total projected savings that are expected to result directly from revised standards. The Department used the Lawrence Berkeley Laboratory Residential Energy Model results, discussed earlier, in its consideration of total projected savings. The savings for the eight products are provided in Section IV of this notice.

4. Lessening of Utility or Performance of Products

This factor cannot be quantified. In establishing classes of products and design options, the Department tried to eliminate any degradation of utility or performance in the eight products under consideration in this rulemaking. That is, to the extent that comments, or the Department's own research, indicated that a product included a utility or performance-related feature that affected energy efficiency, a separate class with a different efficiency standard was created for that product. In this way, the Department attempted to minimize the impact of this factor as a result of the standards that were analyzed.

5. Impact of Lessening of Competition

It is important to note that this factor has two parts; on the one hand, it assumes that there could be some lessening of competition as a result of standards; and on the other hand, it directs the Attorney General to gauge the impact, if any, of that effect.

In order to assist the Attorney General in making such a determination, the Department studied the affected appliance industries to determine their existing concentrations, levels of competitiveness, and financial performances. This information will be sent to the Attorney General. See Technical Support Document, Chapter 7. The Department has also provided the Attorney General with copies of this notice and the Technical Support Document for her review.

6. Need of The Nation to Conserve Energy

The results of the environmental effects from each standard level for each product will be reported under this factor in the product specific discussion (Section IV) of this notice.

7. 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. The Secretary is seeking comments on two issues which may be considered in this rulemaking. The issues are (1) the incremental impact of appliance conservation standards on energy use, consumers, manufacturers and other factors (See the discussion regarding rebuttable presumption under General Analytical Comments) and, (2) the extent to which any proposed national efficiency standard is likely to disproportionally affect identifiable groups of consumers and whether the analysis should be modified to consider such impacts in the selection of efficiency standard levels (See the discussion regarding other comments under Product-Specific Comments for Direct Heating Equipment).

III. Discussion of Comments

The Department received 90 written comments in response to the September 1990, advance notice. These comments addressed all aspects of the analysis. In this section, the Department will present discussions of the general analytical issues raised by the comments, followed by discussions of the product-specific issues.

a. General Analytical Comments

Discount Rates

The Department's plans to use a 7 percent discount rate in the standards' analyses drew more comments than any other issue. (American Council for an Energy Efficient Economy, No. 6 at 6; Public Citizen, No. 7 at 4; Wayne Goode, No. 8 at 1; Ohio Sierra Club, No. 11 at 1; Natural Resources Defense Council, No. 13 at 5 and appendix; Rocky Mountain Institute, No. 15 at 1; Citizens Environmental Coalition Education Fund, Inc. No. 18 at 1; California Energy Commission, No. 24 at 2; Advance Transformer, No. 25 at 3; Whirlpool Corporation, No. 31 at 1; Northwest Power Planning Council, No. 32 at 2; Champaign County (IL) Board, No. 36 at 1; Washington Gas Light, Inc., No. 37 at 2; George Smith, No. 38 at 1; Lone Star Gas Co., No. 39 at 2; Florida Energy Office, No. 42 at 2; Sierra Club, No. 43 at 2; Ohio Office of the Consumers' Council, No. 60 at 7; Helen Satterthwaite, No. 67 at 1; Warren Widener, No. 78 at 1; and Martin Frost, No. 80 at 1).[7] Most of the comments asserted that the 7 percent rate was unjustifiably high, while several stated that a 7 percent or even higher rate was an appropriate rate for the various analyses.

Commentators seeking a higher rate focused on consumer impacts, while those advocating a lower rate generally pointed to societal benefits. These different perspectives are not easily captured in a single discount rate. The Department has reconsidered the issue, and has decided that multiple discount rates, with each pertaining to a different perspective, are warranted. These different rates (i.e., consumer, commercial and societal) are used to capture the impacts of the standards on different constituents. The consumer and commercial rates are used to calculate life-cycle costs for purchasers of residential and commercial products, respectively. The social discount rate is used to calculate the net present value of standards for the Nation as a whole. Separate rates, therefore, were used for the consumer sector, the commercial sector (since fluorescent lamp ballasts are purchased primarily by commercial firms), and for society as a whole. This discussion will describe the derivations of the consumer, commercial and social discount rates that were used in the different analyses.

1. *Consumer discount rate.* On November 17, 1989, DOE published a final rule for refrigerators, refrigerator-freezers, freezers, and small gas furnaces (54 FR 47916, November 17, 1989), hereafter referred to as the November 1989 final rule. In the November 1989 final rule, DOE selected a 7 percent discount rate, based on a methodology derived from the Court of Appeals decision, *Natural Resources Defense Council* v. *Herrington*, 768 F.2d 1355, 1406 (D.C. Cir 1985). As discussed in the November 1989 final rule, the applicability of the court decision changed somewhat with the passage of the Tax Reform Act of 1986 (Pub. L. 99–514). The Tax Reform Act phased out the deductibility of interest paid on consumer loans. Based on the revised methodology, DOE calculated a range of discount rates that consumers incur; this range is from less than 1 percent to slightly more than 15 percent. As explained in the November 1989 final rule, DOE selected 7 percent for the analysis for purposes of that rulemaking proceeding because it was near the mid-point of the potential consumer discount rates. In addition, DOE believes that the approach is reasonable in that it was related to the opportunity cost of money for purchasing consumer durables. As such, it was justified in terms of alternate consumer purchases that are foregone in order to finance the purchases of appliances.

In a subsequent final rule on energy conservation standards for dishwashers, clothes washers, and clothes dryers (56 FR 22250, May 14, 1991), hereafter referred to as the May 1991 final rule, the Department restated that the 7 percent rate was near the mid-point of the range of consumer finance rates for the purchase of appliances. It was further stated that if the Department could obtain data on the methods that consumers use to purchase appliances, it could develop a weighted-average, real, after-tax finance rate to use as a consumer discount rate in the analysis.

In its comments on the September 1990 advance notice, Whirlpool Corporation offered estimates of consumer financing of purchases of its equipment: 40 percent of retail sales are paid in cash; 35 percent use credit cards; 25 percent use retailer loans. These figures excluded new home construction, which accounts for approximately 25 percent of Whirlpool Corporation's total sales. (Whirlpool Corporation, No. 31 at 1–2 and Appendix 1.)

While Whirlpool Corporation represents only one source of data, the Department has no reason to believe that Whirlpool Corporation's customers differ from those of other manufacturers, and, therefore, accepted Whirlpool Corporation's estimates as representative.

These numbers were applied to the real, after-tax finance rates that are incurred by consumers, as reported in the November 1989 final rule. Those rates were estimated to be just over 3 percent for appliances purchased as part of a new home (whose finance rate is a tax-deductible mortgage interest rate), to slightly under 1 percent for cash purchases, to more than 15 percent for credit card purchases.

When these rates were applied to Whirlpool Corporation's estimates, the resulting weighted-average, real, after-tax rate incurred by consumers in appliance purchases was approximately 6 percent. The Department, then, used 6 percent for the consumer discount rate in the analyses, with sensitivities at 4 and 10 percent. The Department believes that this range of discount sensitivities will capture the real, after-

[7] Comments on the advance notice of proposed rulemaking have been assigned docket numbers and have been numbered consecutively.

tax rates that consumers encounter in financing the purchase of an appliance.

The Department recognizes however, that there remains considerable uncertainty in this estimate of the average consumer discount rate. There are numerous possible financial interactions that could be involved in the purchase of an appliance. For example, a credit card purchase could be paid in full within the customary billing grace period, thereby being exempt from finance charges, and, in effect, resembling a cash purchase. This would tend to put downward pressure on the weighted-average range of purchase financing choices. On the other hand, a cash purchase may actually be financed, indirectly, by an increase in credit card debt. This would tend to put upward pressure on the weighted-average range of purchase finance rates. Furthermore, this analysis does not take into account varying consumer perceptions of the value of reducing current consumption in favor of longer- term financial gains. For these reasons, the Department continues to solicit data that might provide a more complete basis for the derivation of a consumer discount rate used in these analyses.

Furthermore, while financing rates may indicate the direct financial impact to consumers of an investment in increased efficiency, they do not reflect either other types of investments available to them, or varying consumer perceptions of the value of reducing current consumption in favor of longer-term financial gains. For example, what value of energy savings does a consumer need to receive from an investment in an energy efficient refrigerator in order to justify reducing savings, increasing debt, or delaying the purchase of other consumer goods?

The costs of consumer financing does not indicate whether there are similar investment opportunities, available to most consumers, that produce higher rates of return. For example, are there home improvements or other investments that could be made by most consumers that would have higher rates of return than an investment in an energy-efficient appliance? Also, a consumer discount rate based on consumer financing expenses does not fully account for the risks of individual consumer investments in improved appliance efficiency. For example, the actual rates of return experienced by individual consumers may vary widely depending on energy prices, appliance usage and useful life.

Some have argued that implicit discount rates estimated through an examination of actual consumer purchases of appliances and related consumer equipment would be a better basis for the consumer discount rate used under this program. Various studies have indicated that these implicit discount rates range from 3 percent to as high as 100 percent (or more) for certain appliances. However, because implicit discount rates are based on actual consumer purchase behavior, they also reflect the extent to which the numerous potential market failures in energy efficiency investments occur, such as inadequate information, conflicting owner/renter incentives, and second party (builder/contractor) purchases. One of the major reasons why Federal appliance efficiency standards were originally established was to overcome these market failures regarding investment in energy efficiency. Consequently, DOE does not believe unadjusted (i.e., not corrected for potential biases) discount rates derived from actual consumer behavior should be used in evaluating the economic impact of proposed standards on consumers.

This conclusion appears to be supported by court rulings affecting the program. In *Natural Resources Defense Council* v. *Herrington*, 768 F.2d 1355, 1406 (DC Cir. 1985), the court stated that "the entire point of a mandatory program was to change consumer behavior" and "the fact that consumers demand short payback periods was itself a major cause of the market failure that Congress hoped to correct." The Department believes that the intent of the legislation which established the appliance standards program is to achieve energy savings which are being foregone because of market failures which distort consumer decision-making (and behavior) from investing in energy efficiency.

However, if information were available on the implicit discount rates revealed by consumer decision-making in the absence of any significant market-failure biases, it might provide a better basis for the discount rates to be used in assessing the impacts on consumers of proposed appliance efficiency standards. Another approach might be to examine the rate of return consumers would require from other fixed investments of comparable risk and liquidity. The Department solicits information on the results of any analyses that could support the derivation of discount rates using either of these approaches.

On the other hand, the nature of the appliance standards program may imply that a household average required rate of return, whether based on actual appliance purchase decisions (in the absence of potential market failure distortions) or on comparable investments, may understate the appropriate rate. Because the Act requires minimum standards, their effect is generally greater on the low-efficiency, low purchase-price end of the market, sometimes eliminating the lowest-priced models. To the extent that low-income households purchase a disproportionate share of these low-efficiency/low-price appliances, they will be disproportionately represented among the affected consumers.

At the same time, limited empirical research [8] suggests that these households exhibit higher-than-average discount rates (i.e., required rates of return) across all of their time-sensitive decisions, including (but not limited to) their appliance purchases. If, indeed, these households are disproportionately affected by standards, their discount rates would need to be given greater weight in determining the effects of alternative standard levels on consumers. The Department seeks comment on this issue.

Based on the information now available, it appears that the average consumer discount rate lies in the range of 4 to 10 percent. As discussed above, the Department has used a 6 percent consumer discount rate for the analyses in this rulemaking. The Department has conducted sensitivity analyses using the 4 to 10 percent range and will continue to solicit data and comments that would provide a better basis for the derivation of consumer discount rates.

2. *Commercial discount rate.* For a discount rate that would be applicable in the fluorescent ballast analysis, the Department believes that one based on consumer expenses is inappropriate; the rate should be based on costs in the commercial sector, since fluorescent lamp ballasts are purchased for use primarily in that sector. In developing a rate for use in the commercial sector, the Department considered a procedure similar to the procedure used to develop a consumer discount rate, and examined possible methods of financing purchases of more efficient lighting equipment. One such method would be to finance a loan. For the most credit-worthy customers, the prime rate of interest would be applicable. Tables 15 and 21 of the DRI/McGraw-Hill *Review of the U.S. Economy; Long-Range Focus; Winter 1990–91* presented forecasts of prime interest rates and percentage changes in the consumer price index (CPI) for each year between 1995 and

[8] Train, Kenneth, Discount Rates in Consumers' Energy-Related Decisions: A Review of the Literature; Energy, December 1985.

2015. During this period, the prime rate is expected to be fairly stable, ranging from 8.37 percent to 8.50 percent. The changes in the consumer price index are projected to range from 3.88 percent to 4.90 percent. The resulting real rates of interest are projected to range from 3.55 percent in 2014 to 4.64 percent in 1995, with a 21-year average of 3.85 percent.

Most companies, of course, are not eligible for prime-rate loans. For them, the terms of borrowing are generally less favorable. While DRI/McGraw-Hill does not forecast long-term, non-prime loan rates, some insight can be gained from how such loans rates differ from prime loan rates.

Based on a telephone conversation with the Federal Reserve System, DOE learned that most commercial loans were in the 6 percent to 15 percent range. Using the higher rate, 15 percent, and deducting the applicable changes in the consumer price index, the Department calculated real rates of interest ranging from 10.1 percent in 2014 to 11.2 percent in 1995, with a 21-year average of 10.46 percent.

Alternatively, the Department looked at the divergence of the 15 percent loans from the then current prime rate; such loans were 50 percent greater than the 10 percent prime rate prevailing in 1990. By applying a 50 percent increase to the projected prime interest rates, the Department obtained nominal rates of interest of 12.56 percent to 12.75 percent. After a deduction of the expected changes in the consumer price index, real rates of interest ranged from 7.76 percent to 9.87 percent, averaging 8.05 percent over the 21-year period.

Another possible financing mechanism would be for the corporation to finance the purchase of the more efficient equipment by displacing investment capital. In Table 8 of DRI/McGraw-Hill's forecasts, there are annual projections of the after-tax costs of financial capital for each year between 1995 and 2015. After converting the numbers to pre-tax costs, and after deducting the expected changes in the consumer price index, the Department obtained the respective real rates of interest. The costs of financial capital are projected to range from 11.61 percent in 1995 to 12.86 percent in 2015. The consumer price index rates forecasts are the same as before, and the resulting real finance rates range from 7.67 percent in 2000 to 7.96 percent in 2015, with the 21-year average being 7.86 percent.

Of the different possible means of companies paying for conservation improvements in lighting equipment, the range of real rates of interest is from 3.55 percent to 11.12 percent.

Economic theory suggests that in deriving a commercial discount rate, the Department should consider the opportunity costs of commercial investments that were foregone. Therefore, the Department also investigated real rates of return from commercial investment activities between 1961 and 1990. These data were compiled from Annual Statistical Digests of the Board of Governors of the Federal Reserve System. The variables that were examined were commercial trade credit, i.e., bankers acceptances; time deposits, i.e. certificates of deposits; U.S. Treasury securities; and commercial paper. During the 30-year period, the average real investment returns realized in the commercial sector ranged from 2.02 percent for bankers' acceptances (which constituted 70 percent of the investment dollars), to 2.29 percent for investments in Treasury securities (which constituted 9 percent of commercial investment dollars).

When more risky investments, such as tax-exempt (class B) and corporate (AA) bonds were examined, their real rates were 1.27 percent and 3.52 percent, respectively, over the 1970-to-1986 period. These real rates, too, were substantially outside of the purchase finance range. The real rates for such bonds in earlier years also fell below the purchase financing range of rates.

After considering the above, the Department elected to use four percent as the commercial discount rate. The Department believes that this rate approximates the real costs likely to be incurred by private businesses which are able to finance small additional investments in energy efficiency by reducing relatively liquid corporate investments, e.g., bankers' acceptances, or by obtaining loans at or near the prime interest rate, without diminishing their normal business investment.

However, if increasing investments in more energy efficient technology are assumed to displace other, more profitable business investments, or would require loans available only at more typical commercial interest rates, the approximate discount rate would be higher. For example, between 1980 and 1991, the real rates of return to nonfinancial corporations averaged between 7 and 8 percent based on data contained in Table 1.16 of the National Income and Product Accounts, as presented in the Department of Commerce's *Survey of Current Business* and, as noted above, real commercial interest rates often exceeded 7 percent.

The Department invites comment on the most appropriate methodology upon which to base the commercial discount rate and the best types and sources of data to use in the calculation of this rate.

3. *Social discount rate.* In identifying a discount rate that is appropriate for use in calculating benefits to the Nation as a whole, the Department must consider the opportunity costs of devoting more economic resources to the production and purchase of more energy-efficient appliances and fewer national resources to other alternative types of investment. It is not necessary, however, to determine the characteristics of specific classes of consumers or businesses directly impacted by the proposed standard. For these reasons, a broad measure of the average rates of return earned by economic investment throughout the United States is the most useful basis for a social discount rate.

Using this approach, the Office of Management and Budget prepared a Background on OMB's Discount Rate Guidance in November of 1992, containing an analysis of the average annual real rate of return earned on investments made since 1960 in nonfinancial corporations, non-corporate farm and non-farm proprietorships, and owner-occupied housing in the United States. The results of this analysis indicated that since 1980, the annual real rate of return for these categories of investments averaged slightly more than 7 percent, ranging from a low of about 4 percent for owner-occupied housing (which represented about 43 percent of total capital assets in 1991 of about $15 trillion) to a high of about 9 percent on non-corporate farm and non-farm capital (which represented about 23 percent of the total). Between 1960 and 1980, the average real rate of return on capital was higher, averaging about 8.5 percent in the 1970's and about 11.2 percent in the 1960's. As a result of this analysis, the Office of Management and Budget chose to designate 7 percent as the social discount rate specified in revisions to Office of Management and Budget Circular A–94 issued on November 10, 1992 (57 FR 53519). In that revised circular, Office of Management and Budget established, *inter alia*, discount rate guidance for benefit-cost analyses of regulatory programs that provide benefits and costs to the general public.

An alternative method for deriving such social discount rate might be broad measures of the costs of financing capital investments in the United States. One such measure is the Federal Government's cost of borrowing or the interest rate that is payable on long-term Government securities. Another might be the prime interest rate available to

major corporate borrowers. In order to derive a real discount rate from either of these measures the relevant interest rate would be adjusted for inflation.

With regard to long-term Government securities as an example, the nominal rates during June 1991 on Government securities maturing between the years 2000 and 2015 averaged 8.55 percent. Adjusted by long term forecasts of inflation, the rate would be approximately 4 percent. Because the Government borrowing rate most accurately reflects the direct cost to the Government of added investment, the Office of Management and Budget has used this approach as the basis for discount rates used in evaluating Federal investments which directly affect Federal costs (such as energy efficiency investments in Federal facilities). Using the prime interest rate or some combination of rates to reflect non-Federal financing costs would result in somewhat higher rates.

As indicated above, because the cost of financing additional capital investments does not reflect the full opportunity cost of shifting private investment from one area to another, it is not considered to be a good basis for deriving discount rates. For this reason, DOE is now proposing the use of a 7 percent social discount rate in National net present value calculations, although it will also perform sensitivity analyses at 4 percent and 10 percent. The Department seeks comment on appropriate discount rates for the analysis.

Life-Cycle Cost Analysis

Another consumer issue that drew a considerable number of comments was the suggestion that in its life-cycle cost analyses, the Department include any additional installation and maintenance expenses that may result from conservation standards. (Southern Gas Association, No. 4 at 10; Energen, No. 12 at 2; American Gas Association, No. 23 at 2; Florida Energy Office, No. 42 at 1; Southern Natural Gas Company, No. 46 at 1; Montana-Dakota Utilities Company, No. 54 at 4; Laclede Gas Company, No. 55 at 4; Oklahoma Natural Gas Company, No. 57 at 3; ENTEX, No. 58 at 4–5; Gas Research Institute, No. 59 at 1; Arkansas Western Gas Company, No. 64 at 7; Piedmont Natural Gas Company, No. 71c at 4; Public Service Company of North Carolina, Inc., No. 74 at 4; Southern California Gas Company, No. 79 at 1; and Louisiana Gas Service Company, No. 81 at 2).

In each of the consumer analyses, such as payback and life-cycle costs, the Department did include all incremental expenses caused by standards. For those design options entailing additional maintenance expenses (beyond the base case), the incremental maintenance expenses were included in the consumer price of the design option. Installation expenses that were specific to the design option and independent of the application were also included in the consumer price of the design option.

Regional and Other Variations in Impacts

Several comments recommended that the Department look at regional variations in usages of some climate-sensitive products, e.g., direct heating equipment. (Southern Gas Association, No. 4 at 10; United Texas Transmission Company, No. 26 at 3; Florida Energy Office, No. 42 at 1; Arkansas Western Gas Company, No. 64 at 3; and Minnegasco, No. 83 at 2.).

The standards analysis assumes that nationwide average appliance usage rates, energy prices, and efficiency applied to all consumers in all areas of the nation, although the Department recognizes that there exist large variations in each of these factors. However, the Department did conduct a sensitivity analysis on the life-cycle cost for energy prices by substituting various high and low regional prices for national prices. The results of these sensitivities are presented in the Technical Support Document. See Technical Support Document, Chapter 4. However, these sensitivity analyses were performed at the national level, and no effort is made to link them with any specific population groups.

The Department seeks information concerning the extent to which any proposed national efficiency standard is likely to affect identifiable groups of consumers disproportionally and how best to consider such impacts in the selection of efficiency standard levels. The Department is also seeking additional data to help it better assess the disproportionate impacts on such groups.

Usage

On a related issue, numerous comments suggested that the usage variables the Department should use are those that are calculated from field usage data. In addition, many of the comments provided estimates of annual operating expenses of several of the appliances, e.g. water heaters, direct heating equipment, and ranges and ovens. (Southern Gas Association No. 4 at 4; —— American Council for an Energy Efficient Economy, No. 6 at 2; Whirlpool Corporation, No. 31 at 17, 19; Washington Gas Light, No. 37 at 5; Lone Star Gas Company, No. 39 at 3; Gas Appliance Manufacturers Association, No. 40 at 8; Columbia Gas, No. 45 at 3; Southern Natural Gas Company, No. 46 at 1; Montana-Dakota Utilities Company, No. 54 at 3; Laclede, No. 55 at 4; Oklahoma Natural Gas Company, No. 57 at 3, 5; Association of Home Appliance Manufacturers, No. 61A at 36; Arkansas Western Gas Company, No. 64 at 6; Peoples Natural Gas Company, No. 65 at 1; Northern Minnesota Utilities, No. 68 at 1; Minnegasco, No. 83 at 2; and Flair, No. 85 at 2).

The Department appreciates the data it received. The Department also obtained data on unit energy consumption by appliance type, principally from utility companies. The Department reviewed the data received from all sources and generated what it believes are the best estimates of energy consumption which are contained in the proposed test procedure amendments for mobile home furnaces, direct heating equipment, pool heaters and kitchen ranges and ovens discussed above, and were used in the analyses for today's notice.

As noted above, regional energy prices were used in sensitivity analyses. Additionally, in the proposed test procedure amendments, the usage for mobile home furnaces and direct heating equipment have been modified from a national basis to a regional one to reflect the mostly regional distribution of these products.

Rebound Effect

Two comments raised the issue of rebound effects, which occur when an appliance that is made more efficient is used more intensively, so that the expected energy savings from the efficiency improvement do not fully materialize. (American Council for an Energy Efficient Economy, No. 6 at 5; Washington Gas Light, No. 37 at 2). American Council for an Energy Efficient Economy commented that the consumer sees and reacts to his or her total utility bill, so any efficiency change in a particular product that has a small impact on his or her total utility bill should not affect usage behavior. Washington Gas Light suggested that usage elasticities should be decided by rigorous analyses of regional appliance usage characteristics.

In this rulemaking, the rebound effects assumed were: 30 percent for direct heating equipment and mobile home furnaces, 20 percent for room air conditioners, and 10 percent for ranges and ovens. These percentages represent the amounts by which the potential

energy savings from standards are reduced.

There is, however, an argument that the usage elasticities/rebound effects for at least some household uses of energy may be substantial. Within a household, the price elasticity of demand will be an average of the elasticities of demand for each end use, e.g. appliance. For example, suppose the price elasticity of demand at the household level is .3. If some levels of appliance usage (say refrigerators) are insensitive to price changes, i.e., zero elasticity, then at least one other use must have an elasticity in excess of .3.

If the usage elasticity for a product is identical to the price elasticity of demand for the energy the product uses, then it follows that the weighted average of the usage elasticities of all household uses must equal the household price elasticity of demand. Since the appliances subject to energy efficiency standards account for more than 80 percent of household consumption, it would be unlikely that all appliances would have usage elasticities less that the overall household price elasticity of demand.

According to the Energy Information Administration, the household price elasticity of demand for electricity is about .15 in the short run and upward of .7 in the long run. Thus usage elasticities, should, on average approximate these estimates. The Department seeks comments on this argument.

Marginal Electricity Rates

American Council for an Energy Efficient Economy, Natural Resources Defense Council, and Washington Gas Light all urged the Department to use marginal electricity rates rather than average ones. (American Council for an Energy Efficient Economy, No. 6 at 6; Natural Resources Defense Council, No. 13 at 18; and Washington Gas Light, No. 37 at 3). American Council for an Energy Efficient Economy and Natural Resources Defense Council both stated that since room air conditioners are run disproportionately during periods of peak utility load (when rates are the highest), the use of average electricity rates will undervalue the electricity savings from improved efficiency.

The Department agrees that use of average electricity prices can produce inaccuracies and does attempt to use energy prices specific to each end use. In the past, electricity rates have been assumed higher for air conditioning than for other end uses, based on survey data of consumer expenditures, disaggregated according to equipment ownership. The consumer analysis for this proposed rule continues to distinguish energy prices by end use, based on such survey results.

Washington Gas Light added that in addition to using marginal electricity prices, the Department should use the All-Ratepayers Test when measuring the cost effectiveness of a standard level. This test was developed by the California Public Utilities Commission, and it measures the impact of an action on all ratepayers, including non-participants in the conservation activity. (Washington Gas Light, No. 37 at 13).

In this program the Department examines the effect of energy conserved by each purchaser of a more efficient appliance, but does not examine the effects that the aggregate conservation effects would impose on the rates charged within a given utility. The impacts on any system's rates from increased energy standards would depend on the participation rates of its customers in the conservation activity and the particular financial position of the utility.

Several comments discussed the impact of energy conservation standards on low-income people. (Rocky Mountain Institute, No. 15 at 2; Southern Union Gas Company, No. 46 at 1; Laclede, No. 55 at 5; Oklahoma Natural Gas Company, No. 57 at 5; and Public Service Company of North Carolina, Inc., No. 74 at 5). While the Rocky Mountain Institute stated that with improved energy efficiency, the prices of used appliances could be expected to decline in the short run, the other comments all stated that the higher prices that would be caused by improved efficiency standards on new units would have price-increasing effects on used appliances and, therefore, be harmful for lower-income and elderly consumers on fixed incomes.

The Department conducted literature searches on purchasing and usage decisions in low-income households, to determine whether the inputs of the consumer analysis should be adjusted to account for differences between low- and average-income households. There was no information available on which to base any changes to the consumer analysis.

Lighting Prices

Another consumer issue was raised by Valmont Electric, which stated that new energy conservation standards on fluorescent ballasts would raise the retail prices of such ballasts, thereby impeding the conversion from incandescent lighting to fluorescent lighting. (Valmont Electric, No. 16 at 2).

Conversions from incandescent lighting to fluorescent lighting occurs principally through compact fluorescent bulbs, the ballasts of which are not included as part of the review of the legislated fluorescent ballast conservation standards. Any revised energy conservation standards on fluorescent ballasts will not affect the prices of compact fluorescent bulbs and thereby slow the conversion from incandescent to fluorescent lighting.

Heat Pump Water Heaters

On the issue of consumer acceptance of heat pump water heaters, Crispaire Corporation stated that studies show consumer satisfaction with them. (Crispaire Corporation, No. 19 at 1). In addition, the company provided attachments with estimates of unit energy consumption and annual performance factors for heat pump and resistance water heaters.

The Department appreciates the information provided and used the cited studies in developing data for the consumer analysis and forecasting efforts.

Appliance Lifetimes

Two comments discussed product lifetimes. Wisconsin Blue Flame Council stated that pilot lights decrease condensate, thereby extending the tank life of gas water heaters. (Wisconsin Blue Flame Council, No. 33 at 2).

The Department based product lifetimes on an analysis comparing recent replacement sales to historical shipments, and researched the effects of particular design options on product life.

Air Energy Heat Systems said that the lifetime of heat pumps for pool heaters is approximately the same as for air conditioning, if the water chemistry of the pool is maintained in proper balance. (Air Energy Heat Systems, No. 44 at 1).

The Department did not analyze heat pump pool heaters because no test procedure is available.

Modeling

There were several issues raised with regard to the forecasting efforts in the analyses. For example, Natural Resources Defense Council suggested that the Department model uncertainty, not point forecasts in economic growth and consumer choice and further suggested that the Department could model uncertainties in economic growth by modeling high-, mid-, and low-growth scenarios. (Natural Resources Defense Council, No. 13 at 35–36).

The Department recognizes that all forecasts contain uncertainties. The

principal method by which DOE has accounted for uncertainties has been through sensitivity analyses, which, in the past, have been performed on equipment prices, energy prices, projected equipment efficiencies and market discount rates (the last of which models uncertainties in consumer choices of efficiency).

The Department favors an explicit representation of the uncertainty in the forecasts. Clearly, the best representation would be a statistical treatment of the uncertainty in each of the important variables, including the coefficients used in the Lawrence Berkeley Laboratory Residential Energy Model. At this time, however, such a specification of the distribution of each of the variables and coefficients does not exist. As the Lawrence Berkeley Laboratory Residential Energy Model is updated, such distributions will be generated, which will allow the Department to work towards the capability to perform an uncertainty analysis in the model. Until then, the Department will model uncertainties with sensitivities.

On the other hand, Natural Resources Defense Council endorsed the Department's different assumptions used when calculating energy savings and net present value. (Natural Resources Defense Council, No. 13 at 36).

For this rulemaking, the Department maintained the current methodologies for calculating energy savings and net present value.

Ballast Energy; Use Forecasting

Advance Transformer Company recommended that the Department exclude fluorescent lamp ballasts from incorporation in the Lawrence Berkeley Laboratory Residential Energy Model because of their small number of sales in the residential sector. (Advance Transformer Company, No. 25 at 3).

The Department did exclude fluorescent lamp ballasts from incorporation in the Lawrence Berkeley Laboratory Residential Energy Model. Instead, the Department analyzed fluorescent lamp ballasts in the commercial sector using the Electric Power Research Institute end-use model and the Commercial Energy End-Use Model.

Television Sets

With regard to television power and usage forecasts, the Electronics Industries Association stated that television sets of newer vintage draw less power than those of older vintage. To support this, Electronic Industries Association presented data for the period 1967–1991. (Electronic Industries Association, No. 30 at 2).

Thomson Consumer Electronics, Inc. provided data on the energy consumption of color televisions by size, and asserted that the most important factor in energy usage is viewing habits, specifically, the number of concurrently operating televisions in a household, the number of daily operating hours for each receiver, and control settings, i.e., brightness and sound levels. (Thomson Consumer Electronics, Inc., No. 49 at 3–5).

The Department welcomes the additional data provided in the comments. The Department agrees that the energy consumption of a television set is a function of vintage. It was included in a previous analysis [9] and is included in the analysis for this proposed rule.

The Department also agrees that the number of television sets per household and number of viewing hours are determinants of energy usage, and included these factors in its forecasts. On the other hand, while the Department recognizes that control settings are important, it does not expect them to be different in the future than from today, and, therefore, it did not forecast them.

Lawrence Berkeley Laboratory Residential Energy Model

Two comments addressed the Lawrence Berkeley Laboratory Residential Energy Model methodology and documentation. Whirlpool Corporation stated that it had no strong concerns with the Lawrence Berkeley Laboratory Residential Energy Model at this time. (Whirlpool Corporation, No. 31 at 1). The Florida Energy Office said that the Department should document, well before the final rule, all model assumptions. In addition, the Florida Energy Office offered to provide Florida-specific data to the Department. (Florida Energy Office, No. 42 at 2, 6).

The Department will continue to use the basic Lawrence Berkeley Laboratory Residential Energy Model methodology, but will incorporate updates to data and coefficients for specific products as new analyses proceed. The model assumptions and data for this rulemaking are documented in the Technical Support Document accompanying this proposed rule.

[9] U.S. DOE Technical Support Document: Energy Conservation Standards for Consumer Products: Refrigerators, Furnaces, and Television Sets, DOE/CE–0239, November 1988.

Lawrence Berkeley Laboratory-Manufacturer Impact Model

1. *Modeling.* There were numerous comments on the manufacturer impact analysis. The Association of Home Appliance Manufacturers and Whirlpool Corporation made several suggestions for improving the modeling of manufacturer impacts.

The Association of Home Appliance Manufacturers suggested that the Department devote more modeling efforts to developing demand curves that are empirically verifiable. (Association of Home Appliance Manufacturers, No. 61A at 66).

In response, the Department notes that many of the demand curves used in the Lawrence Berkeley Laboratory-Manufacturer Impact Model were derived from those that were empirically estimated by Oak Ridge National Laboratory in 1976.[10] The Department recognizes that a project to update the demand curves could be useful, considering the age of the data currently being used. The Department does not believe that such data exist. However, the Department requests that if such data does exist that it be submitted as comment on today's proposed rule.

2. *Product mix.* The Association of Home Appliance Manufacturers stated that the Lawrence Berkeley Laboratory-Manufacturer Impact Model should, but does not, take into account the effect that standards have on the relative prices among product classes, which in turn will change the product mix demanded by the market. (Association of Home Appliance Manufacturers, No. 61A at 67).

The Department did take cross-elasticity effects into account in the analysis of water heaters (between electric and gas fuels) where they were particularly important, and will continue to look for instances where such effects may arise in order to take those effects into account as warranted. (See Technical Support Document, Volume F, Appendix B).

3. *Market power.* The Association of Home Appliance Manufacturers was critical of the way the Department models marketplace monopsony power, i.e., the market power of purchasers. In its critique, the Association of Home Appliance Manufacturers stated that the ability of manufacturers to pass on increased costs to the consumer is limited because their customers are primarily a group of large and sophisticated retailers who have

[10] Lin, Hirst, and Colon, Fuel Choices in the Household Sector, ORNL Report Con-3 Oak Ridge National Laboratory, 1976.

significant and increasing power in the marketplace, and who exert downward pressure on the retail prices of appliances. It further stated that the Lawrence Berkeley Laboratory-Manufacturer Impact Model attempts to model the situation by modeling a larger number of manufacturers than actually exist in the marketplace. The Association of Home Appliance Manufacturers said that no theoretical underpinnings were given for this assertion and that there is no reason why the predictions of this "false model" should have any resemblance to what actually transpires in the real world. (Association of Home Appliance Manufacturers, No. 61A at 67–68).

The Department believes that oligopsony power itself could probably be modeled analogously to oligopoly power. There is, however, no accepted theory on the modeling of an industry characterized by both oligopoly and oligopsony. Thus, DOE detailed the assumptions and relevant mathematical derivations of the approach in the aforementioned Technical Support Document for the final rule for dishwashers, clothes washers, and clothes dryers. The approach is to increase the number of firms input into the Lawrence Berkeley Laboratory-Manufacturer Impact Model until the markups that are actually observed in the marketplace are achieved; this is also an obvious implication of The Association of Home Appliance Manufacturers's comments that manufacturers' ability to pass on costs is limited. In fact, the most prominent comments from a review panel on the Lawrence Berkeley Laboratory-Manufacturer Impact Model indicated a concern that the modeling assumptions had gone too far in the direction of reduced markups.[11]

4. *Individual firm.* There were also three comments critical of the Department's modeling of an individual firm. It was argued that the use of a "typical firm" does not address the differential impacts of standards on companies, e.g., sizes, costs, niche markets. The Association of Home Appliance Manufacturers insisted that the Department could address the lack of data in performing this type of analysis by researching the economic literature or by developing an economic theory of how different classes of manufacturers would be affected by standards. Whirlpool Corporation suggested addressing the data problem by putting a range on the cost and margin data. (Advance Transformer, No. 25 at 3; Whirlpool Corporation, No. 31 at 1; Association of Home Appliance Manufacturers, No. 61A at 68–69).

The problem is essentially a lack of data. The Department's review of the economic literature offered no solution to this problem. The Department does analyze the cost and margin data (in addition to other parameters) by performing a sensitivity analysis where the Department changes those parameters (and others) in the model, and tests the sensitivity of the model's results.

During interviews conducted with manufacturers, the Department asked a series of questions covering the effects of firm size and specialization. To date, DOE has not been given information by the industry to draw conclusions about probable effects.

While it would be desirable to analyze the impact of standards on the distribution of firms in an industry, fundamentally, this requires detailed information on how individual firms differ from the norm.

Stating that the primary concern to manufacturers is the short-run industry impact from standards, Whirlpool Corporation and the Association of Home Appliance Manufacturers called for the Department to present greater focus on, or explanation of, short-run impacts. (Whirlpool Corporation, No. 31 at 1; Association of Home Appliance Manufacturers, No. 61A at 69–70).

There are limitations to such an analysis. While general impacts may be understood, the specific details of how each firm reacts at each point of the short-run adjustment process are beyond the ability of economic theory to elucidate. The Department believes that it has treated the short run properly by modeling it on the short-run impact of the downturn from a business cycle. In addition, in considering standard levels to propose, the Department did take explicit account of the short-run Lawrence Berkeley Laboratory-Manufacturer Impact Model results.

The Association of Home Appliance Manufacturers suggested that more detailed analysis of the impacts on individual firms and other areas should be done. The Association of Home Appliance Manufacturers commented that an analysis of how industry will fare, on average, belies the very serious effects that adjustment can have, especially if standards force a company in a small community to close. Therefore, it is important, the Association of Home Appliance Manufacturers believes, that DOE evaluate these potential short-term and individual company impacts. (Association of Home Appliance Manufacturers, No 61A at 70).

In the analyses to date, the Department has used industry profitability as the best single indicator of plant closures and other significant disruptions on manufacturers. Further, the primary impact variables of returns on equity, net income, revenue, price, and shipments have been presented as the best summary statistics with which to capture the significant impacts resulting from standards.

5. *Multiple standards.* In another comment, the Association of Home Appliance Manufacturers stated that firms face constraints on the share of their resources that can be devoted to meeting each new wave of conservation standards from DOE. The cumulative impact of each new rulemaking on manufacturers' resources must be considered in evaluating manufacturer impacts. (Association of Home Appliance Manufacturers, No. 61A at 70–72).

The Lawrence Berkeley Laboratory-Manufacturer Impact Model is designed to analyze the impact of standards on industry profitability for an individual appliance. To date, this has involved treating each manufacturer of a subject product as a separate company. Recognizing, however, that many of the manufacturers produce more than one appliance type subject to these rulemakings, and recognizing that those companies may have limited resources to comply with the requirements of all of the relevant regulations, the Department is presently seeking approaches to account for the cumulative effects on a multi-product company of the appliance conservation standards that it promulgates and requests comments in this regard.

6. *Variable costs.* On another manufacturer issue, Whirlpool Corporation criticized the Department's assumption that pricing relates only to variable costs. Whirlpool Corporation suggested, instead, that changes in fixed costs do have an impact on pricing in an industry. (Whirlpool Corporation, No. 31 at 1).

The Department acknowledges that firms may try to pass on fixed costs; however, standard economic theory concludes that even monopolists will find this unprofitable, and will eventually decide not to try it. The Department has seen no argument or evidence to the contrary. It is interesting to note that if Whirlpool Corporation were correct, the manufacturers who decided to do so would be impacted far more favorably by standards than the Lawrence Berkeley Laboratory-Manufacturer Impact Model predicted.

[11] Lawrence Berkeley Laboratory, Manufacturers Impact Model (MIM) External Review Panel Meeting, January 11, 1990.

Consumer Demand

Whirlpool Corporation stated the Department assumes that consumers will pay more for energy efficiency. Whirlpool Corporation claims studies have shown this has not been true. In support, Whirlpool Corporation supplied a list of 20 key buying factors from an August 1988 McKinsey study. Energy efficiency placed tenth in consideration for kitchen products. (Whirlpool Corporation, No. 31, at Attachment 2).

The Department notes that energy efficiency placed ahead of other factors such as "lowest price available among similar makes and models," "has an extended service agreement at a fair price," and "runs quietly." These results tend to support the Department's position that consumers are willing to pay for energy efficiency.

Rebuttable Presumption

For consideration of rebuttable presumptions, the Association of Home Appliance Manufacturers stated that incremental payback, not cumulative payback, are the appropriate payback for standards. (Association of Home Appliance Manufacturers, No. 61A at 64).

Since the legislation requires that payback be considered from a standard level compared to the base case, DOE believes that only cumulative payback may be used for the rebuttable presumption determination. Additionally, the other impacts of appliance conservation standards on energy use, consumers, manufacturers, and other factors were determined by comparing projections under the base case [12] with the projections under the proposed standards.

Standards Decision Making

Natural Resources Defense Council and the Rocky Mountain Institute addressed the Department's standards selection criteria. Both Natural Resources Defense Council and the Rocky Mountain Institute stated that in deciding the economic justification of standards, the Department should not be attempting to maximize the economic benefits to consumers, but should instead be maximizing energy savings. (Natural Resources Defense Council, No. 13 at 16; Rocky Mountain Institute, No. 15 at 2).

In response, the Department recognizes that the basic statutory direction to set standards is to achieve the "maximum improvement in energy efficiency that the Secretary determines is technologically feasible and economically justified" (section 325(l)(2)(A). DOE notes that the economic impact of standards on consumers is only one of the factors the Department considers in reaching its decision to set conservation standards. Other factors include impacts on manufacturers and on national benefits and costs. However, regarding consumer benefits, while the minimum consumer life-cycle cost point is selected as a trial standard level, and in many cases, the most stringent standard level that the Secretary determined was economically justified coincided with that level, several of the proposed standard levels have life-cycle costs that exceed the minimum life-cycle cost. Thus, maximizing consumer benefits does not take precedence over maximizing energy savings.

Natural Resources Defense Council further stated that in deciding on standard levels, the Department must first consider the most stringent level of efficiency, i.e., the "max tech" level, and if it is economically justified, DOE must set the standard at that level. If it is not economically justified, DOE must then consider the next most stringent level, and if economically justified, set the standard at that level. (Natural Resources Defense Council, No. 13 at 17).

The Department does consider candidate standard levels in this manner. However, in making its determination as to whether a standard is economically justified, the Department considers both: The benefits and costs of the standard level under consideration relative to the base case; and how these benefits and costs compare to the benefits and costs of other standards analyzed by the Department in the technical support document for this rule.

Currently the costs and benefits of all candidate standard levels are analyzed in comparison to the base case. However, it is possible that more direct comparisons of the impacts of different standard levels may be useful. In light of the above, the Department specifically solicits comment on whether any incremental perspectives would be useful and valid in the determination as to whether a particular standard level is "economically justified."

The Florida Energy Office stated that after considering all relevant costs and benefits over the life of the appliance, the Department should set standards at the highest levels that are cost-effective to the nation. (Florida Energy Office, No. 42 at 1).

As stated above, consideration of the national costs and benefits of the impacts of candidate standard levels was one of the factors considered in this rulemaking. (See Technical Support Document, Chapter 8.)

External Costs and Benefits

A number of comments on the Advance Notice of Proposed Rulemaking urged the Department to consider the external costs and benefits in its economic analyses of the efficiency standards proposed in this Notice of Proposed Rulemaking. For example, the American Council for an Energy Efficient Economy suggested that DOE account explicitly for environmental costs in its economic analysis. (American Council for an Energy Efficient Economy, No. 6 at 6.) In addition, Public Citizen stated that the Department should include in its analyses all external costs and benefits, e.g., environmental quality, national security, and reduced energy imports. (Public Citizen, No. 7 at 4.)

The Sierra Club stated that the difference between "Consumer Analysis" and "Life-Cycle Cost Analysis" is difficult to ascertain. They urged DOE to evaluate, as part of the Consumer Analysis; (a) environmental external costs; and, (b) national security and balance-of-payments costs of increased/decreased oil consumption. (Sierra Club, No. 43 at 2.)

The Ohio Office of the Consumers' Council said that the consumer and utility analyses should include monetization of externalities (environmental and security) such as sulfur oxides, carbon monoxide, carbon dioxide, nitrogen oxides, particulate, and other air, water, and land use impacts of energy production and use. Such considerations should be consistent with current trends in state utility regulations. (Ohio Office of the Consumers' Council, No. 60 at 2.)

The Department recognizes that appliance standards may generate external societal benefits arising from reductions in oil imports, and emissions of SO_2, NO_x, and CO_2 and perhaps other pollutants. In this proposed rulemaking, as in previous rulemakings, the Department derives the quantities of oil savings and emissions reductions associated with the estimated energy demand reductions expected to result from the proposed standards, but does not attach any externality values to these benefits. In a separate Advance Notice of Proposed Rulemaking for three products (58 FR 47326, September 8, 1993), the Department has indicated

[12] The base case assumes implementation of the conservation standards that were set by the Act for central air conditioners and central air conditioning heat pumps and furnaces and by Department of Energy rulemaking in the case of refrigerators-freezers and freezers and small gas furnaces.

that it would be desirable to establish monetary values for these external benefits, if sound analytical bases can be found for doing so. The Department will attempt to develop and use such monetary values in the analysis of the likely impacts of updated standards for these three product categories. However, because there is no consensus on how to undertake the analysis underlying estimates of such environmental and energy security externalities, the Department is not yet able to set monetary values for such externalities accurately enough to be useful in the current rulemaking.

Standards

1. *Regional standards.* On another standards determination issue, the Association of Home Appliance Manufacturers stated opposition to the setting of regional standards for room air conditioners. (Association of Home Appliance Manufacturers, No. 61A at 22.)

The Department is not setting regional standards, but did conduct a sensitivity analysis on life-cycle cost for room air conditioners because their energy use is affected by climate. The sensitivity analysis considered regional energy prices and usage.

2. *Corporate average fuel economy.* The Rocky Mountain Institute stated that the Corporate Average Fuel Economy standards for appliances, like the Corporate Average Fuel Economy for automobiles, could allow for the gradual phase-in of technologies that are substantially different from the present, less-efficient technologies, e.g., horizontal-axis clothes washers and heat pump water heaters. (Rocky Mountain Institute, No. 15 at 3.)

The Department acknowledges that some stringent standard levels could involve radical industry manufacturing changes and recognizes that a Corporate Average Fuel Economy-type approach to such standards could help to ease industry's transition to producing these more efficient appliances. The Department believes, however, that the Act precludes that option since the statute requires any covered product to meet the energy conservation standard.

3. *Fuel switching.* Several of the comments in this area dealt with the standards selection criteria for specific products. For example, Peoples Natural Gas Company stated a concern that standards could unintentionally increase energy consumption by forcing a switch from gas water heaters to electric. Peoples Natural Gas Company recommended limiting standards-induced price increases to consumers for gas water heaters to 120 percent of the standards-induced price increases for electric resistance water heaters. Peoples Natural Gas Company contended that this would avoid switching from gas to electric by price-sensitive consumers, such as home builders and low-income homeowners. (Peoples Natural Gas Company, No. 28 at 1).

In response, the Department analyzed standard levels by the methodology proposed in the September 1990 advance notice, wherein fuel switching was accounted for as part of the Lawrence Berkeley Laboratory Residential Energy Model's forecasting of economic impacts. While some fuel switching did occur (electric water heaters are projected to increase their share of the market from 45.5 percent to 50.3 percent, as shown by Table 3.4 of Volume F of the Technical Support Document), the Department does not believe it occurred because of the relative equipment price increases since the price of electric water heaters are projected to increase much faster than that of gas, as presented in Section IV below. The Department ascribes the fuel switching that is projected to occur to the relative increase in the price of gas compared to electricity as shown in Table 5.5 of Volume A of the Technical Support Document.

Impacts on Manufacturers

The Association of Home Appliance Manufacturers contracted with Arthur D. Little, Inc. to prepare a report on the Department's analysis of top-loading, horizontal-axis clothes washers. In that report, entitled "Financial Impact of DOE Top-Loading Horizontal Axis Standards on U.S. Washing Machine Manufacturers," Arthur D. Little listed a number of criticisms of the Lawrence Berkeley Laboratory-Manufacturer Impact Model and suggested that the Department use a "Cash Flow Model," instead. (Association of Home Appliance Manufacturers, Nos. 61D and 61E). Although clothes washers have been dropped from this rulemaking, as discussed below, many of Arthur D. Little's comments have general applicability to the other appliances.

One of Arthur D. Little's criticisms of Lawrence Berkeley Laboratory-Manufacturer Impact Model involved that model's consumer preference assumptions. Arthur D. Little stated, "The combination of price and energy savings account for under two-thirds of the basis of selection. Thus, the Manufacturer Impact Model at best is taking into account a little less than two-thirds of the consumer's decision to purchase." Arthur D. Little concluded, "neglected features seriously distort the prediction of consumer's * * * well being." (Association of Home Appliance Manufacturers, No. 61E at 25.)

The Department intends to set standards that do not reduce consumer utility, a gauge of well being, by establishing product classes that protect utility. While utility is sometimes a matter of degree, instead of an open and shut case, the basic concept is the establishment of classes that protect a less efficient, but desirable, feature such as the through-the-door ice service for refrigerators. Since the establishment of classes is performed before the manufacturer impact analysis, it is appropriate for the Lawrence Berkeley Laboratory-Manufacturer Impact Model to assume there is no difference in consumer utility between an appliance meeting the different trial standard levels. Furthermore, since standards are intended to affect only an appliance's energy efficiency (which usually is positively related to price), modeling consumer response only to changes in those variables is reasonable.

The Arthur D. Little report was also critical of the Lawrence Berkeley Laboratory-Manufacturer Impact Model's treatment of market power issues. The report stated that the manufacturer analysis concludes that manufacturers can set their own prices because the manufacture of the product is concentrated in the hands of a small number of producers. (Association of Home Appliance Manufacturers, No. 61E at 27.) Furthermore, the report asserted that within the Lawrence Berkeley Laboratory-Manufacturer Impact Model, mark-up is countered only by a very weak consumer reaction, as measured by the elasticity of demand relative to the purchase price of the appliance and its operating expense. (Association of Home Appliance Manufacturers, *Id.*)

A major difference that exists in the manufacturer impact analysis performed for today's notice and typical manufacturer experience to increasing prices is that the analysis assumes that all manufacturers in the industry will have to increase prices to meet the standard. This is a very different scenario from an individual firm raising its prices independently from its competitors. To accomplish the analysis, the Lawrence Berkeley Laboratory-Manufacturer Impact Model uses two elasticities; an individual firm elasticity, which is used to establish price, and an industry elasticity, which is used to establish sales. The individual firm elasticity used by the Lawrence Berkeley Laboratory-Manufacturer Impact Model is greater than the industry elasticity, and is such that if a

firm raises prices it loses sales. It is this price elasticity faced by the individual firm that determines how much the firm can mark up price. However, the initial effect of this elasticity is tempered in the model by the fact that the firm's competitors are also raising prices until equilibrium is reached between increased costs to meet the standard and increased prices. The consumer reaction to this higher price is then calculated by the industry elasticity, which is the consumers' responsiveness to having the appliance or not, as opposed to buying it from a competing seller for less. Since the Department considers the whole industry to be affected by standards, a resulting rise in the general level of prices for an appliance would likely have a relatively weak aggregate consumer reaction.

In addition, the Department notes that in Arthur D. Little's own "cash flow" model, long-run sales of appliances are seemingly unaffected by price; Arthur D. Little has assumed there is no consumer reaction to price, or in other words, a price elasticity of zero.[13]

This assumption would imply that manufacturers were completely free to set price at any level they wanted.

Another area in which the Arthur D. Little report was critical of the Lawrence Berkeley Laboratory-Manufacturer Impact Model was in the treatment of dynamic adjustment issues. As Arthur D. Little's report stated, "To determine the impact on manufacturers, the Manufacturer Impact Model only examines two static cases * * * and misses important changes in the health of the industry [during the adjustment period]." (Association of Home Appliance Manufacturers, *Id.*).

The "two static cases" to which Arthur D. Little is referring are the base and standards cases. However, Arthur D. Little is incorrect in stating that these two cases are static. As is documented in the Technical Support Document, the Lawrence Berkeley Laboratory-Manufacturer Impact Model also computes a short-run analysis, the sole purpose of which is to assess the dynamic impact of standards, in addition to computing the long-run analysis to determine the impacts after those dynamic impacts have been absorbed. The dynamic effect that is captured with the Lawrence Berkeley Laboratory-Manufacturer Impact Model short-run analysis is the extra price competition that may occur when the quantity demanded is suddenly reduced by the standards-induced price increase. This dynamic effect generally results in lower profitability over the short-run, as compared to over the long-run, especially at the higher standard levels as reported in Section IV below. This effect is completely ignored by the Arthur D. Little model with its zero price elasticity. However, Arthur D. Little does address a different dynamic effect which the Lawrence Berkeley Laboratory-Manufacturer Impact Model does ignore.

The dynamic effect addressed by Arthur D. Little is the forward time-shifting of appliance purchases in anticipation of a standards-induced price increase. The Department has been aware of this for some time, but has not incorporated it into the Lawrence Berkeley Laboratory-Manufacturer Impact Model because of a lack of data on the extent of purchase time-shifting.

Additionally, the Department believes that any effect of time-shifting is initially positive and then negative. When appliances are bought in advance of standards, the initial effect probably would be to improve profits and cash flow. When the quantity demanded falls temporarily after standards, the effect probably would be to hurt profits and cash flow. These two effects very nearly should cancel over time. The Department notes that this result is in sharp contrast to the dynamic effect that the Lawrence Berkeley Laboratory-Manufacturer Impact Model does consider, which has a non-recoverable impact on the industry. Nonetheless, DOE agrees that time-shifting could bear further investigation and will evaluate whether the estimates supplied by Arthur D. Little on the magnitude of time-shifting can be of use.

Arthur D. Little also was critical of the Lawrence Berkeley Laboratory-Manufacturer Impact Model's inability to take into account (or try to predict) some of the consequences of the low profitability that the model sometimes predicts. In particular, its report points out that if the rate of profit did decline significantly in real terms, the industry would have a very hard time raising additional equity. Arthur D. Little points out that, in actuality, both owners and financial backers of firms would limit capital until expected return matched their required return. According to the comment, the Lawrence Berkeley Laboratory-Manufacturer Impact Model, therefore, "* * * sacrifices realism in modeling the relationship between expected return and the willingness of owners and financial backers to commit capital for retooling." (Association of Home Appliance Manufacturers, No. 61E at 27–28.)

The Department agrees with Arthur D. Little's statement regarding the difficulty that industry likely would have in raising capital as a consequence of significantly reduced profitability. Furthermore, it is true that the Lawrence Berkeley Laboratory-Manufacturer Impact Model is limited to estimating the impact of potential standards on an industry, whether positive or negative, as characterized by profitability. The model does not attempt to predict the specific forms of the damage and the complex reactions (inability to raise capital, failures of some firms, foreign buy-outs, mergers, capacity reductions, etc.) that could occur within a negatively affected industry. However, the Department does not believe that it is necessary to attempt to predict that sort of detail. Rather, DOE believes it is obligated not to set standards that would cause serious damage.

The Department believes that the magnitude of the hypothetical profit loss is a very good indicator of the magnitude of the impacts that will be imposed on the industry. When the Lawrence Berkeley Laboratory-Manufacturer Impact Model predicts a precipitous decline in profit, this should be interpreted as damaging to the industry. Indeed, in many cases, as discussed in Section IV below, the Lawrence Berkeley Laboratory-Manufacturer Impact Model does predict a sharp drop in profitability, and this prediction figures strongly in rejecting the standard in question.

Because of all the "deficiencies" in the Lawrence Berkeley Laboratory-Manufacturer Impact Model, Arthur D. Little's report suggested that the Department abandon the model, and proposed, instead, that the Department use a cash-flow model. The cash-flow model determines the economic impact of energy conservation standards on manufacturers by estimating the cash flows associated with meeting the standards, and calculating a value for those cash flows. (Association of Home Appliance Manufacturers, No. 61E at 19 and Appendix C.)

However, Arthur D. Little's cash-flow model submitted does not predict whether a manufacturing industry will or will not be hurt by standards. It

[13] This result may be found by examining Appendix C of the ADL report which contains the results of its cash flow model. In it, two cases are discussed: a constant volume case and a variable volume case. The distinction between the two is that in the former, production volume is assumed to be constant for each year, while in the latter, volume is constant for each year until 1997 (two years before standards when, presumably, sales rise in anticipation of higher prices) through 2003. The volume then goes back to the same constant level in 2004. Thus, the results indicate that consumers respond to the coming price increase, but after six years, their demand falls back to the original level, despite the higher price. Thus, aside from a short run effect over a six-year period, the price elasticity of demand is zero.

allows one to make various assumptions about the market's behavior, and then to predict the impact of those assumptions on cash flow; but, it tells nothing about the market's behavior. As a result, the Department notes that Arthur D. Little has run three scenarios with radically different implications for the industry, with no way to choose among them. The model is equally capable of processing the optimistic and the pessimistic scenario, but it does not have an expected scenario. The Department, therefore, does not believe that the cash flow model, as presented in Association of Home Appliance Manufacturers's comments, could serve to replace the Lawrence Berkeley Laboratory-Manufacturer Impact Model for use in the analyses of the impacts of appliance standards on manufacturers.

However, the Arthur D. Little report also stated that one of the key assumptions in the Lawrence Berkeley Laboratory-Manufacturer Impact Model is the proportion of costs that are fixed. The Arthur D. Little report went on to state that, "After interviewing all five domestic manufacturers, Arthur D. Little was unable to verify that the washing machine manufacturers have any sense as to the proportion of their costs which are long-term fixed costs * * *. Basing a model upon an assumption that is not empirically verifiable is a risky proposition." (Association of Home Appliance Manufacturers, *Id.*)

The Department agrees that one of the key assumptions in the Lawrence Berkeley Laboratory-Manufacturer Impact Model is the proportion of costs that are fixed and variable. The Department is sensitive to the claim that this key input parameter to the Lawrence Berkeley Laboratory-Manufacturer Impact Model is "completely alien to manufacturers." The Department would certainly consider alternate manufacturer impact models that utilize more known and verifiable inputs. However, to be an acceptable alternative model, the Department believes that such model would have to have forecasting ability similar in scope and sophistication as the Lawrence Berkeley Laboratory-Manufacturer Impact Model. As discussed above, the cash-flow model submitted by the Association of Home Appliance Manufacturers does not meet this test. Additionally, the Department would be interested in any analyses that indicate adverse manufacturer impacts at any of the proposed standard levels, as opposed to arguments over the severity of the adverse impact of rejected standard levels.

Impacts on Utilities

Several comments addressed the Department's proposed analysis of the impacts of energy conservation standards on electric utilities. Natural Resources Defense Council stated that the utility analysis needs to consider that under the base cases, there will be less forecasting certainty than would occur under new and revised standards, and a greater probability that utilities would misforecast electricity demand. (Natural Resources Defense Council, No. 13 at 32). The Ohio Office of the Consumers' Council also suggested that the utility analysis should consider the value of reduced uncertainty in utility forecasts as a result of standards. In addition, the Ohio Office of the Consumers' Council gave references to a methodology. (Ohio Office of the Consumers' Council, No. 60 at 6).

Increased demand certainty after standards is an effect that was not captured in the utility analysis. It results in substantial benefits to electric utilities, particularly when demand growth is rapid. These benefits accrue because demand growth is uncertain, and if the utility misforecasts demand, it may build too few or too many power plants. This risk of capital misallocation can be substantial in certain cases.

With regard to the appropriate measure of dollars to use in the utility impact analysis, Natural Resources Defense Council stated that "DOE needs to do the utility impact analysis in nominal dollar terms, using actual utility assumptions for depreciation and rate of return. Utility rates and finances are computed in nominal dollars, not real dollars, and this can have a dramatic impact on how new power plant construction will affect rates." (Natural Resources Defense Council, No. 13 at 32).

It is true that utilities calculate rates in nominal dollar terms. The Department, therefore, calculated utility impacts in both real and nominal dollars, in order to determine how adding an inflation factor would affect the results.

With regard to the Clean Air Act Amendments of 1990 (Pub. L. 101–549, November 15, 1990), Natural Resources Defense Council stated that utility expansion plans will need to be consistent with the Act, which will require more controls as the demand for electricity grows. Appliance standards will, all other things being held equal, make compliance with the Clean Air Amendments less expensive for utilities, as it allows them to meet the cap on emissions more easily. (Natural Resources Defense Council, No. 13 at 32, 35).

The utility analysis and the environmental analysis are consistent with the 1990 Clean Air Act Amendments. The Department collected forecasts of the value of marketable permits for sulfur, estimates of the other effects of the Clean Air Act Amendments, and assessments of future utility generation by fuel type. The Department assessed these estimates and assimilated them into the analysis. (See Technical Support Document, Environmental Assessment, Section 2).

The Florida Energy Office stated that capacity cost credit (for avoided capacity) should not be limited to combustion turbines but should match the load characteristics of the subject appliance, categorized into peaking, intermediate, and baseload groups. Air conditioners should be categorized according to their load duration characteristics. (Florida Energy Office, No. 42, at 2).

The Department agrees that load shape characteristics should be included in an assessment of air conditioner (and other appliances) avoided peak demand. The current utility analysis accounted for these effects. The Department investigated separating energy savings into peaking, intermediate, and baseload categories, to determine if this would have a significant effect on the results. The utility analysis assumed a combustion turbine proxy, which values all peak demand savings at the cost of a combustion turbine. This is the most widely used approach by U.S. utilities.

The Ohio Office of the Consumers' Council stated that the utility analysis should consider transmission and distribution capacity savings. (Ohio Office of the Consumers' Council, No. 60 at 5).

The Department agrees that transmission and distribution capacity savings should be included in the utility analysis, and did include them. Avoided transmission and distribution costs were based on the value assigned to this avoided transmission and distribution capacity by many different U.S. utilities.

Two commentators stated that off-peak water heaters (those that heat water only during off-peak hours) save energy, and that this should be included in the utility analysis. (National Regional Electric Cooperative Association, No. 17 at 1; Vaughn Manufacturing Company, No. 75 at 1).

In response, the Department notes that where utilities offer time-of-day rates, the economics of off-peak water heating change dramatically and may be

very attractive. However, the Department does not have the authority to require utilities to offer such rates, and believes the lack of these rates offered nation-wide precludes consideration of off-peak water heaters in a national standard.

Several comments discussed the impacts of appliance conservation standards on natural gas utilities. The Washington Gas Light, Inc. urged the Department to dedicate a similar level of analytical effort to the utility cost consequences of standards on natural gas appliances as it devotes to impacts on electric utilities from standards on electric appliances. (Washington Gas Light, Inc., No. 37 at 12).

The Department initially studied the potential impacts of standards on electric utilities and not natural gas utilities because there were more abundant data on the former. Furthermore, significantly more residential energy consumption is electricity rather than natural gas.

Nevertheless, the Department recognizes that for analytical completeness, it should conduct studies on the potential impacts of standards on natural gas utilities. Accordingly, DOE is now examining methodologies and data sources that will enable it to conduct such studies. The Department, therefore, welcomes submittals of relevant information and data in this regard.

Columbia Gas and the Montana-Dakota Utilities Company stated that conservation standards on gas appliances would result in a loss of natural gas sales, which, in turn, would lead to higher rates to all gas customers. (Columbia Gas, No. 45 at 5; Montana-Dakota Utilities Company, No. 54 at 3).

The Department does not accept the inevitability of that contention; a loss of gas sales may or may not increase rates. The actual effect depends on the cost structure of the gas utility. If avoided costs are larger than rates, then reducing sales would actually decrease rates. Without study of individual gas utility cost structures, no *a priori* conclusion in this regard can be drawn.

Lastly, four comments addressed the Department's planned analysis of environmental effects. Both the Southern Union Gas Company and Columbia Gas pointed out that the negative environmental effects from electric resistance water heaters are more severe than are the effects from natural gas water heaters. Columbia Gas stated that carbon dioxide emissions from electric resistance water heaters are 3.8 times higher than those from a minimum efficiency gas water heater. (Southern Union Gas Company, No. 22 at 2; Columbia Gas, No. 45 at 5). Also, the American Gas Association and Columbia Gas urged the Department to consider the environmental impact of the total energy delivery cycle, i.e., source energy, not just site consumption only. (American Gas Association, No. 23 at 3; Columbia Gas, No. 45 at 2).

The statements regarding the relative environmental impacts of gas and resistance electric water heating are generally correct. Furthermore, the Department does account for source energy (not just site energy) savings by including the fuel used by electric utilities and the consequent emissions in the utility impact assessment and environmental analysis. These effects are reported in Chapter 9 of the Technical Support Document accompanying this Notice.

b. Product-Specific Comments

1. Room Air Conditioners

Classes. In the September 1990 advance notice, DOE proposed 12 classes of room air conditioners. The product classes consist of four categories; units with side louvers, units without side louvers, units with reversing valve with side louvers, and units with reversing valve without side louvers. There are five class divisions by capacity within each of the two categories without reversing valves.

The California Energy Commission proposed a reduction in product classes from 12 to 4, eliminating the class divisions based on capacity. (California Energy Commission, No. 24 at 2). Whirlpool Corporation and Association of Home Appliance Manufacturers proposed two additional classes, a casement slider and a casement only room air conditioner. They stated that restricted geometry adversely impacts the potential new designs that can be applied to those types of room air conditioners. For example, rotary compressors could not be fitted into the casement units. (Whirlpool Corporation, No. 31 at 7; Association of Home Appliance Manufacturers No. 61A at 4). The American Council for an Energy Efficient Economy in its comments cited room air conditioners as an example where broad product classes have been properly selected. (American Council for an Energy Efficient Economy, No. 6, at 1).

There are several constraints placed on the design of room air conditioners. Because most room air conditioners are installed in double-hung windows, the size of the most typical double-hung windows becomes a significant factor in cabinet design and production. Every room air conditioner unit could be designed to optimize performance and efficiency as long as a specific cabinet could be built to best suit the unit's particular capacity and efficiency. Manufacturers cannot afford the luxury of optimizing every model they produce, so they limit their production of cabinets to three or four sizes. Because of space and configuration limitations, the larger capacity units for a given cabinet size will tend to be less efficient. For this reason the Department is rejecting the California Energy Commission proposal to ignore capacity in establishing classes.

The Department decided to adopt additional classes for casement slider and casement only room air conditioners. These units offer a unique utility to the consumer in that they offer a performance-related feature (fitting into casement windows) which other room air conditioners cannot provide. The Department believes that the size limitations imposed on casement units are more significant than those faced by typical double-hung window units. Since its performance-related feature justified a lower standard, separate product classes were established for casement slider and casement only units. Because of the small amount of empirical data on casement type units, the Department was unable to analyze these classes. As a result, the Department is not proposing any standards for them.

Design options. Both the Association of Home Appliance Manufacturers and Whirlpool Corporation provided detailed comments on each design option. (Association of Home Appliance Manufacturers, No. 61A at 5–22 and Whirlpool Corporation, No. 31 at 6–13). A number of the comments concerned design changes to improve heat exchanger (evaporator and condenser) performance. These improvements can be put into two categories; designs for increasing the heat transfer surface area and designs for increasing the heat transfer coefficients. The heat transfer surface area can be increased by any of the following methods: increasing the depth of the coil by adding vertical tube rows, increasing the frontal area of the coil by increasing the height or width, increasing the fin density, or adding a subcooler to the condenser coil. The heat transfer coefficients can be increased by using an enhanced fin design or grooved (rifled) refrigerant tubing. In addition, spraying condensate on the condenser can improve its heat transfer coefficient.

The Association of Home Appliance Manufacturers and Whirlpool Corporation commented that cabinet size could prevent or at least limit the

number of tube rows that could be added to increase the depth of the coil. In addition, they state that the effect of each successive tube row on system performance diminishes rapidly. The Association of Home Appliance Manufacturers also commented that compressor reliability could be affected. The addition of tube rows increases the internal volume of the system and, therefore, the amount of refrigerant required. Compressor reliability could be reduced as the compressor would be required to pump excess refrigerant. Whirlpool Corporation added that a thicker coil will increase air flow restriction and may actually reduce efficiency. (Association of Home Appliance Manufacturers, No. 61A at 9–10; Whirlpool Corporation, No. 31 at 8).

In the analysis of additional tube rows, the Department used engineering design data provided by room air conditioner manufacturers. The data were based on measurements taken from actual room air conditioner units and included information that specified the number of tube rows that could be added to the existing coils. The computer simulation model which was used in the analysis of room air conditioners considered the effect that additional tube rows have on the entire room air conditioner refrigerant system.

The Association of Home Appliance Manufacturers and Whirlpool Corporation commented that increasing the frontal area of the coil would require an increase in chassis size. Coils in existing room air conditioners are already so large that any useful increase would require an increase in the size of the cabinet. The incremental cost for such a change would be significant. Whirlpool Corporation added that an increase in frontal area reduces the water removal capability of the evaporator coil. (Association of Home Appliance Manufacturers, No. 61A at 10; Whirlpool Corporation, No. 31 at 7).

The Department agrees with the Association of Home Appliance Manufacturers's and Whirlpool Corporation's comments regarding the increase of the coil's frontal area. Any useful increase in performance would require that the cabinet size be increased as well. Manufacturers' cost data for this design were taken into consideration in the analysis. The computer simulation model takes into account the impact of increasing the coil frontal area on the evaporator's water removal capability.

Both the Association of Home Appliance Manufacturers and Whirlpool Corporation stated that there is a limit to how high the fin density can be increased before air flow becomes too restricted and adversely affects the efficiency of the unit. In addition, an increased fin density might prevent the proper drainage of condensate from the evaporator. The Association of Home Appliance Manufacturers added that dirt build-up is a serious concern in coil design. With a higher fin density, greater dirt build-up is likely to result in coil degradation and lower unit efficiency. (Association of Home Appliance Manufacturers, No. 61A at 11; Whirlpool Corporation, No. 31 at 8).

The Department solicited comments from room air conditioner manufacturers regarding the maximum allowable fin densities for a variety of evaporator and condenser coils. Their comments served as a guideline to how high fin densities could be increased for prospective coils. The computer simulation model is capable of calculating the effect that increased fin density has on the air-side pressure drop across the coil and, in turn, the power consumption of the fan motor.

In its comment concerning subcoolers, Association of Home Appliance Manufacturers asserted that subcoolers are not used unless it is impossible to achieve the needed subcooling without them. The Association of Home Appliance Manufacturers also stated that when a subcooler is needed, the available room in the chassis dictates the allowable length of the subcooler. (Association of Home Appliance Manufacturers, No. 61A at 12, 13). Whirlpool Corporation stated that a subcooler type that transfers heat from the refrigerant in the liquid line to the superheat exiting the evaporator is not practical in room air conditioners due to limited space within the cabinet. (Whirlpool Corporation, No. 31 at 10).

The Department understands the conventional practice used by manufacturers for incorporating subcoolers into room air conditioners. But the Department does not believe that this should prevent the design option from being considered. As long as the chassis of the particular unit is large enough to accommodate it, a subcooler will be considered as a way to improve a unit's performance. Engineering data supplied by manufacturers provided information on the maximum length of subcoolers which could be incorporated into a particular unit. The data were used to establish subcooler length for prospective room air conditioners.

Enhanced fin surfaces, such as wavy or slit patterns, improve the heat transfer capability of a coil by increasing the air-side heat transfer coefficient. In its comments regarding enhanced fin designs, the Association of Home Appliance Manufacturers stated that most manufacturers now use a wavy or "waffle" fin (Association of Home Appliance Manufacturers, No. 61A at 12). Additional improvement can be achieved through the use of "lanced" or "louvered" fins. The Association of Home Appliance Manufacturers expressed a concern that data based on work performed by manufacturers should be more heavily relied upon than data based on published research papers available in the public domain. The publicly available data seems to be either based upon theoretical analysis or research-type testing of simulated coil configurations. The Association of Home Appliance Manufacturers stated that the correlation between the data and actual performance results in room air conditioners is difficult to determine. (Association of Home Appliance Manufacturers, No. 61A at 13, 14). Whirlpool Corporation stated that air flow is reduced and air-side pressure drop across the coil is increased due to incorporating enhanced fin surfaces into coils. But Whirlpool Corporation added that enhanced fin designs provide significant improvement without substantial additional cost. (Whirlpool Corporation, No. 31 at 9).

The Department generally agrees with the comments made by Association of Home Appliance Manufacturers concerning enhanced fin design. Test data received from room air conditioner manufacturers and heat exchanger manufacturers are given more weight than theoretical analyses when deciding how much of an improvement should be given to the air-side heat transfer coefficients due to enhanced fin surfaces. The Department does not believe that the theoretical or research data available in the public domain should be dismissed entirely, and is using it as a check on the data received from manufacturers to determine if their information is reasonable. Improvements to the air-side heat transfer coefficients are input to the computer simulation model. With this information on improvements, the model is able to determine what effect enhanced fin surfaces have on the entire room air conditioner system.

Augmenting the smooth inside surface of refrigerant tubing with grooves increases the tube's refrigerant-side heat transfer coefficient. Grooved (rifled) tubing can therefore improve the heat transfer capability of a coil. The Association of Home Appliance Manufacturers' comments concerning grooved tubing are similar to the comments it gave regarding enhanced

fin surfaces. The Association of Home Appliance Manufacturers stated that data based on work performed by manufacturers should be more heavily relied upon than data provided by refrigerant tubing manufacturers. The Association of Home Appliance Manufacturers asserted that the data made available by tubing manufacturers are generally obtained under optimized conditions rather than under conditions representing actual application in room air conditioners. (Association of Home Appliance Manufacturers, No. 61A at 15). Whirlpool Corporation states that grooved tubing costs significantly more than smooth tubing but has a beneficial effect on system performance. (Whirlpool Corporation, No. 31 at 9).

As with enhanced fin surface data, the Department is giving more weight to data received from room air conditioner manufacturers when deciding how much improvement should be given to the refrigerant-side heat coefficients due to grooved tubing. The Department is using data made available by refrigerant tubing manufacturers as well as data provided by research papers in the public domain to compliment the data received from room air conditioner manufacturers. (See Technical Support Document, Volume H). Improvements to the refrigerant-side heat transfer coefficients are input as multipliers to the computer simulation model. With the multipliers, the model is able to determine what effect grooved tubing has on the entire room air conditioner system.

Whirlpool Corporation stated that it is standard practice to spray condensate produced by the evaporator onto the condenser coil. (Whirlpool Corporation, No. 31 at 9).

Because most, if not all, manufacturers incorporate the spraying of condensate into their room air conditioners, the Department did not analyze condensate spray as a design option. Baseline models for each of the product classes are assumed to include condensate spray in their designs.

Improving the air system efficiency can be accomplished either by increasing the fan or fan motor efficiency. In a room air conditioner, both the evaporator and condenser fans are driven by one fan motor. The Association of Home Appliance Manufacturers stated that increases in air system efficiency are limited because of the following: Configuration constraints due to the compact design of room air units; standardization of air system components because the industry's supply comes almost entirely from a single vendor; lower fan motor efficiencies that occur because the room air unit design is optimized at fan speeds other than the point of maximum motor efficiency; and air system designs which must limit noise levels. In addition, the Association of Home Appliance Manufacturers stated that fan motor efficiency is not expected to increase significantly by the year 1995. The Association of Home Appliance Manufacturers also stated that reductions in restrictions to air flow can be made only by increasing the space available for air flow. Major increases in cost would be associated with such a change as it would necessitate an increase in the chassis of the room air conditioner. (Association of Home Appliance Manufacturers, No. 61A at 16–19). Whirlpool Corporation repeated much of what the Association of Home Appliance Manufacturers stated and, in addition, stated that the use of separate fan motors would require significant redesign and increase the product cost. (Whirlpool Corporation, No. 31 at 11). Natural Resources Defense Council said that DOE should add improved air flow past coils as a design option. (Natural Resources Defense Council, No. 13 at 27). The American Council for an Energy Efficient Economy recommended that DOE treat fan and fan motor efficiency separately. (American Council for an Energy Efficient Economy, No. 6 at 3).

In its analysis of increasing the air system efficiency, the Department analyzed only improvements that could be made to the fan motor. The data from fan manufacturers did not provide information on the effect of different fan types on air system efficiency in a room air conditioner application. Therefore, the Department did not analyze improvements due to changes in the fan efficiency. The Department agrees with the Association of Home Appliance Manufacturers's comment regarding restrictions to air flow. Increasing the space available for air flow can be accomplished only by enlarging the chassis size. In the analysis of increased coil face areas where the cabinet size had to be increased, increases in system efficiency were assumed to be a result not only of the enlarged coil, but also the improvement in air flow resulting from the larger cabinet. Therefore, improvements in the air flow past the coils are inherently considered in the analysis of increased coil face areas. The Department utilized data obtained from fan motor manufacturers to determine efficiency increases and the associated incremental costs for improving the efficiency of fan motors.

Both the Association of Home Appliance Manufacturers and Whirlpool Corporation commented that most room air conditioner manufacturers use rotary compressors. Improvements beyond the currently available efficiency of 11.0 energy efficiency ratio are expected to be small. They also stated that higher efficiency scroll compressors might be suitable for larger capacity room air units. But use of scroll compressors would significantly increase the cost of room air conditioners. (Association of Home Appliance Manufacturers, No. 61A at 19, 20; Whirlpool Corporation, No. 31 at 11). Natural Resources Defense Council said that DOE should disaggregate the design option of improving the compressor efficiency into motor efficiency, volumetric efficiency, reduced mechanical resistance in pumps, and alternate compressor designs. (Natural Resources Defense Council, No. 13 at 27).

The Department took into account data from both room air conditioner and compressor manufacturers when determining the available efficiency increase in compressors. The data indicated that most room air conditioners use rotary compressors and that the maximum energy efficiency ratio for compressors of this type is 11.0. Other compressor types were also analyzed. New technologies for reciprocating compressors with capacities exceeding 17,000 Btu/h have pushed energy efficiency ratios past 11.0. These reciprocating compressors were considered for the two largest capacity classes of room air conditioners. Scroll compressors were also considered, but for the compressor capacities in the range used in room air conditioner units, energy efficiency ratios did not exceed 11.0. Compressor manufacturers indicated that there is a high probability that compressor energy efficiency ratios ranging from 11.5 to 12.0 would be available by the year 1995. Based on this information, compressor efficiencies of this magnitude were analyzed by the Department. In response to Natural Resources Defense Council's comment, compressor manufacturers increase compressor efficiency by improving the performance of these individual components. Data for the impact of component improvements are not available but, component improvements are reflected in higher compressor energy efficiency ratios. Therefore, the Department is analyzing the compressor as a whole rather than attempting to analyze individual components.

Other comments. The American Council for an Energy Efficient Economy proposed that DOE revise the room air conditioner test procedure to determine the energy savings on a

cycling rather than a steady state basis. If the test procedure cannot be revised during the rulemaking, the American Council for an Energy Efficient Economy recommended development of methods to estimate the benefits of design options which tend to improve efficiency under cycling conditions. (American Council for an Energy Efficient Economy, No. 6 at 2). On the other hand, the Association of Home Appliance Manufacturers and Whirlpool Corporation stated room air conditioners are not normally turned on for extended periods of time, and when they are turned on the (room and ambient) temperature is more likely to be high, reducing the amount of cycling. The current one-temperature test procedure adequately matches consumer usage patterns for room air conditioners. The Association of Home Appliance Manufacturers said that any change in the procedure will drive up the product cost and provide no benefit. It was the contention of the Association of Home Appliance Manufacturers and Whirlpool Corporation that design options such as variable speed compressors, electronic expansion valves, thermostatic cycling controls, and possibly use of alternative refrigerants that improve efficiency under cycling conditions will not result in any measurable efficiency improvements. The Association of Home Appliance Manufacturers stated that the addition of a cycling test must be justified by in-depth studies and field experiments to determine if the efficiency improvements such a revision would predict are cost-effective. (Association of Home Appliance Manufacturers, No. 61A at 6–8; Whirlpool Corporation, No. 31 at 12–14).

In response, the Department believes that some design options may improve efficiency under cycling conditions. The Department also agrees that before such design options are translated into test procedure credits, field tests would need to be conducted to provide evidence to support such credits. Therefore, for purposes of this rulemaking, cycling designs for room air conditioners will not be given test procedure credit.

Though no test procedure credit will be given to cycling designs, the Department believes that energy savings can be realized through the use of variable speed compressors. Energy savings for variable speed compressors have been estimated by extrapolating from results based on tests performed on central air conditioners. The extrapolated estimate is significantly lower than what test results indicate for central systems. A low estimate is used because room air conditioners probably cycle less than central systems. Cycling data for room air conditioners are not available.

There are some design options listed in the Advance Notice of Proposed Rulemaking which are theoretically possible, but for which experimental data or prototypes are not available. The impact of electronic expansion valves and thermostatic cycling controls on the efficiency of room air conditioners has not been analyzed because the Department was not able to obtain any data for these designs.

Both the Association of Home Appliance Manufacturers and Whirlpool Corporation made comments regarding replacement refrigerants for R–22. They commented that though research has identified refrigerant blends (non-azeotropic mixtures) that could improve the efficiency of room air conditioners, no prototypes have been developed that demonstrate this potential. In addition, changes would be required in room air conditioner systems, e.g., heat exchangers, in order for the unit to operate efficiently with the replacement refrigerant. (Association of Home Appliance Manufacturers, No. 61A at 8; Whirlpool Corporation, No. 31 at 15).

The Department agrees with the comments made by the Association of Home Appliance Manufacturers and Whirlpool Corporation regarding replacement refrigerants for R–22. Since no prototypes exist, the Department did not analyze replacement refrigerants as a design option for room air conditioners.

The Association of Home Appliance Manufacturers provided extensive comments regarding the computer simulation model used by the Department to analyze room air conditioners. The Association of Home Appliance Manufacturers proposed the following changes to the computer simulation model: (1) Modification of the compressor subroutine to model rotary compressors and to simulate reciprocating compressors better; (2) correction of the condensate spray subroutine to predict its effect on system performance better; (3) addition of correction factors to account for indoor/outdoor air leakage, short-circuiting of indoor air, and heat leakage through the divider wall; (4) addition of multiplication factors to modify coil heat transfer coefficients as a result of using enhanced fin surfaces; (5) addition of correction factors to modify such values as the compressor power and refrigerant mass flow rate in order to assist in calibrating the model to test data; and (6) addition of a psychometric heat balance routine to check that the results from the simulation model are thermodynamically consistent. In addition to making changes to the simulation model, the Association of Home Appliance Manufacturers requested that DOE calibrate the model to match industry test data for the baseline models chosen to represent each of the room air conditioner product classes. The Association of Home Appliance Manufacturers also requested that the room air conditioner industry be given the opportunity to conduct experiments to judge the models validity after the needed changes to the model were completed. The Association of Home Appliance Manufacturers also stated that manufacturers' data should be given significant weight in predicting the increases to efficiency due to design modifications. (Association of Home Appliance Manufacturers, No. 61A at 2,3). Whirlpool Corporation stated that it fully supports the Association of Home Appliance Manufacturers's recommended changes to the computer simulation model. (Whirlpool Corporation, No. 31 at 15).

The Department has made the changes to the simulation model that were proposed by the Association of Home Appliance Manufacturers. Simulation of baseline models were calibrated against test data submitted by manufacturers. The Department encourages the room air industry to test the validity of the simulation model and submit results in response to the standard levels being proposed in this rulemaking.

The Rocky Mountain Institute proposed that latent cooling be considered in room air conditioner energy savings, and that DOE investigate whether the spread between evaporator temperatures has been reduced to a minimum. (Rocky Mountain Institute, No. 15 at 4).

The computer simulation model used in the analysis of room air conditioners evaluated the thermodynamic performance of the refrigerant system. In this evaluation, the removal of latent heat was calculated. Minimization of the difference in evaporator inlet and outlet temperatures is an inherent consideration in heat exchanger and system design. This temperature difference was determined by the simulation model.

The Florida State Energy Office (FSEO) suggested that the Department consider classifying room air conditioners according to their load characteristics. (FSEO, No. 42 at 5, 6). The Association of Home Appliance Manufacturers stated that regional

standards could increase the product's cost by denying manufacturers the economy of large production runs and augment distribution problems by isolating inventories by region. (Association of Home Appliance Manufacturers, No. 61A at 22–25).

The Department assumes that the Florida State Energy Office comment concerns regional standards. The Department believes the program requires the setting of a national standard and is proposing therefore only a national standard for room air conditioners.

The Natural Resources Defense Council and the Florida State Energy Office proposed that DOE establish procedures that take into account the integration of room air conditioners and water heaters (heat recovery units). (Natural Resources Defense Council No. 13 at 29; FSEO No. 42 at 2,3).

Establishing standards and developing test procedures for appliances which serve two types of loads simultaneously is a very complex problem. The Department is in the process of developing standards and test procedures for combined central air conditioners and water heaters. However, because of the difficulty of running water lines to a remote room air conditioner location and the inherent heat losses from the hot water line, a room air conditioner/water heater configuration does not seem particularly appropriate. At this time, DOE will not establish a standard for room air conditioner/water heater systems.

The Natural Resources Defense Council, the Florida State Energy Office and the American Council for an Energy Efficient Economy stated that DOE should consider the cost of peak power in evaluating the cost effectiveness of room air conditioner standards. (Natural Resources Defense Council No. 13 at 18; Florida State Energy Office No. 42 at 5,6; American Council for an Energy Efficient Economy No. 6 at 7).

The price of electricity used for room air conditioners is the projected 1996 average residential electricity price from DOE Annual Energy Outlook 1991. Analysis of electricity price by end-use from data in the DOE/EIA 1987 Residential Energy Consumption Survey indicates that the average electricity price for residential air conditioning was the same as the national average residential electricity price (in other words, the end-use price multiplier is 1.00). Cost effectiveness to the consumer, e.g., life cycle cost, payback and cost of conserved energy, is evaluated according to the actual charges to the consumer.

The Fedders Corporation urged DOE to establish a minimum energy efficiency ratio for window air conditioners of 10.0, stating that this should be done to keep the industry competitive on a global basis. The Fedders Corporation also stated that existing technology clearly can support this minimum efficiency at small cost to manufacturers. (Fedders, No. 91 at 1).

The Association of Home Appliance Manufacturers responded to the Fedders Corporation's comment stating that the Association of Home Appliance Manufacturers was unclear as to which classes the Fedders Corporation was referring, and urging DOE to maintain and evaluate separate classes of room air conditioners. Furthermore, the Association of Home Appliance Manufacturers stated that the Fedders Corporation cannot accurately judge the technological and economic impacts of such a minimum energy efficiency ratio on other manufacturers. (Association of Home Appliance Manufacturers, No. 92 at 1).

The Department notes both comments and has analyzed each proposed class of room air conditioners separately, using all available cost and performance data. The results presented in today's notice as proposed minimum energy efficiency ratio's for room air conditioners range from 9.3 to 11.1, depending on size and configuration.

2. Water Heaters

Classes. There was considerable discussion about water heater product classes. Many comments came from gas utilities.

The American Gas Association urged DOE to adopt a source-based energy analysis and to recognize the importance of efficiency of the total energy delivery cycle. (American Gas Association, No. 23 at 3.)

The National Appliance Energy Conservation Act separates water heaters into three product classes by fuel type: Gas, electric and oil.[14] Also, the National Appliance Energy Conservation Act directs the Secretary to develop different standards for product classes within an appliance type if they "consume a different kind of energy from that consumed by other covered products within such type."[15] Therefore, the Department did not compare water heaters of different fuel types. However, the Department considered the effects of fuel-switching caused by the standards, as forecasted by the Lawrence Berkeley Laboratory Residential Energy Model.

The American Gas Association and many of the gas utilities proposed additional classes for gas water heaters based on several factors. These included the utility of having hot water if the power fails and the high cost of bringing electricity to locations without electric outlets near the water heater. The American Gas Association argued that a precedent already exists with ranges/ovens for separate product classes with or without an electric cord. (American Gas Association, No. 23 at 4–6.)

Several comments proposed that DOE establish four classes for gas water heaters: With and without draft hood, and with and without electric cord. (American Gas Association, No. 23 at 2; Southern Gas Association, No. 4 at 3; Lone Star Gas Company, No. 39 at 3; Southern Natural Gas Company, No. 46 at 2; LaClede Gas, No. 55 at 3; Equitable Resources, No. 72 at 1; Madison Gas & Electric, No. 77 at 1; Louisiana Gas, No. 81 at 1; United Texas Transmission, No. 26 at 2; Southern Union Gas Company, No. 22 at 1; Colorado Interstate Gas, No. 14 at 2; Wisconsin Gas Company, No. 33 at 1; South Carolina Electric and Gas Company, No. 34 at 2; Bay State Gas, No. 52 at 1; Arkansas Oklahoma Gas, No. 56 at 1; Providence Gas, No. 62 at 1; Southern Connecticut Gas, No. 63 at 1; Arkansas Western Gas, No. 64 at 4; ENTEX, No. 58 at 5; Essex County Gas, No. 69 at 1; K N Energy, No. 70 at 3; and Delta Natural Gas, No. 73 at 2.)

The Gas Appliance Manufacturers Association stated that DOE should recognize the particular utility and performance characteristics of conventional gas water heaters and preserve the availability of this product to the American consumer. (Gas Appliance Manufacturers Association, No. 40 at 3.)

Two gas utility companies proposed three product classes for gas-fired water heaters: with a draft hood with and without electric cord, and with electric cord (no designation on presence of draft hood). (Atlantic Gas Light Company, No. 29 at 2; and Energen, No. 12 at 4.)

Some gas utilities proposed two product classes for gas water heaters, namely, with and without electric cord. (Oklahoma Natural Gas Company, No. 57 at 1; and Northern Indiana Public Service, No. 48 at 2.)

The Arkansas Western Gas Company listed several benefits provided by a standing pilot in water heaters. These benefits include keeping the flue warm, helping maintain water temperature in the tank, providing a low-cost, fail-proof ignition system, allowing operation

[14] "Standards for Water Heaters; Pool Heaters; Direct Heating Equipment." *42 U.S.C. 6295(e).*

[15] "Special Rule for Certain Types or Classes of Products", *42 U.S.C. 6295 (n)(1)(A).*

during power outages, and low operating cost. (Arkansas Western Gas Company, No. 64 at 5.) Piedmont Natural Gas Company, Inc. urged the Department to evaluate fully the benefits of standing pilot ignition systems. Many citizens in North and South Carolina continued to have hot water and were able to cook after hurricane Hugo caused extensive power outages which lasted up to several weeks. (Piedmont Natural Gas Company, No. 71C at 2.)

The Department considered only one product class for gas-fired storage water heaters. The Department believes that designs that eliminate draft hoods or add electric cords do not change the utility of water heaters; therefore, these designs do not warrant inclusion in a separate class. These design options were evaluated solely on economic considerations. Additional installation cost to bring electricity to water heaters not close to outlets was included in the analysis of those design options. When condensation from mid-efficiency water heaters would damage masonry chimneys, the cost of relining or power venting was added to the installation costs.

The Department does not consider the utility of having hot water, or other amenities, during power outages adequate reason to develop separate product classes. Between 90 percent and 93 percent of residential electric customers experience no electricity outages longer than four hours per year.[16] Currently, central gas furnaces are not divided into product classes based on the use of electricity as proposed above for gas water heaters. Additionally, in this proposal, ranges/ovens are not divided into two product classes based on the use of electricity.

The Public Service Company of North Carolina, Inc. recommended that additional product classes be defined for gas-fired storage water heaters installed outside. (Public Service Company of North Carolina, Inc., No. 74 at 3).

The Department is not aware of any unique water heater design features that lead to any utility and lower energy efficiency that justifies a separate class. Therefore, the Department is not establishing a separate product class for gas-fired water heaters installed outside.

The Pacific Power and Edison Electric Institute supported three separate classes for electric water heaters (resistance, instantaneous, and heat pump). The Pacific Power stated that heat pump water heater efficiency depends upon climate and use patterns. (Pacific Power, No. 53 at 1, and Edison Electric Institute, No. 20 at 2). Peoples Natural Gas Company stated that heat pump water heaters should be promoted over electric resistance water heaters. (Peoples Natural Gas Company, No. 28 at 3).

Several comments proposed that heat pump water heaters be treated as a design option for electric storage water heaters, and not as a separate product class. (DEC International No. 3 at 1; Mr. Wayne Goode, No. 8 at 1; Mr. Joe Wilson, No. 10 at 1; American Council for an Energy Efficient Economy, No. 6 at 1; Natural Resources Defense Council, No. 13 at 21; Rocky Mountain Institute, No. 15 at 2; Crispaire, No. 19 at 1; Citizens Environmental Coalition Educational Fund, No. 24 at 3; Champaign County Board, No. 36 at 1; Northwest Power Planning Council, No. 32 at 1; Mr. George Smith, No. 32 at 2; Sierra Club, No. 43 at 2; and Mr. Warren Widener, No. 78 at 2). Northwest Power Planning Council proposed a separate product class for add-on heat pumps for water heaters. (Northwest Power Planning Council, No. 32 at 2).

The Natural Resources Defense Council argued that heat pump water heaters should not be a separate class. In its comments, the Natural Resources Defense Council acknowledged some arguments in favor of keeping them a separate class, such as the inability to operate at low temperatures, which the Natural Resources Defense Council claimed can be overcome with electric resistance backup; first hour rating, which the Natural Resources Defense Council stated can be overcome with a larger tank; and noise, which the Natural Resources Defense Council suggested can be overcome with more insulation. The Natural Resources Defense Council argued that these are economic considerations, not product utility considerations. (Natural Resources Defense Council, No. 13 at 22). On the other hand, Edison Electric Institute supported a separate product class for heat pump water heaters. Because of replacement market considerations, the heat pump compressor may have to be located outdoors, the air temperature must be greater than 45°F, sufficient air circulation is needed (500 cfm) or surrounding air space must be of sufficient volume (1000 ft^3), and there must be provision for condensate drainage. (Edison Electric Institute, No. 20 at 2).

The Gas Appliance Manufacturers Association stated that DOE should not analyze heat pump water heaters since their shipments are extremely low, totaling less than 0.05 percent of all electric water heater shipments. (Gas Appliance Manufacturers Association, No. 40 at 4).

The Department considered only one product class for electric storage water heaters. Heat pump water heaters were regarded as design options for electric storage water heaters. They provide the same utility as electric resistance storage water heaters. The Department agreed with the Natural Resources Defense Council that all of the issues regarding heat pump water heaters discussed above are economic in nature, and are treated as such in the analyses.

The Department decided a separate product class was not appropriate for add-on heat pumps. Since this type of heat pump is always used with a storage tank, there is no difference in the utility provided to the consumer.

No detailed information describing the location of electric water heaters in existing houses was provided. Lacking better data, DOE assumed sufficient volume of air circulation would be available to allow proper operation of heat pump water heaters. Most of the heat pump water heaters considered in this analysis are currently available. They are all equipped with freeze protection and have backup resistance elements. This permits operation under adverse conditions. Providing condensate drains was included in the installation costs for all heat pump water heaters.

The Department rejected the Gas Appliance Manufacturers Association's comment that heat pump water heaters not be considered in the analysis because of their low sales volume. The Department would agree with the Gas Appliance Manufacturers Association if heat pump water heaters warranted a separate class; however, since they are treated as a design option, DOE concluded that they warrant consideration. The effect on water heater manufacturers of standard levels requiring heat pump water heaters was considered in the manufacturing impact analysis.

The low heating rate of electric instantaneous water heaters presents a disadvantage with respect to their capability to provide a large quantity of hot water as rapidly as an electric resistance storage water heater. This difference justified two product classes (instantaneous and all other) for electric water heaters. There is little that can be done to improve the efficiency of electric instantaneous water heaters. Therefore, standards were not

[16] A.P. Sanghvi. 1990. *Cost-Benefit Analysis of Power System Reliability: Determination of Interruption Costs.* Prepared by RCG/Hagler/Bailly Inc. for Electric Power Research Institute EL-6791, vol 2, p 3-3.

developed for electric instantaneous water heaters.

Gas-fired instantaneous water heaters can provide unlimited amounts of hot water, but at limited rates. The Department judged this to be a significant difference in utility to the consumer. Gas instantaneous water heaters were, therefore, specified as a separate product class, and analyzed as such for standards.

United Technologies Carrier proposed a separate product class for a combined space and water heater. Electricity-using design options are viable for combination appliances, but would cause substantial increases in prices for gas water heater installations, and would inconvenience many customers. (United Technologies Carrier, No. 84 at 1). The Florida Governor's Office and the Northwest Power Planning Council proposed a product class for desuperheater water heaters. These are popular in Florida and use waste heat from air conditioners. Therefore, they operate only during the cooling season. (Florida Governor's Office, No. 42 at 6, and Northwest Power Planning Commission, No. 32 at 2).

Before the Department can consider combination space and water heating appliances and desuperheating water heaters for regulation, test procedures would have to be developed and adopted by DOE for such appliances. Furthermore, appliances that provide combined services will be examined during a forthcoming rulemaking on amended standards for central air conditioners and central air conditioning heat pumps.

Design options. There were many comments on the design options for water heaters. A discussion of these comments follows below.

The Southern Gas Association and other gas companies provided price estimates of more efficient water heater designs. For water heaters with energy factors of 0.63, 0.74, and 0.54, the American Gas Association estimated uninstalled prices of $667, $729, and $195, respectively. (Southern Gas Association No. 4 at 4; Energen Corp. and Alabama Gas Corp., No. 12 at 6; South Carolina Electric and Gas Co., No. 34 at 3; Montana-Dakota Utilities Co., No. 54 at 3; Oklahoma Natural Gas Company, No. 57 at 4).

The Columbia Gas provided a comparison of design options, energy factors and retail prices for four designs of efficiencies of gas water heaters. These were atmospheric draft/underfired (energy factor .54, $150-$350), atmospheric draft/subchamber (energy factor .62, $250-$500), forced draft/subchamber (energy factor .72, $600-$900), forced draft/immersed chamber (energy factor .82, $1300-$1800). (Columbia Gas, No. 45 at 3).

The Department used a retail price of $155.48 for the baseline model with an energy factor of .54. This is based on a factory cost of $95.63 supplied by the Gas Appliance Manufacturers Association. The 63 percent markup from factory cost to retail price was provided by the Lawrence Berkeley Laboratory-Manufacturer Impact Model. Installation expense used in the analysis for the baseline model was $126.12.

The Department included a standard venting, submerged combustion chamber water heater with heat traps, reduced heat leaks and R–16 insulation in the analysis, with an estimated energy factor of .57. At large-scale production, the submerged combustion chamber will not increase the factory cost.[17] The heat traps, reduced heat leaks, and R–16 insulation added $18.19 to the factory cost, for a total factory cost of $113.82. The Lawrence Berkeley Laboratory-Manufacturer Impact Model estimated a markup of about 57 percent for a total retail price of $179.22.

A model with an energy factor of .74 (calculated to have an energy factor of .71 using the proposed test procedure) was also included in the analysis. This unit has 2 inches of foam insulation surrounding a plastic tank, heat traps, indirect heating of the water, and electronic ignition. The Department estimated the factory cost of this unit at large-volume production to be $344.41. This estimate was based on an estimated 16 percent reduction in factory costs due to large-scale production. The retail price predicted by Manufacturer Impact Model was $612.96, with a 78 percent markup.

A water heater with forced draft and submerged combustion chamber was not analyzed. However, the Department did consider forced draft with increased baffling. An estimated incremental manufacturing cost of $312.50 was supplied by the Gas Appliance Manufacturers Association. Heat traps, reduced heat leaks, and R–16 insulation were also included on this unit for an energy factor of .67 (calculated to have an energy factor of .66 using the proposed test procedure). A total factory cost of $426.32 was used. A markup of 40 percent from the Lawrence Berkeley Laboratory-Manufacturer Impact Model was applied to arrive at a retail price of $596.83.

The Department was not aware of any existing designs or prototypes for water heaters with forced draft and immersed chambers. No analysis was done for this design option.

The Wisconsin Blue Flame Council cited an incremental unit cost of $150 to $200 to add automatic ignition devices and flue dampers to residential gas-fired water heaters. (Wisconsin Blue Flame Council, No. 33 at 33). Equitable Resources stated the additional cost for electrical safety controls to be approximately $20 to $50. (Equitable Resources, No. 72 at 2).

The Department used an incremental material cost of $49 for a spark ignition system, flue damper, 24-volt plug-transformer, and control relay.[18] Other factory costs were from the Gas Appliance Manufacturers Association data.

Design Options for Storage Water Heaters

The Rocky Mountain Institute stated that DOE should study insulated pressure relief valves, plastic drain pipes, and flexible anode rods. (Rocky Mountain Institute, No. 15 at 4). The Natural Resources Defense Council proposed that DOE evaluate thermal short circuits through insulation. Work performed by the California Energy Commission and the National Institute of Standards and Technology showed that the effective thermal resistance is often 50 percent or less than the thermal resistance calculated from the level of insulation. (Natural Resources Defense Council, No. 13 at 27).

Reduced heat leaks were included as one of the design options in the analysis of water heaters. The actual features of this design option were not specified. Measures that could be included in this design option were to eliminate thermal bridges from jacket to feed throughs, to eliminate voids in insulation, to insulate the pressure relief valve, to install plastic drain pipes, and to reduce the number of feed throughs by combining functions. These measures were not modeled separately.

The American Council for an Energy Efficient Economy proposed that vacuum panels be considered as a design option. (American Council for an Energy Efficient Economy, No. 6 at 3).

Vacuum insulation was considered as one of the design options for both gas-fired and electric storage water heaters.

[17] This information was from Robert Cook who cited a study on projected costs done by A.O. Smith.

[18] Paul, D.D., Stickford, G.H., & Locklin, D.W. *Assessment of Technology for Improving the Efficiency of Residential Gas Water Heaters, Second Interim Report*, June 3, 1991, Battelle, Columbus OH, prepared for Gas Research Institute.

[19] James E. Harris, *Test Results on the Effectiveness of Heat Traps on Water Heaters*, May 1982, Building Equipment Division, Center for Building Technology, National Bureau of Standards.

The Rocky Mountain Institute stated that DOE should study more accurate thermostats and pipe insulation. (Rocky Mountain Institute, No. 15 at 4).

The Department is not aware of any method to quantify energy savings from more accurate thermostats. Pipe insulation, which is not part of the water heater, was not considered as a design option because of concerns that it might not always be installed in the field.

The Pacific Power stated its research shows that heat traps add only 1 percent to an electric water heater's efficiency, not 5 percent as assigned in the previous DOE testing procedure for water heaters. (Pacific Power, No. 53 at 2).

The Department used data from a letter report prepared for DOE.[19] This report determined actual heat losses out of pipe fittings with and without heat traps. The letter reported that heat traps provide a savings of nine watts on the hot water outlet and seven watts on the inlet. Applied to the baseline model, this results in a 2.5 percent increase in energy factor.

Design Options for Gas-Fired Storage Water Heaters.

The Gas Appliance Manufacturers Association recommended that the multiple flues and submerged combustion chamber design options be combined into a single category to be called increased heat transfer surface. (Gas Appliance Manufacturers Association, No. 40 at 4).

The Department found enough difference in efficiency and cost between these designs to merit classification as individual design options. Water heaters currently on the market with submerged combustion chambers have recovery efficiencies of 85 percent, whereas currently available units with multiple flues have recovery efficiencies of 80 percent.

The Gas Appliance Manufacturers Association recommended that pulse combustion and condensation be simplified to condensation of flue gases. The essential efficiency improvement is to extract enough heat out of the flue gases, such that condensation occurs. (Gas Appliance Manufacturers Association, No 40. at 5).

The Department notes that manufacturing costs and actual efficiencies for design options that condense flue gases depend on the method of condensation. Therefore, pulse combustion was retained as a separate design option.

Northern Indiana Public Service recommended that pulse combustion and condensation of flue gases be eliminated as design options. While these designs are clearly feasible from a technical standpoint, cost considerations have proven to be insurmountable thus far. (Northern Indiana Public Service, No. 48 at 3).

Since pulse combustion and condensation of flue gas technologies are feasible, the Department cannot eliminate these design options, but has considered their cost impacts using the best available estimates of manufacturing cost.

The American Council for an Energy Efficient Economy proposed that flue dampers and intermittent ignition devices be treated as separate designs. (American Council for an Energy Efficient Economy, No. 6 at 3).

Because of concerns about contaminating indoor air with combustion products from the pilot light, the Department did not consider flue dampers as a separate design option.

The Natural Resources Defense Council proposed that DOE evaluate power combustion with intermittent ignition devices. (Natural Resources Defense Council, No. 13 at 27).

From the limited description of this design option, the Department assumed that the Natural Resources Defense Council was referring to a fan-assisted combustion system using electronic ignition with the fan before the combustion chamber. Part of the increase in efficiency from this design is caused by the fan restricting off-cycle air flow through the flue. This reduces off-cycle flue losses. The Department analyzed power vent with intermittent ignition devices, which is a fan-assisted combustion system with the fan after the combustion chamber. The reduction of flue losses would be similar to the reduction for the design option recommended by the Natural Resources Defense Council.

Northern Indiana Public Service also stated that for vent fans, the main energy-conserving value is the reduction of flue losses, and a thermal vent damper could be used to accomplish that reduction more simply. (Northern Indiana Public Service, No. 48 at 4).

The Department did not analyze vent dampers, which are above the draft hood, but did analyze flue dampers, which are below the draft hood, in conjunction with intermittent ignition devices as discussed above.

Oklahoma Natural Gas proposed that DOE analyze improved burner design, modulating controls, improved flue baffling and improved fill tube designs to reduce sediment buildup and temperature stacking of heated water. (Oklahoma Natural Gas, No. 57 at 2).

The Department was not able to obtain cost and efficiency data for improved burner design or fill tube designs. No analysis was done for modulating controls, because the Department is not aware of how this design would improve efficiency. Improved flue baffling was included as a design option.

Mr. Rajendra Narang provided patented items for improving the efficiency of gas and oil water heaters. These included preheat of combustion air, self-regulating fuel flow to the burner, lower heat input, combustion dampers, and better heat exchangers. (Narang, No. 82).

No data on potential energy efficiency improvements or incremental manufacturing costs were available for these design options. In addition, DOE was not able to develop any estimates on the cost or efficiency of these designs. Therefore, they were not included in today's proposed rule. The Department requests cost and efficiency data on these designs in order to evaluate them for inclusion in the final rule.

Pilot Light Design Options

The Gas Appliance Manufacturers Association stated that "reduced pilot light input rate" should not be considered as a design option because pilot inputs have been reduced to the optimal point. (Gas Appliance Manufacturers Association, No. 40 at 4).

The Department agrees with the Gas Appliance Manufacturers Association on this issue. Therefore, further reductions in pilot light input rate were not considered.

Northern Indiana Public Service stated that the elimination of a pilot light has a very small savings. (Northern Indiana Public Service, No. 48 at 4). Washington Gas Light Company noted that not all of the heat from a pilot light is wasted. (Washington Gas Light Company, No. 37 at 9).

The Department agrees that only a portion of the heat from a pilot light is wasted. In the analysis, DOE assumed 76 percent of the pilot light's energy went to maintaining water temperature. This is based on the theory that a pilot light would have the same efficiency as the recovery efficiency of the water heater. Therefore, only the 24 percent of the pilot light input available to be saved by an intermittent ignition device was included in the analysis.

[19] James E. Harris, *Test Results on the Effectiveness of Heat Traps on Water Heaters*, May 1982, Building Equipment Division, Center for Building Technology, National Bureau of Standards.

Design Options for Electric Storage Water Heaters

The National Rural Electric Cooperative Association stated that off-peak water heaters save energy. (National Rural Electric Cooperative Association, No. 17 at 1). Vaughn said that off-peak electric water heaters can save energy use by controlling time period elements are allowed to heat water. (Vaughn, No. 75 at 2).

The Department did include off-peak water heaters as a design option in the Engineering Analysis for electric water heaters. However, as stated above, the Department believes that the economics of this design option, in the absence of the nationwide availability of time-of-day rates, precludes using this design option in setting national standards.

Crispaire provided unit energy consumption and annual performance factors for heat pump water heaters and electric resistance water heaters. Crispaire also stated that its studies showed consumer acceptance of heat pump water heaters. (Crispaire, No. 19 at 2).

The Department included two existing models of heat pump water heaters in the analysis of electric water heaters. One was an E-Tech brand model manufactured by Crispaire. Energy consumption for this model was calculated from the energy factor derived from the DOE water heater test procedure in effect prior to October 17, 1990,[20] derated by 25 percent to account for estimated reductions due to the current test procedure relative to the previous test procedure. This derating value was based on estimated reductions of 15–20 percent from ETL Testing Laboratories,[21] 27 percent from the Gas Appliance Manufacturers Association,[22] and 30 percent from Electric Power Research Institute[23] simulation models. The Gas Appliance Manufacturers Association estimate was based on the difference between data supplied in support of the rulemaking and the least efficient heat pump water heater listed in its directory. This is a minimum estimate of the difference. The Department requests test data on heat pump water heaters, in accordance with the existing test procedures, for consideration in the final rule.

The Natural Resources Defense Council advised that increased jacket insulation and heat traps be evaluated for heat pump water heaters. (Natural Resources Defense Council, No. 13 at 27).

Heat pump water heaters were analyzed as a design option for electric storage water heaters. Increased jacket insulation and heat traps were also included as design options for this product class.

The Ohio Sierra Club commented that in many parts of the U.S., a solar water heating system is considerably more cost-effective than an electric water heater. (Ohio Sierra Club, No. 11 at 2).

The Department included solar pre-heating as a design option for electric storage water heaters. Baltimore, Maryland was used as the location for evaluating the solar water heating systems. Baltimore was chosen as the one site that most closely approximated the population-weighted average climate of the United States.

Design Options for Instantaneous Gas-Fired Water Heaters

The Gas Appliance Manufacturers Association commented that reducing the amount of water within instantaneous water heaters would reduce the heater's ability to provide sufficient heated water. The Gas Appliance Manufacturers Association further noted that instantaneous water heaters do not utilize flues to transfer heat to water. Design options which concern flue improvements are not applicable to instantaneous water heaters. (Gas Appliance Manufacturers Association, No. 40 at 5).

The Department agrees with the Gas Appliance Manufacturers Association on these issues. Reducing the amount of water in the heater and flue improvements were not considered in the analysis of instantaneous water heaters.

The Natural Resources Defense Council recommended that DOE consider an intermittent ignition device for instantaneous water heaters as a design option. (Natural Resources Defense Council, No. 13 at 27).

This design option was included in the analysis of instantaneous water heaters.

Reducing Water Heater Setpoint Temperature

Another comment on design options dealt with a design to limit the temperature of the hot water produced by a water heater. National Wildlife Federation proposed that DOE consider the promulgation of a design standard covering the factory setting of water heater temperature controls. It stated that 140°F water can cause burns, and reducing this temperature could lower accidents. In addition, the energy savings would be substantial. (National Wildlife Federation, No. 21 at 3).

The Department did not consider the hot water setting as a design option for water heaters. While it is true that reducing the hot water temperature will save energy at the water heater, hot wash cycles in clothes washers and dishwashers with 140°F water are required for certain conditions. All clothes washers and dishwashers would have to contain electric resistance booster heaters to maintain this utility. The use of these electric resistance booster heaters would mean that some water heating currently being performed by gas water heaters would be performed by electrical resistance heating with a corresponding loss in overall efficiency.

Other Comments. Fuel switching. One of the most discussed consumer issues involved the impact of increases in initial purchase price for gas water heaters, since standards could alter consumer fuel choice, resulting in increased electricity consumption at the expense of gas consumption, and increased environmental degradation. (Middle Tennessee Natural Gas Utility District, No. 1 at 1; Wisconsin Southern Gas Company, No. 9 at 1–2; Colorado Interstate Gas Company, No. 14 at 2; Peoples Natural Gas Company, No. 28 at 1; Wisconsin Blue Flame Council, No. 33 at 1–2; WGL, No. 37 at 5; Columbia Gas Distribution Company, No. 45 at 3; Northern Indiana Public Service Company, No. 48 at 4; ENTEX, No. 58 at 2; Peoples Gas Light and Coke Company (Peoples), No. 65 at 1; Mobile Gas Service Corporation, No. 66 at 2; Northern Minnesota Utilities, No. 68 at 1; Delta Natural Gas Company, Inc., No. 73 at 1; Public Service Company of North Carolina, Inc., No. 74 at 4; and Southern California Gas Company, No. 79 at 1).

Concern was expressed that if standards imposed on gas water heaters include automatic ignition, requiring electric service, there will be a sizeable increase in the prices of gas appliances. The comments argued that builders are concerned with initial purchase prices, not life-cycle costs; thus, a switch to electricity consumption will occur.

The Department is sensitive to fuel-switching issues. The Department incorporated available data about fuel shares in new housing and replacement markets, based on historical purchase patterns, in the Lawrence Berkeley

[20] Gas Applicance Manufacturers Association, Consumer's Directory of Certified Efficiency Ratings for Residential Heating and Water Heating Equipment, October 1990, pg 184.

[21] John Sabelli, ETL Labs. Phone conversation on 1/29/91.

[22] Consumers' Directory of Certified Efficiency Ratings for Residential Heating and Water Heating Equipment, GAMA, October 1990.

[23] Carl Hiller, Electric Power Research Institute. Phone conversation, 7/23/91.

Laboratory Residential Energy Model. Additional data to quantify the sensitivity in the market to first cost and to operating cost were obtained. Also, sensitivity analyses were performed in the forecast of shipments of water heaters.

The Department also notes that standards resulting in price increases on gas water heaters would cause switching to electric water heaters only if similar or greater price increases did not occur for efficiency improvements to electric water heaters, which is certainly not the case.

Supplying Electricity to Gas-Fired Storage Water Heaters

Several comments addressed inclusion of installation and maintenance expenses in the engineering analyses. The Southern Gas Association, American Gas Association, and Gas Appliance Manufacturers Association, among others, stated that installation (electric supply and venting alterations) and maintenance for gas water heater designs that would require electricity, such as intermittent ignition device, induced draft combustion, power venting, and condensing, must be included in the analyses. (Southern Gas Association, No. 4 at 10; American Gas Association, No. 23 at 3; and Gas Appliance Manufacturers Association, No. 40 at 8).

The American Gas Association, Southern Gas Association, and several other gas utilities gave estimates of costs for providing electric service to a water heater. For an existing appliance location, costs ranged from $75 to $200 and for new construction from $15 to $50. (American Gas Association, No. 23 at 5; Southern Gas Association, No. 4 at 3; Lone Star, No. 39 at 6; Energen, No. 12 at 5; Equitable Resources, No. 72 at 2; South Carolina Gas and Electric Company, No. 34 at 2, 3; Arkansas Western Gas Company, No. 64 at 5; ENTEX, No. 58 at 5; Public Service Company of North Carolina, No. 74 at 4; Oklahoma Natural Gas Company, No. 57 at 3.)

The Gas Appliance Manufacturers Association stated that installation expenses for electric service could double the installed price of the water heater. (Gas Appliance Manufacturers Association, No. 40 at 3). On the other hand, Flair said that in northern climates, the water heater most likely stands next to the furnace, which has an electrical supply readily and cheaply available to the water heater. Flair estimated that the average price of adding electricity is much less than the cost of the water heater. (Flair, No. 85 at 1).

The Department used a cost of $11.20 for the installer to add a small plug-in transformer and install low-voltage wiring to the water heater.[24] The Department assumed this would not require an electrician, and would allow the water heater to be installed a large distance from an existing outlet. This would provide sufficient power to run safety controls, spark ignition, flue damper, and a small venting fan. For design options, such as condensing flue gases, submerged combustion, and direct firing, which would require higher voltage, a charge of $100 was used as the installation price of providing electricity. This figure was presented to the Department by Southern Gas Association.

Modification of Existing Venting Systems

The Gas Appliance Manufacturers Association mentioned that for water heating systems to be compatible with existing venting systems, recovery efficiencies must be less than 82 percent. Gas Appliance Manufacturers Association further stated that elimination of the draft hood and installation of a new venting system for both a furnace and water heater would modify the installed price of the water heater by three to five times. (Gas Appliance Manufacturers Association, No.40 at 4). The Gas Research Institute said that additional expenses of altering venting systems are necessary for high-efficiency water heaters. Estimates of these expenses[25] were provided to the Department on a regional basis. (Gas Research Institute, No. 59 at 2–3).

The Washington Gas Light, Inc. indicated that "installing a water heater with a vent damper or power combustion into an existing masonry chimney . . . may result in the need to reline the chimney." The charge for this would be between $500 and $2000. (Washington Gas Light, Inc., No. 37 at 8). ENTEX estimated installing a new vent system in its service area would be approximately $260. (ENTEX, No. 58 at 5). Energen Corporation estimated the incremental cost of adding a new vent system at $125 to $175. (Energen, No. 12 at 6).

The charge for relining venting systems that were not type-B was added to the installation expense of all design options with recovery efficiencies above 80 percent that were not power vented. The Department used values of $408 for relining masonry chimneys, $85 for replacing vent connectors, and $75 for adding a sidewall venting system.[26]

Maintenance

Mississippi Valley and Energen stated that when an intermittent ignition device and flue damper or forced draft combustion are added to a gas water heater, it is likely that at least one of the following components (ignitor, fan motor, printed circuit board, fan relay system, or vent damper assembly) will fail and need service or replacement in the 10- to 12-year life of the water heater. (Mississippi Valley, No. 5 at 6; Energen, No. 12 at 8).

Among other comments on the engineering analysis of water heaters, Energen stated that reliability and functionality issues are most important in a total system-specific, real world situation. Issues such as venting materials, vent categories, common venting, vent-system condensation, corrosion, masonry chimney suitability, backdrafting, spillage, negative room pressure, combustion air management, construction clearances, vent termination requirements, heat or flame roll out, flammable vapors ignition, and others must be a significant part of the efficiency equation. (Energen, No. 12 at 9).

The limited data available on component lifetimes suggested failure would occur near the end of the service life of water heaters. Therefore, the Department did not include maintenance expenses in the analysis. The Department requests data on water heater lifetimes, component lifetimes and service costs for consideration in the final rule.

Baseline Model

The Southern Gas Association and other gas suppliers recommended baseline units and costs. (Southern Gas Association, No. 4 at 8). Energen said that the baseline unit should logically be a natural draft, non-powered unit upgraded to the highest field-proven technology level, including heat traps, advanced insulation techniques, sealing of the pilot light and/or main burner combustion cavity, piezo pilot ignitors, flue dampers and or advanced flue baffling. (Energen No. 12 at 8). Lone Star proposed that shipment data from the Gas Appliance Manufacturers Association be used for baselines. (Lone Star, No. 39 at 3).

The baseline model used in this analysis was established from data provided by the Gas Appliance Manufacturers Association who was

[24] Paul, D.D., Stickford, G.H., & Locklin, D.W. *Assessment of Technology for Improving the Efficiency of Residential Gas Water Heaters, Second Interim Report*, June 3, 1991, Battelle, Columbus OH, prepared for Gas Research Institute.

[25] Ibid.

[26] *Ibid.*

supplied with the data by manufacturers. The baseline represents a typical water heater that marginally meets the 1990 National Appliance Energy Conservation Act standards.

The baseline gas-fired storage water heater is a center flue, glass- lined steel tank with a standing pilot. It has a 40-gallon tank and 1-inch-thick foam insulation. Both the inlet and outlet are at the top of the tank. It has six feed throughs and no heat traps. It is bottom-fired with a three-inch central flue. The burner input is 34,000 Btu per hour. The pilot light input rate is 400 Btu per hour.

The baseline model for the electric water heater analysis is a glass-lined steel tank, with two 4,500-watt resistance elements. It has a 52-gallon tank and 2-inch-thick foam insulation. Both the inlet and the outlet are on top of the tank. It has eight feed throughs and no heat traps.

Measured Versus Rated Volume

The California Energy Commission proposed that the measured volume rather than the rated volume of water heaters be used in all analyses. (California Energy Commission, No. 24 at 3).

With regard to how the Department should set water heater conservation standards, the California Energy Commission proposed that any standard be expressed as EF = A + (B * V), and not as EF = A − (B * V), so that an exaggeration of volume, V, by manufacturers would result in a more stringent standard. (California Energy Commission, No. 24 at 3).

The California Energy Commission also argued that tolerances between rated and measured volumes of 5 percent and 10 percent, respectively, for gas and electricity water heaters volumes, are too high. (California Energy Commission, No. 24 at 2).

The energy conservation standards are in the form of equations that are a function of the volume of the water heater. A footnote refers to the volume as being rated volume. The DOE test procedure contains provisions to determine the measured or actual volume, but is silent on the rated volume which is established by the manufacturer. The tolerances to which the California Energy Commission are referring are those set by safety testing agency specifications and are not related to the energy efficiency program. In the vast majority of cases, the measured volume is lower than the rated volume. All of the 13 water heaters tested by the National Institute of Standards and Technology in support of the DOE test procedure had measured volumes below rated volumes. Furthermore, one out of six electric water heaters and one out of five gas water heaters tested by the National Institute of Standards and Technology exceeded the safety tolerances for rated volume. (55 FR 42166, October 17, 1990 and 54 FR 1893, January 17, 1989). To conduct the analysis which forms the basis for today's notice in an accurate manner, the actual volume had to be used. To be consistent with that analysis, the Department is proposing that the volume referred to in the efficiency equation be the actual or measured volume. The Department believes that the use of measured volume rather than rated volume in the calculation will eliminate this issue.

Definitions in Test Procedure and Conservation Standards

The California Energy Commission proposed that the coverage of the water heater test procedures and efficiency standards be consistent, i.e., the test procedure does not cover some classes and sizes of water heaters that otherwise would be covered by the efficiency standards. (California Energy Commission, No. 24 at 2–3).

Modifications to the test procedures for water heaters, which address these issues, are contained in the Notice of Proposed Rulemaking referenced above.

Gas Research Institute Study

Energen urged DOE to evaluate thoroughly a study commissioned by the gas industry on cost/efficiency of water heater designs. (Energen, No. 12 at 9.)

The Department did review and use information from this Gas Research Institute study,[27] particularly cost data for installation and reventing. The study was also useful in categorizing standby losses.

3. Direct Heating Equipment

Classes. Among the comments on product classes, Southern Gas Association, Energen Corp. and Atlanta Gas Light Company proposed that direct heating product classes be expanded to separate each present class into two classes, one with and one without an electric cord. The division of product classes by capacity is not mentioned. Their arguments deal generally with economic and utility issues, i.e., the ability of products without an electric cord to provide heat if a power outage occurs, and the affordability of these products to lower-income people. (Southern Gas Association, No. 4 at 6; Energen, No. 12 at 12–13; and AGLC, No. 29 at 3). The California Energy Commission stated that there are too many product classes for this product and proposed three classes which are wall (fan and gravity), floor (fan and gravity), and room (fan and gravity). (California Energy Commission, No. 24 at 4).

As stated above, the Department does not believe that the ability of gas equipment to operate during electricity outages is a utility that requires separating the existing gravity product classes into those with and without a power cord. Instead, designs that use electricity are evaluated on their economic advantages and disadvantages. The Department has kept the four product class categories as designated by the National Appliance Energy Conservation Act. The categories are: fan-wall, gravity-wall, room, and floor. With respect to division by capacity, the Department kept the National Appliance Energy Conservation Act divisions during the engineering analyses. The current class divisions by capacity are necessary because of the manner in which direct heating equipment is evaluated by the DOE test procedure. The energy descriptor for this equipment, the annual fuel utilization efficiency, is a function of, among other things, the pilot fraction. The pilot fraction is defined as the energy input rate to the pilot light (Q_p) divided by the steady-state heat input rate to the heater (Q_{in}). As the pilot fraction decreases, the annual fuel utilization efficiency will increase. For each of the four categories of direct heating equipment (fan-wall, gravity-wall, room, floor), the pilot light input rate is constant. Thus, for heaters of two different capacities within the same category and with the same steady-state efficiency, the annual fuel utilization efficiency will always be higher for the larger capacity equipment. The division of classes by capacity is required to account for this relationship between the annual fuel utilization efficiency and the pilot fraction.

Design options. The Gas Appliance Manufacturers Association stated that gravity-type direct heating units provide a unique utility in that they operate during an electrical power outage. In addition, gravity-type equipment can be used where an external electrical source is not available. Because of these reasons, the Gas Appliance Manufacturers Association argued that design options requiring electricity should not be required for floor heaters, room heaters, or gravity wall furnaces. (Gas Appliance Manufacturers Association No. 40 at 6).

[27] *Ibid.*

As stated above, the Department does not believe that the ability of gas equipment to operate during electric outages is a utility that forecloses consideration of electricity-using design options for those appliances. Therefore, the Department considered, for economic justification, design options that would require electricity for gravity wall, floor, and room direct heating equipment.

With regard to electronic ignition systems, both Southern Gas Association and North Carolina Public Service Co. stated that adding an automatic ignition system and electronic controls would add significantly to the price of direct heating equipment. The Southern Gas Association said it would add $190 while North Carolina Public Service Co. stated it would add $150 to $200. (Southern Gas Association, No. 4 at 7; North Carolina Public Service Co., No. 74 at 5). The American Council for an Energy Efficient Economy said that intermittent ignition device and vent dampers should be considered separately. (American Council for an Energy Efficient Economy, No. 6 at 3).

The Department took into account all sources of available data when determining the cost of an electronic ignition system for direct heating equipment. Sources of data included manufacturers, suppliers, utilities, and published papers and reports. The electronic ignition design option was evaluated not only separately from any other design option, but also with other design options, including vent dampers.

The Gas Appliance Manufacturers Association commented that increased insulation does not improve the energy efficiency of room heaters since this equipment is located within the heated space. (Gas Appliance Manufacturers Association, No. 40 at 6).

The Department agrees with the Gas Appliance Manufacturers Association's comment and is not considering the increased insulation design option for room heaters or wall furnaces. Insulation is only applicable to floor furnaces as this equipment's intended installation is in an unconditioned crawl space.

The Gas Appliance Manufacturers Association also commented that two-stage or modulating burners reduce the energy efficiency of direct heating equipment. (Gas Appliance Manufacturers Association, No. 40 at 6).

The Department agrees with the Gas Appliance Manufacturers Association's comment. When incorporated into a typical gravity or forced-air direct heater, i.e., heaters that are currently being manufactured, two-stage and modulating burners actually reduce the energy efficiency of direct heating equipment. Two-stage and modulating burners which are currently manufactured regulate the gas flow but not the air flow. Excess air is induced at lower gas-flow rates, resulting in lower combustion efficiencies when compared to a normal or maximum gas flow rate. Because of this, typical heaters equipped with two-stage or modulating burners will always have a lower energy efficiency, as measured by the DOE test procedure, than heaters equipped with single-stage burners. The Department is not aware of any two-stage or modulating burners that regulate both the gas and air flow. The Department believes however, that it is possible to regulate the air flow being drawn into a two-stage or modulating burner if the direct heater is also equipped with a two-speed or variable-speed combustion fan, i.e., induced or forced draft system. With a multi-speed combustion fan, a low fan speed can be used to reduce the excess air that would normally occur at low gas flow rates. Thus, the steady-state efficiency that occurs at the high gas flow rate of a two-stage or modulating burner can be maintained at its lower gas flow rate. Since currently manufactured two-stage and modulating burners actually reduce energy efficiency in typical direct heating equipment, DOE is considering them as a design option only if they are incorporated into a heater already equipped with a multiple-speed induced or forced draft combustion system.

The American Council for an Energy Efficient Economy said that DOE should consider two-speed or variable-speed blowers. (American Council for an Energy Efficient Economy, No. 6 at 3).

The practical application of two-speed or variable-speed blowers is with two-stage or modulating burners. When heating loads are low, both the burner rate and the blower speed could be reduced. This would prevent cycling of the unit and reduce large fluctuations in room temperature. In addition, overall energy consumption could be reduced. As with two-stage and modulating burners, two-speed and variable-speed blowers will also be considered by the Department only on heaters already equipped with a multiple-speed induced or forced draft combustion system. This is because two-stage or modulating operation can improve system efficiency only if coupled with a device, i.e., a multi-speed combustion system that can regulate the air flow rate into a two-stage or modulating burner.

The North Carolina Public Service Co. suggested that DOE consider whether blowers can be used in direct heating equipment with self-generating pilots. (North Carolina Public Service Co., No. 74 at 5).

It is not clear to what North Carolina Public Service is referring, as it fails to define clearly in its comment which blower it is discussing and what a self-generating pilot is. A blower could be interpreted as either an air circulation fan or an induced or power draft fan. The self-generating pilot is probably some type of electronic ignition device. The Department has evaluated all of the above-mentioned design options and has determined that blowers of any type can be used with electronic ignition systems.

The Gas Appliance Manufacturers Association commented that for a replacement unit incorporating an increased heat exchanger surface area, condensate must be avoided in the existing vent system. This requirement results in limiting the combustion efficiency to 83 percent. (Gas Appliance Manufacturers Association, 40 at 7).

The Department agrees with the Gas Appliance Manufacturers Association's comment and considered venting issues in the analysis. Design options that increased the combustion efficiency over 83 percent require an additional installation charge to account for venting low-temperature flue gases and draining condensate.

Other comments. The Southern Gas Association, Energen, and the Atlanta Gas Light Company recommended baseline units for direct heating equipment. (Southern Gas Association, No. 4 at 8; Energen, No. 12 at 15,16; Atlanta Gas Light Company, No. 29 at 4).

The Department considered these comments regarding baseline units in the Engineering Analysis. Baseline unit efficiency levels for each of the direct heating product classes have been set at the standard levels established by the National Appliance Energy Conservation Act. Of the units currently produced, the National Appliance Energy Conservation Act minimum efficiency standards are representative of the efficiency levels that presently exist for most models.

Minnegasco said that installation and maintenance expenses for direct heating products are important, and that DOE must consider them. (Minnegasco, No. 83 at 3).

The Department has considered these expenses in the analysis of direct heating equipment. The increase in consumer expenses caused by a design option includes not only the increase in retail price, but also any additional installation and maintenance expenses

that result from incorporating that design option into the equipment.

Southern Gas Association contended that more efficient direct heating equipment would have a severe economic impact on lower-income and elderly consumers, and that low usage in Southern states should be evaluated. (Southern Gas Association, No. 4 at 7,10). Minnegasco also commented on the issue of low usage by urging DOE to consider regional usage when performing the engineering analysis. (Minnegasco, No. 83 at 2).

The Department has lowered its usage assumption by using the modified burner operating hours contained in the Notice of Proposed Rulemaking mentioned above for furnace test procedures. The proposed burner operating hours for direct heating equipment has been revised downward to account for the regional distribution of this product disproportionately to the southern half of the Nation. The Department has no data with which to measure the standards' impacts on elderly and lower-income consumers in determining whether a standard level is economically justified; however, DOE will consider the financial effect that the standard has on such consumers.

In the Advance Notice for this rulemaking, the Department described how it performs sensitivity analyses to help it understand the effects on the forecasted impacts because of changes in the exogenous variables and assumptions. (55 FR 39633).

Those sensitivities were developed at the national level, and no effort was made to link them with any specific population groups. With the exception of the direct heating equipment analysis discussed above, the standards analysis assumed that nationwide average appliance usage rates, energy prices, and efficiency applied to all consumers in all areas of the nation, although the Department recognized that there exist large variations in each of these factors. The Department seeks additional information concerning the extent to which any proposed national efficiency standard is likely to affect identifiable groups of consumers disproportionally and, especially how best to consider such impacts in the selection of efficiency standard levels. The Department is also seeking additional data to help it better assess the disproportionate impacts on such groups.

4. Mobile Home Furnaces

Design options. The Gas Appliance Manufacturers Association stated that an intermittent ignition device design is not appropriate to mobile home furnaces. The Gas Appliance Manufacturers Association stated there is almost no flow through the heat exchanger during the off-cycle. If the intermittent ignition device failed, a gas-air mixture could build up and possibly lead to an explosion when the intermittent ignition device is activated. (Gas Appliance Manufacturers Association, No. 40 at 7).

The Department accepted Gas Appliance Manufacturers Association's comment and did not consider an intermittent ignition device plus vent damper as an engineering design for mobile home furnaces.

American Council for an Energy Efficient Economy proposed intermittent ignition devices and vent dampers be separately considered and that two-speed or variable-speed blowers be evaluated. (American Council for an Energy Efficient Economy, No. 6 at 4).

The Department has accepted these approaches. The intermittent ignition device with fan-forced combustion has been considered as one option, while the combustion box damper has been considered as a separate option. A combustion box damper has the same effect on efficiency as a vent damper for isolated combustion-type systems. Mobile home furnaces are required to have isolated combustion systems by the Housing and Urban Development code. Both two-stage and continuously modulated burners were included in the final list of design options.

Evcon commented that vent dampers are inappropriate designs because of damper location and isolated combustion design. (Evcon, No. 76 at 1).

The Department has considered combustion box dampers instead of vent dampers. The Department knows of no design considerations that would render combustion box dampers inappropriate.

Evcon also suggested that condensing designs and intermittent ignition devices are inappropriate because of excessive cost. (Evcon, No. 76 at 1–2).

The Department has incorporated the costs for materials, components, maintenance, and installation into the Engineering Analysis.

Evcon further commented that expense and noise problems exist with pulsed combustion furnaces. (Evcon, No. 76 at 1).

The Department acknowledges these points and notes that pulsed combustion is no longer on the list of design options. In eliminating this design option, the Department reasoned that non-pulsed combustion technology can achieve efficiencies equivalent to pulsed-combustion technology at a lower cost. This is particularly true for manufacturers having to pay patent royalties for pulse combustion technology. Manufacturing cost data from the manufacturers supported this conclusion.

Lastly, Evcon commented that corrosion and cost problems exist with two-stage and modulating burner designs. (Evcon, No. 76 at 2).

In the Engineering Analysis, the Department assumed that material costs (for the concentric flue/supply air assembly) would increase because of the need to design for possible intermittent condensation in two-stage non-condensing furnaces. Non-condensing modulating furnaces are not included in the present list of design options.

Other comments. Gas Appliance Manufacturers Association also commented that replacement furnaces must be able to fit into the same spaces as the units being replaced. (Gas Appliance Manufacturers Association, No. 40 at 7).

The Department does not believe that any of the studied design options would result in significant space problems.

Evcon also commented that American Society of Heating, Refrigerating, and Air-conditioning Engineers Standard 103–1982 is inadequate for the testing of various design options and urged that American National Standards Institute/ American Society of Heating, Refrigerating, and Air-conditioning Engineers Standard 103–88 be adopted. (Evcon, No. 76 at 2).

Modifications to the test procedures for furnaces, which address these issues, are contained in the Notice of Proposed Rulemaking referenced above.

5. Kitchen Ranges and Ovens

Classes. The comments on classes for conventional ranges and ovens ranged from Aloha Systems Inc.'s recommendation that all electric cooktops be one product class to Association of Home Appliance Manufacturers's proposal to add several classes to those proposed in the Advanced Notice of Proposed Rulemaking. Specifically, the Association of Home Appliance Manufacturers recommended that DOE add, as classes, electric cooktops with grill/griddle without downdraft feature, and for gas cooktops—grill/griddle with downdraft feature, grill/griddle without downdraft feature with and without an electric cord, and warming/simmer burners. (Aloha Systems, Inc., No. 2 at 1; and Association of Home Appliance Manufacturers, No. 61A at 38).

Several comments supported the range/oven product classes that were listed in the Advanced Notice of Proposed Rulemaking. Four gas utilities,

Southern Gas Association, Energen, South Carolina Electric and Gas Company - Gas Operations, and the Oklahoma Natural Gas Co., all supported the classes selected by DOE for gas cooktops and gas ovens. (Southern Gas Association, No. 4 at 7; Energen, No. 12 at 14; South Carolina Electric and Gas Company - Gas Operations, No. 34 at 6; and the Oklahoma Natural Gas Co., No. 57 at 6).

The rest of the comments on range/oven product classes argued that the Department had proposed far too many different classes in the September 1990 advance notice. As mentioned, Aloha Systems, Inc. recommended a single product class for electric cooktops. The American Council for an Energy Efficient Economy, the Natural Resources Defense Council, the California Energy Commission, and the Ohio Office of the Consumers' Council all stated that there are too many classes for conventional ranges and ovens. (Aloha Systems, Inc. No. 2 at 1; American Council for an Energy Efficient Economy, No. 6 at 1; Natural Resources Defense Council, No. 13 at 25, California Energy Commission, No. 24 at 5; and Ohio Office of the Consumers' Council, No. 60 at 9). ENTEX proposed that the Department specify freestanding, drop-in, and slide-in ovens and wall ovens as one class. (ENTEX, No. 58 at 6). Whirlpool Corporation, a manufacturer of ranges and ovens, suggested that DOE not analyze those classes with low sales volumes, and instead restrict the analysis to the following nine classes: Electric cooktops with open coil elements; electric cooktops with solid disk elements; standard or catalytic electric ovens; self-cleaning electric ovens; conventional or sealed burner gas cooktops (with and without power cords); standard or catalytic gas ovens (with and without power cords) and self-cleaning gas ovens. (Whirlpool Corporation, No. 31 at 16). Association of Home Appliance Manufacturers stated that three of the classes listed in the Advanced Notice of Proposed Rulemaking for gas cooktops, conventional burners with electrical cords, conventional burners without electrical cords and sealed burners, should be consolidated into two classes, namely, conventional and sealed burners with electrical cords and conventional and sealed burners without electrical cords. (Association of Home Appliance Manufacturers, No. 61A at 47, 48).

After considering the comments and reviewing the data, the Department believes that many of the classes proposed in the September advance notice were not warranted on a utility and performance basis.

For this proposed rule, four product classes were considered for electric cooktops: Low or high wattage open (coil) elements, smooth cooktops, grill with or without downdraft feature, and griddle with or without downdraft feature. The baseline cooktop element selected for smooth cooktops is a solid disk element. As compared to open coil element cooktops, smooth cooktops are much easier to clean. Because cleanability is a consumer utility, the Department believes that a separate class is warranted for smooth cooktops. Induction cooking, halogen lamps, and radiant elements were considered as design options for smooth cooktops and assessed according to the economic characteristics of the particular design. Because of the small amount of empirical data on grill and griddle cooktops, the Department was unable to analyze these classes. In addition, the DOE test procedure is presently unable to measure grill or griddle energy consumption, and the Department has not proposed to include the testing of grills or griddles. As a result, the Department is not proposing any standard for these two classes.

Four product classes are now considered for gas cooktops: Conventional burners, grill with or without downdraft feature, griddle with or without downdraft feature, and warming/simmer burners. For other designs, the Department does not believe that significant utility issues exist, for example, in the ability of the appliance to operate during electric outages, which would require that classes be established into gas cooktops with and without electrical cords. Between 90 and 93 percent of residential electricity customers experience no electric outages longer than four hours per year.[28] Designs which use electricity were evaluated on their economic advantages and disadvantages. Other classes in the Advance Notice of Proposed Rulemaking (sealed and radiant burners) were considered as design options for conventional cooktops. There were no utility issues warranting separate classes for sealed and radiant burners. As with electric cooktops, because of the small amount of empirical data on grill and griddle cooktops and warming burners, the Department was unable to analyze these classes. In addition, the DOE test procedure is presently unable to measure grill, griddle or warming burner energy consumption, and the Department has not proposed to include the testing of grills, griddles or warming burners. As a result, the Department is not proposing any standard for these three classes.

Two product classes were considered for electric ovens: Standard ovens with or without catalytic linings and self-cleaning ovens. Oven types that were listed as classes in the September 1990 advance notice (forced convection for cooking, forced convection for cleaning, halogen lamp, and steam cooking with and without pressure) were considered as design options. The Department believes that no utility issues exist warranting additional classes beyond standard and self-cleaning ovens.

As with electric ovens, two product classes were considered for gas ovens: Standard ovens and self-cleaning ovens. Oven types that were listed as classes in the September 1990 advance notice (radiant burner and convection) were considered as design options. In addition, the Department does not believe that significant utility issues exist in the ability of the appliance to operate during electric outages, which would require that classes be established into those with and without electrical cords. Designs which use electricity are evaluated on their economic advantages and disadvantages.

As for microwave oven classes, both Whirlpool Corporation and Association of Home Appliance Manufacturers recommended that the Department limit its analysis to microwave ovens with and without browning elements, the classes which accounted for 96.8 percent of domestic shipments in 1989. (Whirlpool Corporation, No. 31 at 9; Association of Home Appliance Manufacturers, No. 61A at 30).

The Department rejected the proposals to limit the analysis to two product classes: conventional microwave ovens with and without browning elements. The Department combined these ovens into one class. Since the test procedure does not measure the energy use of the browning element, there is no need to separate these two kinds of ovens into classes; therefore, only one class of microwave ovens was analyzed.

Design options. There were numerous comments on the design options for ranges/ovens and microwave ovens. Natural Resources Defense Council recommended that DOE study (for ranges/ovens) reduction in thermal mass, catalytic burners, reflective surfaces, the biradiant concept, and improved magnetrons for microwave

[28] A.P. Sanghvi, 1990. *Cost-Benefit Analysis of Power System Reliability: Determination of Interruption Costs.* Prepared by RCG/Hagler/Bailly Inc. for Electric Power Research Institute EL-6791, vol 2, p3-3.

ovens. (Natural Resources Defense Council, No. 13 at 27–28). Aloha Systems, Inc. said that induction cooking is the most efficient method. (Aloha Systems, Inc., No. 2 at 1,2). American Council for an Energy Efficient Economy proposed that DOE evaluate the infrared jet gas burner for conventional ovens, and for microwave ovens, advanced transformer winding and core materials, and the high-efficiency electronic controller (which turns power on and off). (American Council for an Energy Efficient Economy, No. 6 at 4). The Rocky Mountain Institute proposed that DOE study improved controls that allow the resistance element to "coast" the food to completion. A reference to European tests was given, stating that this design requires a thermostat and temperature control knob and saves 20 percent or more of the energy. (Rocky Mountain Institute, No. 15 at 5). The Oklahoma Natural Gas Co. suggested that thermostatically controlled gas burners be replaced by various-sized (Btu/h input and dimensions) and manually controlled surface burners to accommodate different-size cookware. (Oklahoma Natural Gas Co., No. 57 at 6). The Association of Home Appliance Manufacturers provided comments on each design option for ranges/ovens and microwave ovens. (Association of Home Appliance Manufacturers, No. 61A at 30–62). Whirlpool Corporation supported the Association of Home Appliance Manufacturers' comments on ranges/ovens and microwave ovens. (Whirlpool Corporation, No. 31 at 16, 19).

For gas cooktops, the Association of Home Appliance Manufacturers stated that thermostatically controlled gas burners are not effective at controlling temperature. The sensing element which is designed to make contact with the cooking vessel will not allow effective control if the cooking utensil has an uneven bottom in the area where it is to be "sensed." In addition, since the electric sensing element will retain heat due to its mass, reaction times could be delayed, thus allowing wide swings in the thermostatically selected temperature. The DOE test procedure also cannot measure the effect of thermostatically controlled burners. (Association of Home Appliance Manufacturers, No. 61A at 54, 55.) The Association of Home Appliance Manufacturers stated that the performance of reflective surfaces is degraded significantly from reaction to cooking vapors, burnt-on spillovers and cleaning with abrasive pads. To maintain reflective surfaces it would be necessary to replace these expensive units periodically. The Association of Home Appliance Manufacturers felt that the energy savings from reflective surfaces are very small. (Association of Home Appliance Manufacturers, No. 61A at 56, 57.) With regard to insulation, the Association of Home Appliance Manufacturers stated it is occasionally used in gas cooktops where there are surface temperature problems on the surrounding structures. The insulation is attached outside of the burner box. Any other placement would impair utility, because the space underneath the countertop cooktop unit (that is designed to fit in drawers) would become significantly reduced.

The Association of Home Appliance Manufacturers also felt that the energy savings from insulation is very small. (Association of Home Appliance Manufacturers, No. 61A at 56, 57.) In its comments regarding product classes, the Association of Home Appliance Manufacturers, though it suggested that both conventional and sealed burners be considered as one class, stated that it is incorrect to assume that sealed burners are more efficient than conventional burners. Sealed burners obtain all of their secondary air from above the cooktop, which requires that either the grate height be raised or the burner be derated in order for it to be as efficient as conventional burners. (Association of Home Appliance Manufacturers, No. 61A at 47, 48.) The Association of Home Appliance Manufacturers stated that radiant burners should be considered as a product class rather than a design option and went on to state several problems with these burner types. Since radiant burners use a powered pre-mix burner, carbon monoxide control is more critical, and the burner flame can only be varied by 30 percent. Test work performed by the Gas Research Institute with the American Gas Association Laboratories on prototypes has revealed that low burner rate is difficult to maintain. This means that current prototypes would not meet American National Standards Institute standards. The Association of Home Appliance Manufacturers also stated that burner efficiency might be no better than conventional burners. (Association of Home Appliance Manufacturers, No. 61A at 49–51.)

The Department took into account all sources of available data when determining the cost and energy savings from thermostatically controlled burners, reflective surfaces, and sealed burners. Sources of data included the Association of Home Appliance Manufacturers, manufacturers, suppliers, and published papers and reports. Lack of any available data regarding catalytic burners, high efficiency electronic controllers, and insulation prevented the Department from analyzing these design options. The Department agrees with the Association of Home Appliance Manufacturers' comments regarding radiant gas burners. Because there is no prototype that works satisfactorily, it is not possible to determine if this design option is technologically feasible..

For electric open coil cooktops, the Association of Home Appliance Manufacturers stated that the contact conductance of open coil elements cannot be significantly improved. Manufacturers have worked together to improve the flatness of this element type, and have produced an element that is doing an excellent job. (Association of Home Appliance Manufacturers, No. 61A at 57, 58.) The reflective surface and insulation design options cause the same problems for electric open coil cooktops as for gas burners. See comments, supra, for gas cooktops. (Association of Home Appliance Manufacturers, No. 61A at 58.)

Manufacturers' data provided by the Association of Home Appliance Manufacturers and published reports [29] were used by the Department to analyze the effects from improved contact conductance and reflective surfaces. Cost data were also provided by these sources. The electronic controls referred to by the American Council for an Energy Efficient Economy and the Rocky Mountain Institute cannot be evaluated by the DOE test procedure. Different types of tests based on boiling water have been used to evaluate electronic controls. But boiling water tests have yet to be standardized by DOE as a method to rate cooktops. Therefore, this design option was not analyzed by the Department.

For electric smooth cooktops, the Association of Home Appliance Manufacturers's comments on product classes proposed separate classes for solid disk elements, radiant elements under glass, halogen elements under glass, and induction elements. The

[29] "Costing Analysis of Design Options for Residential Appliances and Space Conditioning Equipment," Lawrence Berkeley Laboratory, prepared by ADM Associates, Inc., Purchase No. 4541710, December 1987, "Energy Efficient Electrical Product Knowledge Base," Canadian Electrical Association, prepared by ORTECH International, C.E.A. No. 821 U 678, October 1989, M. Shepard, A.B. Lovins, J. Neymark, D.J. Houghton, and H.R. Heede, "The State of the Art: Appliances," Rocky Mountain Institute, Competitek, August 1990 Edition, and U.S. Department of Energy Engineering Analysis, DOE/CS–0166, June 1980.

Association of Home Appliance Manufacturers commented that though solid disk elements are inherently less efficient than open coil elements, they should be a separate class because of the additional utility in their ease of cleaning. (Association of Home Appliance Manufacturers, No. 61A at 39, 40). With regard to radiant and halogen elements under glass, the Association of Home Appliance Manufacturers commented that not only are these cooktops easy to clean because of their smooth surfaces, but additional work space is gained when the cooktop surface is not in use. The Association of Home Appliance Manufacturers also stated that the recommended cookware for halogen elements are metal pots and pans, since glass and ceramic cookware are not good heat conductors. (Association of Home Appliance Manufacturers, No. 61A at 40, 41). The Association of Home Appliance Manufacturers stated that since induction elements heat items by transferring electromagnetic energy, the glass or ceramic countertop under which they lie is unaffected and remains relatively cool. This also means that the cookware used with induction elements must be made from magnetic materials. The Association of Home Appliance Manufacturers listed the following advantages of induction cooking: fast response and control of heat source, ease of cleaning (since food spills do not burn onto the cooking surface), and the ability to heat utensils that are not flat. The Association of Home Appliance Manufacturers pointed out that because the DOE test procedure uses non-magnetic aluminum blocks, it is not suitable for testing induction elements. (Association of Home Appliance Manufacturers, No.61A at 41–43).

As stated in the discussion of product classes, the Department has established two classes for electric cooktops (open coil and smooth), and believes that radiant, halogen, and induction elements offer no consumer utility which prevents them from being analyzed as design options for smooth cooktops. Solid disk elements are treated as the baseline unit for smooth cooktops. Data provided by the Association of Home Appliance Manufacturers, cooktop manufacturers, suppliers, and a published report [30] were used in the analysis of smooth cooktops. Data were provided which evaluated radiant, halogen, and induction elements according to the DOE test procedure. The Department test results were obtained for induction elements by attaching a ferro-magnetic material to the aluminum test block. As with open coil elements, different types of tests based on boiling water have been used to evaluate electronic controls for smooth cooktops. But boiling water tests have yet to be standardized by DOE as a method to rate cooktops. Therefore, this design option was not analyzed by the Department.

In its comments on design options for gas and electric ovens, the Association of Home Appliance Manufacturers stated that since the DOE test procedure does not require maintaining heat in the oven over a period of time, improving the insulation in the cabinet will not show any energy savings. (Association of Home Appliance Manufacturers, No. 61A at 58). With regard to reduced vent size, the Association of Home Appliance Manufacturers stated that this design option should be considered only for electric ovens, not for gas ones. It then proceeded to state how any reductions in vent size will negatively impact cooking and baking performance as well as safety (Association of Home Appliance Manufacturers, No. 61A at 58, 59). The Association of Home Appliance Manufacturers stated that, according to the DOE test procedure, existing instrumentation cannot measure the small energy efficiency gains that result from reducing conduction losses. (Association of Home Appliance Manufacturers, No. 61A at 59). As with cooktops, the Association of Home Appliance Manufacturers stated that reflective surfaces degrade quickly in ovens. This significantly reduces their impact on energy use over the life of the product. (Association of Home Appliance Manufacturers, No. 61A at 59, 60). The Association of Home Appliance Manufacturers asserted that oven thermal mass cannot be reduced. Further reductions in the gauge of the oven wall material may result in cracking and heat loss. (Association of Home Appliance Manufacturers, No. 61A at 60). The Association of Home Appliance Manufacturers stated that an oven separator to reduce oven thermal mass would pose potential safety problems due to improper installation, gas combustion considerations, and the handling of the separator by the consumer. No test procedure currently exists to certify the safety or performance of an oven using a separator. In addition, the Association of Home Appliance Manufacturers questioned the separator's utility, as consumers already use microwave and toaster ovens for small loads. The Association of Home Appliance Manufacturers also questioned whether the DOE test procedure could evaluate this design option. (Association of Home Appliance Manufacturers, No. 61A at 60–62).

For electric ovens, the Association of Home Appliance Manufacturers proposed separate product classes for forced convection ovens for cooking and cleaning, halogen lamp ovens, and steam cooking ovens. The Association of Home Appliance Manufacturers stated that due to unique operating characteristics a separate class should be adopted for convection ovens. (Association of Home Appliance Manufacturers, No. 61A at 45, 46). With regard to halogen lamp ovens, the Association of Home Appliance Manufacturers asserted that the baking performance is relatively poor compared to the characteristics of a conventional electric oven. But since it may have certain advantages for broiling applications, the Association of Home Appliance Manufacturers said it should be a separate class. (Association of Home Appliance Manufacturers, No. 61A at 46). Since no United States manufacturer is currently producing steam ovens and because the food products that can be cooked or baked by this oven type are limited, the Association of Home Appliance Manufacturers said it should be adopted as a separate class. (Association of Home Appliance Manufacturers, No. 61A at 47).

As stated in the discussion of product classes, the Department has established two product classes for electric ovens (standard and self-cleaning), and analyzed halogen lamp, convection, and steam cooking as design options for electric ovens. The design options commented on by the Association of Home Appliance Manufacturers and others have all been considered for electric ovens. This includes the biradiant oven concept that was referred to by the Natural Resources Defense Council. Data provided by the Association of Home Appliance Manufacturers, oven manufacturers, suppliers, and published reports [31] were

[30] M. Shepard, A.B. Lovins, J. Neymark, D.J. Houghton, and H.R. Heede, "The State of the Art: Appliances," Rocky Mountain Institute, Competitek, August 1990 Edition.

[31] "Costing Analysis of Design Options for Residential Appliances and Space Conditioning Equipment," Lawrence Berkeley Laboratory, prepared by ADM Associates, Inc., Purchase No. 4541710, December 1987, "Energy Efficient Electrical Product Knowledge Base," Canadian Electrical Association, prepared by ORTECH International, C.E.A. No. 821 U 678, October 1989, U.S. Department of Energy Engineering Analysis, DOE/CS–0166, June 1980, and D.P. DeWitt and M.V. Peart, "Bi-Radiant Oven a Low-Energy Oven System," Purdue University, prepared for Oak Ridge National Laboratory, April 1980, ORNL/Sub–

used in the analysis of electric ovens. Manufacturers' data supplied by the Association of Home Appliance Manufacturers were the only source of cost and efficiency data provided to analyze oven separators. The improved insulation and reduced vent size design options were analyzed only for standard electric ovens. Insulation improvement levels and vent size reductions for standard ovens were selected to bring their baseline unit to the same efficiency level as the baseline unit selected for self-cleaning ovens. The Department received no data that indicated that insulation could be improved beyond the baseline level for self-cleaning ovens. In addition, any further reductions in vent size were assumed to jeopardize both oven safety and cooking performance. The Department did not receive any energy-use or cost data concerning the halogen lamp and steam cooking design options, thus preventing them from being analyzed for electric ovens.

For gas ovens, the Association of Home Appliance Manufacturers proposed separate product classes for standard and self-cleaning convection ovens and radiant burner gas ovens. As with electric convection ovens, the Association of Home Appliance Manufacturers said the unique operating characteristics of the convection oven warrant a separate class. (Association of Home Appliance Manufacturers, No. 61A at 53). For radiant burner gas ovens, the Association of Home Appliance Manufacturers made reference to its comments on radiant burners for gas cooktops. (Association of Home Appliance Manufacturers, No. 61A at 53).

As stated in the discussion of product classes, the Department has established two product classes for gas ovens (standard and self-cleaning). The Department believes that convection and radiant burner gas ovens should be analyzed as design options. A separate class would be warranted if lower efficient design options had consumer utility relative to convection and radiant burner gas ovens. The design options commented on by the Association of Home Appliance Manufacturers and others have all been considered for gas ovens. The bi-radiant oven concept referred to by the Natural Resources Defense Council was determined to be applicable to electric ovens only.[32] Data provided by the Association of Home Appliance Manufacturers, manufacturers, suppliers, and published reports[33] were used in the analysis of gas ovens. Manufacturers' data supplied by the Association of Home Appliance Manufacturers were the only source of cost and efficiency data provided with which the Department could analyze oven separators. As with electric ovens, the improved insulation and reduced vent size design options were analyzed only for standard gas ovens. The Department did not receive any energy-use or cost data concerning the radiant burner gas oven, thus preventing it from being analyzed.

For microwave ovens, the Association of Home Appliance Manufacturers stated that high-grade stainless steel (or reflective material steel coating) would be more efficient than painted cold-rolled steel by approximately one percent. (Association of Home Appliance Manufacturers No. 61A at 30–33). The Association of Home Appliance Manufacturers stated that a small efficiency improvement may be available if fan air flow is increased or if motor energy consumption is decreased. (Id. at 32). The Association of Home Appliance Manufacturers said that magnetron efficiency has reached its maximum at 72 percent. (Id. at 33). The Association of Home Appliance Manufacturers stated that solid-state power supplies are not more efficient, but cost more. At low power levels, improved performance is expected because they eliminate the on/off cycling used by other power supplies. (Id. at 34). The Association of Home Appliance Manufacturers stated that there are no data available to suggest that solid-state microwave generators would increase the generating efficiency over the 70+ percent efficiency available in today's magnetrons. (Id. at 34). The Association of Home Appliance Manufacturers said that a modified wave guide may decrease energy absorption by one percent. (Id. at 35). The Association of Home Appliance Manufacturers stated that microwave oven models with fan-type stirrers use a cover over the fan to prevent inadvertent damage to the fan when inserting or removing food and to prevent degradation of the wave guide due to food splatter. While these ceramic stirrer covers may absorb some microwave energy, they are essential for protecting the stirrer and to prevent accumulation of food splatter inside the wave-guide. (Association of Home Appliance Manufacturers No. 61A at 35).

The Department has utilized the Association of Home Appliance Manufacturers's estimates for energy savings from improved magnetrons, reflective surfaces, modified wave guides, and more efficient fans. After considering the Association of Home Appliance Manufacturers's comments, the Department has also excluded solid-state microwave generators and modified food stirrers from its cost/efficiency tables. The Department has generated data for, and included a more efficient power supply in, its cost/efficiency analysis for microwave ovens.

Arkansas Western Gas said that maintenance and installation should be considered. (Arkansas Western Gas, No. 64 at 7).

Maintenance and installation costs were considered for ranges and ovens. The Department determined that the only design option which required additional maintenance costs was electronic ignition for gas cooktops. Using data obtained from electronic ignition manufacturers, the Department established a price for replacing malfunctioning electronic ignition devices. A retirement function based on data received from electronic ignition manufacturers and service technicians was used to establish the rate of failure of these control devices. With the retirement function and replacement cost, the expected maintenance expense was then determined.

Mr. Rajendra Narang provided patents for improving the efficiency of gas ranges/ovens. These included, for ovens: Combustion air preheated by discharge gases, heated discharge gases discharged only when combustion occurs, and circulation fans for better airflow; for cooktops: an efficient piloted ignition and flame containing burner rings to support pots and pans. (Narang, No. 82).

The Department was not able to assess the energy savings from most of the design options presented by Mr. Narang. (Circulation fans were analyzed, however.) Experimental data and simulation models were not available to allow evaluation of these design options.

Other comments. The Association of Home Appliance Manufacturers recommended that the usage assumptions for ranges/ovens be decreased to account for changes in

80/0082/1, ORNL/Sub–80/0082/2, ORNL/Sub–80/0082/3.

[32] D.P. DeWitt and M.V. Peart, "Bi-Radiant Oven a Low-Energy Oven System," Purdue University, prepared for Oak Ridge National Laboratory, April 1980, ORNL/Sub–80/0082/1, ORNL/Sub–80/0082/2, ORNL/Sub–80/0082/3.

[33] "Costing Analysis of Design Options for Residential Appliances and Space Conditioning Equipment," Lawrence Berkeley Laboratory, prepared by ADM Associates, Inc., Purchase No. 4541710, December 1987, "Energy Efficient Electrical Product Knowledge Base," Canadian Electrical Association, prepared by ORTECH International, C.E.A. No. 821 U 676, October 1989, U.S. Department of Energy Engineering Analysis, DOE/CS–0166, June 1980.

lifestyles since the original usage values were estimated. The Association of Home Appliance Manufacturers said the reductions in energy use are from 68 to 74 percent for cooktops and ovens. (Association of Home Appliance Manufacturers, No. 61 at 38). Whirlpool Corporation stated that DOE should revise the test procedure to account for lower usage; the present test procedure overstates usage for cooktops and ovens by 70 and 76 percent, respectively. (Whirlpool Corporation, No. 31 at 17). The American Council for an Energy Efficient Economy also recommended that the usage values be updated. (American Council for an Energy Efficient Economy, No. at 2). Finally, Arkansas Western Gas said range use is down, and that gas use is so low (6Mcf) that any conservation item will have little effect. (Arkansas Western Gas, No. 64 at 6).

As stated previously, the Department has proposed revised test procedures for kitchen ranges and ovens. The Department used the proposed test procedure, including the more current field usage numbers, for the analyses in today's notice. The new annual useful cooking energy output values were determined to be 209.4 kWh for electric cooktops, 732.5 kBtus for gas cooktops, 35.5 kWh for electric ovens, and 124.2 kBtus for gas ovens.

With regard to potential microwave oven standards, the Association of Home Appliance Manufacturers contended that such standards would have an insignificant effect on energy consumption. (Association of Home Appliance Manufacturers, No. 61A at 29).

The Department analyzed quantitatively the energy-saving potential of standards on microwave ovens and found that significant savings are possible. (See Technical Support Document, Chapter 5).

With respect to the usage values for microwave ovens, Whirlpool Corporation stated that microwave energy use has increased significantly, and DOE should initiate a new study to determine a reasonable estimated energy use for microwave ovens. (Whirlpool Corporation, No. 31 at 19). Citing the Electronic Industries Association's estimated 100 kWh/yr usage for microwave ovens in 1987, the Association of Home Appliance Manufacturers stated that it was consistent with its 1976 data showing 75 kWh/yr usage because, although average family size has decreased, microwave oven use within the household has increased. (Association of Home Appliance Manufacturers, No. 61A at 27).

As with the usage number for conventional ranges and ovens, the Department used the proposed test procedure usage values for the analysis of microwave ovens. The Department obtained the proposed energy use values from several utility conditional demand studies resulting in the proposed usage value of 270 kWh/yr for microwave ovens.

Lastly, some comments urged changes in the ranges and ovens test procedure as well as the microwave oven test procedure. Aloha Systems, Inc. commented that the present test procedure using an aluminum block is not realistic, and that induction cooking cannot be evaluated with the present test procedure since that procedure requires iron pots and pans. (Aloha Systems, Inc., No. 2, at 2). Whirlpool Corporation and the Association of Home Appliance Manufacturers both urged the Department to change its microwave test procedure to the 1988 International Electrotechnical Commission test procedures for measuring microwave power and energy use. (Whirlpool Corporation, No. 31 at 18; Association of Home Appliance Manufacturers No. 61A at 25.)

Modifications to the test procedures for kitchen ranges and ovens, which address these issues, are contained in the Notice of Proposed Rulemaking referenced above.

6. Pool Heaters

Classes. With regard to comments on pool heater classes, Southern Gas Association, Energen, South Carolina Gas and Electric, Laclede, and the Oklahoma Gas Co. proposed that an additional product class for pool heaters be established—gas pool heaters with automatic ignition. (Southern Gas Association, No. 4 at 8; Energen, No. 12 at 15; South Carolina Gas and Electric, No. 34 at 6; Laclede, No. 55 at 6; and Oklahoma Gas Company, No. 57 at 7.)

The Department believes there is no significant difference in consumer utility between gas-fired pool heaters which use electricity and those which do not. In addition, pool heaters are customarily installed adjacent to the pump and filter. Therefore, electricity will be readily available for the pool heater. The Department decided to keep gas-fired pool heaters as one class and to consider electricity-using design options as another design option. Accordingly, the installation and maintenance expenses (in addition to increased manufacturer costs) associated with design options using electricity were considered in the economic calculations.

Another product class issue dealt with heat pump pool heaters. Air Energy Heat Systems (Air Energy Heat Systems, No. 44 at 1) provided efficiency data. The company stated that coefficients of performance are available in the mid five's and will reach the low six's in the future.

The Department has adopted American National Standards Institute Standards Z21.56–1989 and Z21.56a–1990 as the test procedure for pool heaters. The American National Standards Institute standards apply to gas-fired pool heaters only, not electric resistance pool heaters or electric heat pump pool heaters. Since a test procedure does not exist for electric pool heaters, coefficients of performance data were not used in the analysis.

Design options. As for pool heater design options, the Gas Appliance Manufacturers Association argued that since pool heaters have "no flues," many of the design options listed in the Advanced Notice of Proposed Rulemaking are inappropriate, such as use of flue dampers, multiple flues, and increased flue baffling. (Gas Appliance Manufacturers Association, No. 40 at 5.)

Most pool heaters currently being manufactured pass the water through a heat exchanger pipe which is located inside a combustion chamber above the burner. This design does not have a flue, and would not benefit from design options to improve the flue. The Department agrees with Gas Appliance Manufacturers Association and is not considering these design options.

One company took issue with the Gas Appliance Manufacturers Association's comments about flue dampers not being an appropriate design for pool heaters. Flair said, "We know of several manufacturers who build boiler-type pool heaters equipped with flues." (Flair, No. 85 at 1.) Flair also recommended that the Department evaluate a water heater design option of automatic ignition with a flue damper for pool heaters. (Flair, No. 85 at 2.)

The Department is not aware of any residential pool heaters being manufactured currently with separate boilers or tanks that store water at elevated temperatures. Flue dampers are effective only at reducing standby losses from storage tanks. Therefore, flue dampers were not considered. Automatic ignition was included as a design option.

Other comments. One comment dealt with pool heater test procedure issues. The California Energy Commission stated new test procedures are needed for oil-fired, electric resistance, and heat pump pool heaters, and the gas-fired pool heater test needs to include

standby losses so that intermittent ignition devices are credited for increasing the energy factor. (Commission Energy Commission, No. 24 at 5.)

Modifications to the test procedures for pool heaters, which address these issues, are contained in the Notice of Proposed Rulemaking referenced above.

Lastly, one comment proposed that pool heaters be brought under the appliance labeling program. (California Energy Commission, No. 24 at 6).

In response, the Department notes that the appliance labeling program is administered by the Federal Trade Commission. It will be the Federal Trade Commission's decision, not the Department's, whether to bring pool heaters under labeling requirements.

7. Clothes Washers

In a final rule regarding standards for three types of appliances, including clothes washers, published in the **Federal Register** on May 14, 1991 (56 FR 22250), the Department announced that it was accelerating the second review of energy efficiency standards for clothes washers. In response to that notice, a number of energy-efficiency advocates and appliance manufacturers requested that the Department delay the second review until 1995–96.[34] The additional time was requested in order to allow manufacturers time to implement the standards imposed by the 1991 final rule and to fully evaluate new, more energy-efficient technologies such as top-loading horizontal-axis clothes washers. This additional time, manufacturers contend, will enable them to provide more meaningful and relevant comments on the next, legislatively required rulemaking. The Department considered the request, and by letter, dated February 26, 1992, notified the parties requesting the delay that the Department had determined that it will conduct the rulemaking on the later schedule, as requested.[35]

8. Fluorescent Lamp Ballasts

Classes. Several fluorescent ballast class issues were raised in the comments on the Advanced Notice of Proposed Rulemaking. One comment supported the Department's proposed classes. (Advance Transformer, No. 25 at 2). On the other hand, a number of comments recommended additional classes for fluorescent lamp ballasts based on the size and type of lamp for which the ballast is designed. One set of comments proposed adding three and four-lamp F40T12 ballasts and F32T8 ballasts as product classes. (American Council for an Energy Efficient Economy, No. 6 at 2; Public Citizen, No. 7 at 3; Natural Resources Defense Council, No. 13 at 26; Rocky Mountain Institute, No. 15 at 3; California Energy Commission, No. 24 at 6; Northwest Power Planning Council, No. 32 at 2; and Sierrra Club, No. 43 at 2). Several comments proposed adding ballasts for compact fluorescent lamps as a product class. (Natural Resources Defense Council, No. 13 at 26; Rocky Mountain Institute, No. 15 at 3; Northwest Power Planning Council, No. 32 at 2; and Sierra Club, No. 43 at 2). Lastly, three comments proposed that dimming features on ballasts warrant a separate class, since such ballasts provide the utility to vary light output. (American Council for an Energy Efficient Economy No. 6 at 5; California Energy Commission, No. 24 at 7; Northwest Power Planning Council, No. 32 at 6).

In response, the Department has added three and four-lamp F40T12 ballasts and one, two, three, and four-lamp F32T8 ballasts to the list of product classes. These new classes will all have unique ballast efficiency factors. Compact fluorescent ballasts, however, are integrated with a lamp and sold as one package. As such, one cannot determine the efficiency of the ballast separate from the lamp. Although dimming ballasts do provide a unique utility to vary light output, the Department believes that such ballasts do not warrant a separate class. At full light output, their energy efficiency is expected to be equal to that of non-dimming ballasts. Therefore, any standard developed for non-dimming ballasts will apply to dimming ballasts operated at full light output.

Design options. The comments on the fluorescent lamp ballast design options consisted largely of suggestions of additional designs for the Department to consider. Certified Ballast Manufacturers stated that it feels there are only two design options, electromagnetic and electronic. (Certified Ballast Manufacturers, No. 47 at 2). Four comments proposed improvement of magnetic ballasts through the use of lower resistance conductors and low-loss silicone or amorphous steel core material. (American Council for an Energy Efficient Economy, No. 6 at 5; Valmont Electric, No. 16 at 1; California Energy Commission, No. 24 at 7; and Northwest Power Planning Commission, No. 32 at 5). A number of comments suggested that design options which reduce energy use of magnetic ballasts through cathode (heater) cutout, including use of electronic controls (hybrid ballasts), be considered. (American Council for an Energy Efficient Economy, No. 6 at 5; Public Citizen, No. 7 at 3; Natural Resources Defense Council, No. 17 at 29; Valmont, No. 16 at 1; California Energy Commission, No. 24 at 7; and Northwest Power Planning Council, No. 32 at 5). The California Energy Commission stated that instant start should be considered as one of the design options for magnetic ballasts. (California Energy Commission, No. 24 at 7). There were several comments regarding the consideration of levels of efficiency of electronic ballasts as design options such as instant start and use of integrated circuits. (American Council for an Energy Efficient Economy, No. 6 at 5; Public Citizen, No. 7 at 3; Sierra Club, No. 16 at 2; Natural Resources Defense Council, No. 17 at 29; Valmont, No. 16 at 1; California Energy Commission, No. 24 at 7; and Northwest Power Planning Council, No. 32 at 5). Finally, three comments proposed that dimming capability (task tuning) be considered as a design option of electronic ballasts. (American Council for an Energy Efficient Economy, No. 6 at 5; California Energy Commission, No. 24 at 7; and Northwest Power Planning Commission, No. 32 at 5).

Dimming capability (task tuning) is addressed above in the product class discussion. The analysis treated cathode cutout and instant start for magnetic ballasts, as well as lower resistance conductors and low-loss steel cores, as design options. The Department also analyzed one efficiency level for instant start and one for rapid-start electronic ballasts. The Department concluded that the use of integrated circuits as a substitute for discrete components is common enough to be included in the initial electronic ballast design option.

Other comments. Two comments recommended that energy-efficient magnetic ballasts be used as the baseline for all product classes. (Valmont, No. 16 at 1; and Magnetek Universal, No. 35 at 1).

The Department agrees with these recommendations and used energy-efficient magnetic ballasts for the baseline units for all classes.

Several comments advised against the Department's considering standards to reduce the harmonic distortion of fluorescent lamp ballasts. (Valmont, No. 16 at 3; Advance Transformer, No. 25 at 4; Magnetek, No. 35 at 2; and National Electrical Manufacturers Association, No. 41 at 1). These comments contended that the harmonic distortions caused by fluorescent lamp ballasts, presently less than 30 percent, are not a serious problem, and that options designed to

[34] ACEEE, AHAM, NRDC, No. 89 at 1.

[35] J. Michael Davis, P.E., No. 90 at 1.

reduce such distortions would not be cost-effective. (Both magnetic and electronic ballasts generate harmonic distortion.)

The Department treated the harmonic content for electronic ballasts as acceptable for conventional, i.e., non-compact, ballasts and did not assign any additional cost to achieving reduced harmonic distortion.

With regard to the fluorescent ballast test procedure, Advance Transformer and the National Electrical Manufacturers Association stated that there is presently no test procedure for electronic ballasts. (Advance Transformer, No. 25 at 2; National Electrical Manufacturers Association, No. 41 at 2).

The Department used the present test procedure for magnetic ballasts to measure the ballast efficacy factor of electronic ballasts. The Department notes that the 60 hertz input power measurement and the light output measurement are the same, regardless of the type of ballast (low or high frequency). The Department believes that the existing test procedure is adequate to measure the ballast efficacy factor of electronic ballasts.

Three manufacturers provided energy savings estimates for various design options. Energy Advantage stated that 20 percent savings from electronic ballasts, compared to energy-efficient magnetic ballasts, are possible. In addition, this energy savings can be accomplished with up to a 50 percent increase in lifetime. (Energy Advantage, No. 27 at 1). Magnetek said that losses for a two lamp F40 electronic ballast can be reduced from 5–6 watts to about 3.5–4.5 watts, for a savings of 1.25–1.5 watts out of 56–58 watts, by substitution of an integrated circuit for discrete components. (Magnetek, No. 35 at 1). One other company, Valmont, provided energy savings tables for five ballast product classes, their maximum technologically feasible efficiencies, and the costs of achieving those efficiencies. (Valmont, No. 16 at 4–7).

The Department used some of the above data in combination with data from directories and other published data [36] to determine energy savings for various classes of fluorescent ballasts. (See Technical Support Document, Volume B). The Department found that 10–15 percent energy savings from electronic ballasts, relative to energy-efficient magnetic ballasts, are possible. The Department developed data that indicated larger energy savings are possible with electronic ballasts than were estimated by Valmont. This resulted in higher maximum technologically feasible efficiencies for all ballast product classes than provided by Valmont. The Department used incremental manufacturer costs that were specific to the energy efficiency gains estimated for each ballast product class studied, and, therefore, did not use the cost data provided by Valmont. A more detailed discussion of assumptions and analysis used for this product class are provided in the Technical Support Document. As for lifetimes of ballasts, the Department assumed the lifetime for an electronic ballast to be equal to that of a magnetic ballast, since no experimental data were received or found to differentiate their lifetimes.

Three manufacturers suggested that some combination of education and controls would be superior to standards in saving lighting energy use. Advance Transformer contended that fluorescent ballasts do not belong in the proposed rulemaking, and that improved education about lighting will accomplish more than standards. (Advance Transformer, No. 25 at 1). Magnetek and Certified Ballast Manufacturers both stated that controls, i.e., occupancy sensors, light feedback, daylighting, and automatic timers, can save more energy than can more stringent ballast standards. (Magnetek, No. 35 at 1; Certified Ballast Manufacturers, No. 47 at 2).

In response, the Department notes that the Act requires DOE to consider, in this rulemaking, more stringent fluorescent ballast standards and the concomitant energy savings therefrom. The Department considered such programs as alternatives to standards in the Regulatory Impact Analysis found in Section V of today's notice.

9. Television Sets

Classes. The Natural Resources Defense Council, Rocky Mountain Institute, and Thomson commented on television set class delineations. The Natural Resources Defense Council stated that separate classes may be needed for stereo sound, remote control, and other features. (Natural Resources Defense Council, No 13 at 24). Also, the Rocky Mountain Institute stated that it might make sense to differentiate on the basis of features like remote control, electronic tuning, and stereo sound. (Rocky Mountain Institute, No. 15 at 2).

Thomson stated that the large number of necessary variables or items used to classify television receivers, including, for example, feature content and screen size, would greatly complicate any attempt to categorize television receivers in order to establish meaningful energy usage guidelines. Thomson also said that many customer-preferred performance qualities, such as high picture brightness and high-quality stereo sound consume correspondingly higher levels of power than television sets that do not exhibit those qualities. There are other desirable, if not necessary, features, such as remote control and on-screen function displays, and federally mandated features, such as closed caption decoding, that may increase energy use. (Thomson, No. 49 at 3, 5).

The Electronic Industries Association stated that in 1989, 83 percent of color television sets sold to dealers reportedly included a remote control feature and that virtually all television sets use electronic tuning. (Electronic Industries Association, No. 30 at 3, 4).

In response to these comments, the Department established one class for color television sets with electronic tuning and remote control. However, the Department believes that the energy used to illuminate the screen is strongly affected by screen size and, therefore, has proposed standards for television sets that are a function of screen size. Furthermore, DOE believes that there is no need to separate classes according to stereo sound because the sound is not on during the efficiency test and therefore sound energy does not affect test procedure measurements.

The standard level analysis is based primarily on manufacturers' data for 19/20" color television sets because recent manufacturer cost and energy use data for other screen sizes were very limited. The results of the analysis, based on the 19/20" color television sets and the limited data available for other screen sizes ranging from 13.5" to 33", were then used to derive the proposed standards as a function of screen size.

Additionally, the Department did not consider standards for black and white television sets since their share of the market is rapidly decreasing and over 50 percent of those sold are designed for battery or battery-AC operation and are thus designed to minimize energy use.

Design options. Among the comments on television set design options, the Rocky Mountain Institute proposed that DOE consider all reasonable options for reducing standby power as well as operating power. One option would be

[36] R. Verderber, O. Morse, and F. Rubinstein, "Performance of Electronic Ballast and Controls with 34 and 40 Watt F40 Fluorescent Lamps," *IEEE Transactions on Industry Applications*, Vol. 25 No. 6, November 1989 and A. Loruss and K. Bowes, *Harmonic and Power Characteristics of Electronic Ballasts for Fluorescent Applications*, Northeast Utilities Service Company, Lab Test, June 1990; Directory of Certified Fluorescent Lamp Ballasts and Certified Luminaire Manufacturers, CEC, March 4, 1991.

to require a clearly labeled switch that would give consumers the choice of turning the set to standby or completely off. (Rocky Mountain Institute, No. 15 at 5).

The American Council for an Energy Efficient Economy suggested that DOE analyze use of a step down transformer rather than a resistance circuit for electronic tuning and new transformer materials with low core loss (amorphous alloys). The American Council for an Energy Efficient Economy also urged DOE to look at television sets in other countries, particularly Germany. (American Council for an Energy Efficient Economy, No. 6 at 3–4). The Natural Resources Defense Council proposed that DOE consider power supply efficiency improvement. (Natural Resources Defense Council, No. 13 at 38).

The Electronics Industry Association said that average remote control power is 4W, while some are as low as 2W; electronic tuning uses less than 1W, brightness sensor less than 1W. (Electronic Industries Association, No. 30 at 3–4). Thomson said that remote control uses 3–6W and that a brightness sensor consumes essentially no power in itself and offers no energy benefit not otherwise available to the consumer by using the customary picture control adjustments. (Thomson, No. 49 at 6, 7). The Electronic Industries Association provided data on voltage-regulating power supplies. It said that a change in the type of regulator from shunting to switching can save approximately six watts at an additional cost of $1.50. Other comments were provided for other design options, but no additional data were submitted. (Electronic Industries Association, No. 30 at 4).

The Department considered all comments on design options by analyzing standby power; power supply efficiency improvements, including voltage-regulating power supplies; and step down transformers for electronic tuning. These design options are shown in the cost/efficiency tables in the Technical Support Document. Data submitted by the Electronic Industries Association and previously submitted data from manufacturers were used to develop these tables. While a switch to allow consumers to turn off the remote control portion of the television (suggested by the Rocky Mountain Institute) would likely save some energy, the amount would be determined by consumer behavior and is not predictable. The Department discovered no data on improved transformer materials with low core loss nor any data on the energy use, as measured according to DOE test procedure, for the German models. The Department did develop data on Japanese models measured according to its test procedure. These data were included in the analysis.

Other comments. Several comments questioned the feasibility of establishing energy conservation standards for television sets. The Electronic Industries Association said that television set efficiency has improved over the years because manufacturers have been steadily limiting power to reduce internal heat. (Electronic Industries Association, No. 30 at 2). Thomson said there is little, if any, opportunity for further reductions in energy use. Thomson also said the major factors that influence energy use are controlled by the consumer: Operating hours, brightness, sound level, and control settings. (Thomson, No. 49 at 2–6). The Electronic Industries Association argued that efficiency standards would impede the development of high definition television. (Electronic Industries Association, No. 30 at 6). G&A Consultancy suggested that DOE "not place retarding restrictions upon television sets because precluding the television set's potential role as an energy control may inadvertently deny the American homeowner a far more valuable system of energy savings." (G&A Consultancy, No. 50 at 4).

The Department considered all these comments in the decision-making process for television set standards. With regard to such standards precluding the potential for a television set to become a home energy controller, it is the Department's belief that if television sets were transformed to home energy controllers, the nature of the appliance might have changed sufficiently for it to be considered a new appliance. If so, it would not be a covered product and subject to an energy conservation standard for television sets.

Two comments stated that standards are inappropriate for television sets, stating that they already are energy efficient, leaving little room for improvement. (Electronic Industries Association, No. 30 at 7; Thomson, No. 49 at 2).

The Department analyzed television set standard levels by the methodology proposed in the advance notice, thereby taking into account the costs and benefits of any potential efficiency improvements. The Department found that the efficiency of the typical television set can be improved.

IV. Product-Specific Discussion

a. Room Air Conditioners

1. Efficiency Levels Analyzed

The Department examined a range of standard levels for room air conditioners. Table 4–1 presents the seven efficiency levels selected for analysis for the twelve classes of room air conditioners. Level 7 corresponds to the highest efficiency level, max tech, considered in the engineering analysis.

TABLE 4.1—STANDARD LEVELS ANALYZED FOR ROOM AIR CONDITIONERS

Product class	Baseline	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
With louvered sides less than 6,000 Btu	8.27	9.36	9.36	10.44	10.62	11.08	11.52	13.04
With louvered sides 6,000 to 7,999 Btu	8.45	9.32	9.32	9.79	9.79	10.25	10.74	12.14
With louvered sides 8,000 to 13,999 Btu	9.33	9.33	10.05	10.34	10.34	11.02	11.97	13.50
With louvered sides 14,000 to 19,999 Btu	9.00	9.00	10.09	10.09	10.37	11.13	11.13	13.58
With louvered sides 20,000 and more Btu	8.32	8.32	8.32	8.32	9.08	9.63	10.70	11.43
Without louvered sides less than 6,000 Btu ..	7.96	9.01	9.01	10.06	10.24	10.67	11.10	12.56
With louvered sides 6,000 to 7,999 Btu	8.15	8.15	9.22	9.43	9.43	9.98	10.35	11.69
Without louvered sides 8,000 to 13,999 Btu .	9.00	9.00	9.69	9.96	9.96	10.65	11.54	13.01
Without louvered sides 14,000 to 19,999 Btu	8.64	8.64	9.75	9.75	10.01	10.81	10.81	13.10
Without louvered sides 20,000 and more Btu	8.03	8.03	8.03	8.03	8.77	9.30	10.34	11.02
With reverse cycle and with louvered sides ..	8.71	8.71	9.83	9.83	10.10	10.75	12.11	13.22
With reverse cycle and without louvered sides	8.78	8.78	9.42	9.71	9.71	10.39	11.24	12.66

Rather than presenting the results for all classes of room air conditioners in today's notice, the Department selected a class of room air conditioners as being representative, or typical, of the product, and is presenting the results only for that class. The results for the other classes can be found in the Technical Support Document in the same sections as those referenced for the representative class. The representative class for room air conditioners is room air conditioners with side louvers, less than 6,000 BTU's per hour, which is one of the most prevalent classes of room air conditioners. For this representative class, trial standard levels 1 and 2 accomplish the above efficiency improvements from the baseline by enhanced evaporator and condenser fins and the use of a permanent split-capacitor fan motor; level 3 adds a subcooler and grooved tubes to both the evaporator and condenser coils; level 4 increases the compressor energy efficiency ratio to 11.0; level 5 increases the compressor energy efficiency ratio further to 11.5; level 6 increases the evaporator and condenser coil area; and level 7 adds a variable-speed compressor and brushless DC fan motor. Similar design options are used to achieve the above efficiencies for the other classes and are found tabulated in Section 1.4 of the Technical Support Document.

2. Payback Period

Table 4–2 presents the payback periods for the efficiency levels analyzed for the representative class of the product. For this representative class, standard levels 1 through 4 satisfy the rebuttable presumption test, i.e., the additional price of purchasing a product will be less than three times the value of the energy savings that the consumer will receive during the first year. Payback for all classes of room air conditioners may be found in Tables 4.13 to 4.24 of the Technical Support Document.

TABLE 4–2.—PAYBACK PERIODS OF DESIGN OPTIONS FOR REPRESENTATIVE CLASS OF ROOM AIR CONDITIONERS

[In years]

Standard level	Payback period
1	1.01
2	1.01
3	1.71
4	1.82
5	3.50
6	5.30
7	16.07

3. Significance of Energy Savings

To estimate the energy savings by the year 2030 due to revised standards, the energy consumption of new room air conditioners under the base case is compared to the energy consumption of those sold under the candidate standard levels. For the candidate energy conservation standards, the Lawrence Berkeley Laboratory-Residential Energy Model projects that over the period 1996–2030, the following energy savings would result for all classes of the product:

Level 1—0.28 Quad
Level 2—0.62 Quad
Level 3—1.24 Quads
Level 4—1.42 Quads
Level 5—2.22 Quads
Level 6—3.06 Quads
Level 7—5.22 Quads

The Department finds that each of the increased standards levels considered above would result in a significant conservation of energy.

4. Economic Justification

A. *Economic impact on manufacturers and consumers.* The per unit increased cost to manufacturers to meet the efficiency of levels 1 and 2 for the representative class is $3.81; to meet levels 3–7, the manufacturers' cost increases are $10.10, $11.75, $23.42, $50.24, and $210.24, respectively. See Technical Support Document, Table 1.6.

At those levels of efficiency, the consumer price increases are $4.77 for levels 1 and 2 and $13.64, $15.43, $32.55, $54.61, and $220.04 for standard levels 3–7, respectively. See Technical Support Document, Table 4.1.

The per-unit reduction in annual cost of operation (energy expense) at levels 1 and 2 is $5.12 for the representative class; standard level 3 would reduce energy expenses by $9.13; standard level 4 by $9.73; standard level 5 by $11.16; standard level 6 by $12.41; and standard level 7 by $16.10. See Technical Support Document, Table 4.1.

The Lawrence Berkeley Laboratory-Manufacturer Impact Model results for all classes of room air conditioners show that revised standards would cause a prototypical manufacturer to have some reductions in short-run return on equity from the 8.6 percent return in the base case. Standard levels 1 through 7 are projected to produce short-run return on equity's of 8.5 percent, 8.5 percent, 8.4 percent, 8.4 percent, 8.4 percent, 5.2 percent and minus 4.3 percent, respectively. However, revised standards have little or no effect on the prototypical manufacturer's long-run return on equity. Standard levels 1 through 7 are projected to produce long-run return on equity's of 8.5 percent, 8.5 percent, 8.5 percent, 8.5 percent, 8.6 percent, 7.9 percent and 7.1 percent, respectively. See Technical Support Document, Tables 5.1 and 5.2.

Most financial data of the type needed to characterize the prototypical manufacturer are generally not available because most real firms are subsidiaries or divisions of larger parent companies. Hence, DOE assumes that the prototypical firm has largely the same financial characteristics (e.g. debt-equity ratio, interest rate on debt, etc.) as parent firms. Financial data for the parent firms are based on publicly available sources such as Securities and Exchange Commission 10K reports and company annual reports.

B. *Life-cycle cost and net present value.* A life-cycle cost is calculated for a unit meeting each of the candidate standard levels. For the representative class, life-cycle costs at all standard levels other than level 7, the max tech level, are less than the baseline unit. Of the seven candidate standard levels, a unit meeting level 4 has the lowest consumer life-cycle cost. See Technical Support Document, Figure 4.1.

However, other than at the max tech level, consumers do not purchase units of the same efficiency. At each candidate standard level, the Department determines the average change in life-cycle costs by considering only those consumers who are being forced by the standard to move from a lower efficiency unit to one which just meets the standard level being considered. This is done by assuming in the base case a distribution of purchases of units meeting the efficiencies of the various standard levels. The base case distribution is based on the distribution of current sales as a function of efficiency. As each standard level is examined, the change in life-cycle cost reported is the average change only for affected consumers. Under this scenario, standard levels 1 and 2 would cause reductions in life-cycle costs for the average affected consumer of $38.86 for the representative class of room air conditioner; standard level 3 would reduce average life-cycle costs by $54.75; standard level 4, by $56.68; standard level 5, by $53.47; and standard level 6, by $43.47. These life-cycle cost reductions indicate that no standard level, other than max tech, would cause any economic burden on the average consumer. At standard level 7, the life-cycle costs are projected to increase $86.09, compared to the base case. See Technical Support Document, Table 4.13.

The Department examined the effect of different discount rates (4, 6, and 10 percent) on the life-cycle cost curves and generally found little impact. The Department did not consider higher discount rates, since such rates would be beyond the range of real, after-tax rates that consumers would likely face in financing the purchase of room air conditioners. Similarly, DOE did not consider different energy prices, including regional prices, in the life-cycle cost analysis. Since any standard is to be a national standard, DOE believed that national average energy prices were appropriate.

The Net Present Value analysis, a measure of the net savings to society, indicates that for all classes of room air conditioners, standard level 1 would produce an NPV of $0.44 billion to consumers. The corresponding net present values for standard levels 2–6 are $0.82 billion, $1.59 billion, $1.68 billion, $1.85 billion and $1.32 billion, respectively. The net present value for standard level 7 is minus $4.70 billion. See Technical Support Document, Table 3.6.

C. *Energy savings.* As indicated above, standards will result in significant savings of electricity consumption by room air conditioners.

D. *Lessening of utility or performance of products.* As indicated above, DOE established classes of products in order to assure that the standards analyzed would not lessen the existing utility or performance of room air conditioners.

E. *Impact of lessening of competition.* The determination of this factor must be made by the Attorney General.

F. *Need of the nation to save energy.* Room air conditioners use electricity directly. In 1987, 4.3 percent of residential sector source electricity (or 0.45 quads) was accounted for on a national basis by room air conditioners.

In addition, decreasing future electricity demand as a result of standards will decrease air pollution. See Technical Support Document, Appendix D of Volume A.[37] Decreases in air pollution will occur for sulfur oxides (listed in equivalent weight of sulfur dioxide, or SO_2). For all classes of room air conditioners at standard level 1, over the years 1996 to 2030, the total estimated SO_2 reduction would be 52,000 tons. During this time period, the peak annual reduction of SO_2 emissions that are expected to be emitted by powerplants in the United States is 0.03 percent. For standard levels 2–7, the reductions are 116,000 tons; 229,000 tons; 261,000 tons; 394,000 tons; 520,000 tons; and 777,000 tons, respectively. The highest peak annual reduction of these levels is 0.35 percent.

Standards will also result in a decrease in nitrogen dioxide (NO_2) emissions. For standard level 1, over the years 1996 to 2030, the total estimated NO_2 reduction would be 47,000 tons. During this time period, the peak annual reduction of NO_2 emissions that are expected to be emitted by power plants in the United States is 0.03 percent. For standard levels 2–7, the reductions are 103,000 tons; 205,000 tons; 234,000 tons; 353,000 tons; 467,000 tons; and 698,000 tons, respectively. The highest peak annual reduction of these levels is 0.35 percent.

Another consequence of the standards will be the reduction of carbon dioxide (CO_2) emissions. For standard level 1, over the years 1996 to 2030, the total estimated CO_2 reduction would be 24 million tons. During this time period, the peak annual reduction of CO_2 emissions that are expected to be emitted by power plants in the United States is 0.03 percent. For standard levels 2–7, the reductions are 53 million tons; 105 million tons; 119 million tons; 181 million tons; 240 million tons; and 360 million tons, respectively. The highest peak annual reduction of these levels is 0.35 percent.

Decreasing future electricity demand is also likely to result in reductions in the demand for oil used in electricity generation. Because virtually all sources of oil, on the margin, are foreign, any reductions in oil demand are likely to be reflected in reductions in oil imports. For standard level 1, the estimated decrease in oil imports is 4.91 million barrels over the years 1996 to 2030. For standard levels 2–7, the reductions in oil imports are estimated to be 10.76, 21.5, 24.45, 37.14, 49.21 and 73.69 million barrels, respectively.

5. Conclusion

Section 325(l)(2)(A) of the Act specifies that the Department must consider, for amended standards, those standards that "achieve the maximum improvement in energy efficiency which the Secretary determines is technologically feasible and economically justified." Accordingly, the Department first considered the max tech level of efficiency, i.e., standard level 7 for amended room air conditioner standards.

Of the standard levels analyzed, level 7 would save the most energy (5.22 quads between 1996 and 2030). In order to meet this standard, the Department assumes that all room air conditioners would incorporate improved and increased heat transfer devices and high efficiency and variable-speed fan motors and compressors. However, the payback at this standard level of 16.1 years for the representative class, and up to 23.9 years for other classes, exceeds the 15-year life of the product and causes life-cycle cost increases of $86 for the representative class, and up to $178 for other classes. This level also drives the short-run manufacturer return on equity from 8.6 percent to negative 4.3 percent.

The Department therefore concludes that the burdens of standard level 7 for room air conditioners outweigh the benefits, and rejects the standard level.

The next most stringent standard level is standard level 6. This standard level is projected to save 3.06 quads of energy. This level produces life-cycle cost savings compared to the base case of $43, with a payback of 5.3 years, which is slightly more than one third of the average product lifetime. However, this level causes payback as high as 9.1 years for other classes (over 60 percent of product life) and reduces manufacturer short-run return on equity from 8.6 percent to 5.2 percent, a

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[37] The expected environmental impacts of the candidate standard levels were calculated prior to passage of the Clean Air Act Amendments of 1990 (CAAA, Pub. L. 101–549, November 15, 1990). As explained below, the CAAA will lower emissions of SO_2 and NO_2. Since appliance standards reduce the need for generation of electricity, they will cause lower emissions by powerplants of SO_2 and NO_2, thereby helping those utilities meet their required pollution reductions.

For SO_2, any emission reductions caused by appliance standards prior to the year 2000 will be part of much greater SO_2 reductions that are required by the CAAA. After the year 2000, SO_2 reductions achieved through appliance standards or any other means by those emitting SO_2 can be earned as credits. These are credits to emit an amount of SO_2 equivalent to the amount of the SO_2 reduction that created the credits. The new amendments allow those earning the credits either to sell them to others or to "bank" them for future use.

Therefore, after the year 2000, to the extent that appliance standards result in SO_2 credits being earned, and to the extent that such standards—induced credits are sold and used by others, the national SO_2 reductions from standards will not occur.

The new law also requires that utility boilers emit lower levels of NO_x and requires that additional actions to reduce emissions be taken in regions not now in compliance with Federal ambient air quality standards for NO_x or derivative pollutants, such as ground-level ozone. Because of these new requirements, the actual reductions in NO_x emissions likely to result from the appliance standards are very likely to be substantially less than the estimates made prior to the enactment of the Clean Air Amendments of 1990 and contained in this document.

With respect to CO_2, there are as yet no such regulatory constraints on national or regional emissions. However, efforts to comply with international commitments to stabilize CO_2 emissions, such as voluntary commitments by utilities and industries to reduce greenhouse gas emissions to 1990 levels by 2000, may result in constraints that are similar in nature to those for SO_2 and NO_2. If so, the reductions in CO_2 emissions estimated to result from the standards also may not be fully realized.

reduction of almost 40 percent. Also, at this standard level, some classes are assumed to incorporate variable-speed compressors, for which there is not a DOE test procedure. The Department believes that the development of such a test procedure would be a lengthy process which would probably delay the effective date of the standard for room air conditioners.

The Department therefore, concludes that the burdens of standard level 6 for room air conditioners outweigh the benefits, and rejects the standard level.

After carefully considering the analysis, the Department is amending the National Appliance Energy Conservation Act-imposed 1990 standard for room air conditioners with standard level 5 for room air conditioners. The Department concludes that standard level 5 for room air conditioners saves a significant amount of energy and is technologically feasible and economically justified.

There would be significant energy savings at this level of efficiency. During the period 1996–2030, these savings are calculated to be 2.22 quads of primary energy. In addition, the standard could have a positive effect on the environment by reducing the emissions of NO_2 and SO_2 by 353,000 tons and 394,000 tons, respectively, or by as much as 0.18 percent each by the year 2030. Furthermore, the standard will reduce emissions of CO_2 by 181 million tons, or as much as 0.18 percent, over the forecast period.

The technologies that are necessary to meet this standard are presently available. The Department finds the level to be economically justified. The consumer payback of this standard level is 3.5 years for the representative class and no more than 7.0 years for any class. This standard is at or near the lowest life-cycle cost for all classes and is expected to result in a reduction in life-cycle cost of approximately $53 for the representative class. Additionally, the standard is expected to have essentially no impact on the prototypical manufacturer's return on equity of 8.6 percent. Since this standard does not involve substantial redesign or retooling, the Department expects that it will not have negative impacts on smaller competitors.

b. Water Heaters

1. Efficiency Levels Analyzed.

The Department examined a range of standard levels for water heaters. Table 4–3 presents the efficiency levels selected for analysis for the four classes of water heaters. Electric and gas storage water heaters each have five efficiency levels that were analyzed, but were paired together to yield the eight combinations shown below. Level 8 corresponds to the highest efficiency level, max tech, considered in the engineering analysis for each class.

TABLE 4–3.—EFFICIENCY LEVELS ANALYZED FOR WATER HEATERS

[Energy factor]

Product class	Standard level								
	Baseline	1	2	3	4	5	6	7	8
Electric	0.86	0.90	0.93	1.77	1.89	1.89	2.54	2.54	2.54
Gas	0.54	0.54	0.55	0.57	0.57	0.58	0.58	0.60	0.82
Instan.	0.62	0.62	0.62	0.62	0.75	0.75	0.75	0.78	0.90
Oil	0.53	0.58	0.60	0.67	0.67	0.69	0.69	0.69	0.78

Rather than presenting the results for all classes of water heaters in today's notice, the Department selected two classes of water heaters as being representative, or typical, of the product, and is presenting the results only for those classes. The results for the other classes can be found in the Technical Support Document in the same sections as those referenced for the representative classes. The representative classes for water heaters are electric storage water heaters and gas storage water heaters, which are the most prevalent classes of water heaters. For electric storage water heaters, trial standard level 1 accomplishes the above efficiency improvement from the baseline by the use of heat traps and by reducing heat leaks; level 2 increases the insulation level to R–25; at level 3 the insulation is reduced back to the baseline level of R–16, but an add-on heat pump is added; levels 4 and 5 increase the insulation back to R–25; and levels 6, 7 and 8 assume the use of an integral heat pump. For gas storage water heaters, trial standard level 1 is the same as the baseline, trial standard level 2 accomplishes the above efficiency improvement by the use of heat traps and by reducing heat leaks, levels 3 and 4 increase the insulation level to R–16, levels 5 and 6 increase the insulation level to R–25, at level 7 the insulation level is reduced back to R–16 but electronic ignition is added, and at level 8 the flue gases are assumed to condense. Similar design options are used to achieve the above efficiencies for the other classes and are found tabulated in Sections 1.5 and 1.6 of the Technical Support Document.

2. Payback Period

Table 4–4 presents the payback period for the efficiency levels analyzed for gas and electric storage water heaters. For gas water heaters, standard level 2 satisfies the rebuttable presumption test, i.e., the additional price of purchasing a product will be less than three times the value of the energy savings that the consumer will receive during the first year; for electric water heaters standard levels 1 through 5 satisfy the rebuttable presumption test.

TABLE 4–4.—PAYBACK PERIODS OF DESIGN OPTIONS FOR WATER HEATERS

[In years]

Standard level	Payback period	
	Gas	Electric
1	N/A	0.5
2	2.6	2.3
3	3.5	1.9
4	3.5	2.0
5	10.1	2.0
6	10.1	3.5
7	11.2	3.5
8	18.9	3.5

3. Significance of Energy Savings

To estimate the energy savings by the year 2030 due to revised standards, the energy consumption of new water heaters under the base case is compared to the energy consumption of those sold under the candidate standard levels. For the candidate energy conservation standards, the Lawrence Berkeley Laboratory-Residential Energy Model projects that over the period 1996–2030,

the following energy savings would result for all classes of the product:

Level 1—0.09 Quad
Level 2—0.73 Quad
Level 3—32.10 Quads
Level 4—34.89 Quads
Level 5—34.99 Quads
Level 6—44.39 Quads
Level 7—45.85 Quads
Level 8—54.45 Quads

The Department finds that each of the increased standards Levels considered above would result in a significant conservation of energy.

4. Economic Justification

A. *Economic impact on manufacturers and consumers.* The per unit increased cost to manufacturers to meet the level 1 efficiency for gas water heaters is zero since it is the same as the baseline; to meet level 2 the manufacturers' cost increase is $5.47, levels 3 and 4 are $18.19, levels 5 and 6 are $28.57, level 7 is $72.14, and level 8 is $358.23. The per-unit increased cost to manufacturers to meet the level 1 efficiency for electric water heaters is $5.32; to meet level 2 the manufacturers' cost increase is $14.33, level 3 is $201.82, levels 4 and 5 are $210.83, and levels 6 through 8 are $585.06. See Technical Support Document, Table 1.5, "Cost Data for Gas-Fired Storage Water Heaters" and Table 1.9, "Cost Data for Electric Storage Water Heaters."

At those levels of efficiency, the consumer price increases for gas water heaters are zero for level 1, since it is the same as the baseline, $7.35 for level 2, $24.05 for levels 3 and 4, $59.60 for levels 5 and 6, $108.55 for level 7 and $901.80 for level 8. For electric water heaters the consumer price increases are $6.85 for level 1, $42.04 for level 2, $361.36 for level 3, $394.38 for levels 4 and 5, and $834.31 for levels 6 through 8. See Technical Support Document, Tables 4.1 and 4.2.

The per-unit reduction in annual cost of operation (energy expense) at level 1 is zero for a gas water heater because it is the same as the baseline; standard level 2 would reduce energy expenses by $2.87; standard levels 3 and 4 by $7.46; standard levels 5 and 6 by $9.20; standard level 7 by $13.32; and standard level 8 by $53.02. For electric water heaters standard level 1 would reduce energy expenses by $14.66, standard level 2 by $26.78, standard level 3 by $195.01, levels 4 and 5 by $207.13 and levels 6 through 8 by $250.79. See Technical Support Document, Tables 4.1 and 4.2.

The Lawrence Berkeley Laboratory-Manufacturers Impact Model results for all classes of water heaters show that any of the revised standards would cause a prototypical manufacturer to have negative short-run return on equity. This is caused in part by the very low base case return of 0.4 percent, indicative of an industry which is extremely price-competitive. The negative short-run return on equity's are especially severe at the three most stringent levels. Standard levels 1 through 8 are projected to produce negative short- run return on equity's of 0.2 percent, 0.3 percent, 3.3 percent, 3.5 percent, 3.7 percent, 17.1 percent, 18.1 percent and 31.7 percent respectively. However, revised standards will slightly increase the prototypical manufacturer's long-run return on equity at standard levels above level 2. Standard levels 1 through 8 are projected to produce long-run return on equity's of 0.4 percent, 0.4 percent, 0.8 percent, 0.8 percent, 0.8 percent, 1.6 percent, 1.7 percent and 1.9 percent, respectively. See Technical Support Document, Tables 5.1 and 5.2.

Furthermore, most financial data of the type needed to characterize the prototypical manufacturer are generally not available because most real firms are subsidiaries or divisions of larger parent companies. Hence, DOE assumes that the prototypical firm has largely the same financial characteristics (e.g. debt-equity ratio, interest rate on debt, etc.) as parent firms. Financial data for the parent firms are based on publicly available sources such as Securities and Exchange Commission 10K reports and company annual reports. Also, DOE based its assumptions for the prototypical firm strictly on information regarding water heater manufacturers. The Department seeks comments on how to better characterize a prototypical firm when heat pump water heaters are included in the mix of products. For example, it may be that room air conditioner manufacturers become the system manufacturer, with the water heater tank becoming a purchased part. In that case, at those levels where heat pumps are assumed, it may be reasonable to introduce some of the financial characteristics of the room air conditioner industry since the heat pumps in question are very similar to room air conditioners.

B. *Life-cycle cost and net present value.* A life-cycle cost is calculated for a unit meeting each of the candidate standard levels. For the representative classes, life-cycle costs at all standard levels other than level 8, the max tech level, for gas water heaters are less than the baseline unit. Of the eight candidate standard levels, units meeting levels 4 and 5 have the lowest consumer life-cycle costs for electric water heaters and units meeting levels 3 and 4 have the lowest consumer life-cycle costs for gas water heaters. See Technical Support Document, Figures 4.2 and 4.1.

However, other than at the max tech level, consumers do not purchase units of the same efficiency. At each candidate standard level, the Department determines the average change in life-cycle costs by considering only those consumers who are being forced by the standard to move from a lower efficiency unit to one which just meets the standard level being considered. This is done by assuming in the base case a distribution of purchases of units meeting the efficiencies of the various standard levels. The base case distribution is based on the distribution of current sales as a function of efficiency. As each standard level is examined, the change in life-cycle cost reported is the average change only for affected consumers. Under this scenario, standard level 1 would cause reductions in life-cycle costs for the average consumer of $70.39 for the representative class of electric water heaters with no impact on gas water heaters, which remain at the base case at this level; standard level 2 would reduce average life-cycle costs by $81.04 and $19.13 for electric and gas water heaters, respectively; standard level 3, by $974.88 and $29.81; standard level 4, by $1024.20 and $29.81; standard level 5, by $1024.20 and minus $3.77; standard level 6, by $907.99 and minus $3.77; standard level 7, by $907.99 and minus $13.12; and standard level 8, by $907.99 and minus $437.41. These life-cycle cost reductions indicate that no standard level, other than levels 5 through 8 for gas water heaters, would cause any economic burden on the average consumer. See Technical Support Document, Tables 4.5 and 4.6.

The Department examined the effect of different discount rates (4, 6, and 10 percent) on the life-cycle cost curves and generally found little impact. The Department did not consider higher discount rates, since such rates would be beyond the range of real, after-tax rates that consumers would likely face in financing the purchase of water heaters. Similarly, DOE did not consider different energy prices, including regional prices, in the life-cycle cost analysis. Since any standard is to be a national standard, DOE believed that national average energy prices were appropriate.

The net present value analysis, a measure of the net savings to society, indicates that for all classes of water heaters, standard level 1 would produce a net present value of $0.19 billion to consumers. The corresponding net present values for levels 2–8 are $0.99

billion, $40.17 billion, $42.92 billion, $42.68 billion, $38.15 billion, $39.91 billion and $32.50 billion, respectively. See Technical Support Document, Table 3.6.

C. *Energy savings.* As indicated above, standards will result in significant savings of energy consumption for water heaters.

D. *Lessening of utility or performance of products.* As indicated above, DOE established classes of products in order to assure that the standards analyzed would not lessen the existing utility or performance of water heaters.

E. *Impact of lessening of competition.* The determination of this factor must be made by the Attorney General.

F. *Need of the nation to save energy.* Water heaters use electricity, gas, and oil directly. In 1987, 18.4 percent of residential sector source electricity (or 1.94 quads) and 30.7 percent of residential sector natural gas consumption (or 1.59 quads) were accounted for on a national basis by water heaters.

In addition, decreasing future energy demand as a result of standards will decrease air pollution. See Technical Support Document, Appendix D of Volume A [38]. Decreases in air pollution will occur for sulfur oxides (listed in equivalent weight of sulfur dioxide, or SO_2). For all classes of water heaters at standard level 1, over the years 1996 to 2030, the total estimated SO_2 reduction would be 17,000 tons. During this time period, the peak annual reduction of SO_2 emissions that are expected to be emitted by power plants in the United States is 0.01 percent. For standard levels 2–8, the reductions are 145,000 tons; 5,381,000 tons; 5,885,000 tons; 5,890,000 tons; 7,796,000 tons; 7,823,000 tons; and 7,124,000 tons, respectively. The highest peak annual reduction of these levels is 3.58 percent.

Standards will also result in a decrease in nitrogen dioxide (NO_2) emissions. For standard level 1, over the years 1996 to 2030, the total estimated NO_2 reduction would be 14,000 tons. During this time period, the peak annual reduction of NO_2 emissions that are expected to be emitted by power plants in the United States is 0.01 percent. For standard levels 2–8 the reductions are 118,000 tons; 4,890,000 tons; 5,338,000 tons; 5,336,000 tons; 6,995,000 tons; 7,086,000 tons; and 7,109,000 tons, respectively. The highest peak annual reduction of these levels is 3.57 percent.

Another consequence of the standards will be the reduction of carbon dioxide (CO_2) emissions. For standard level 1, over the years 1996 to 2030, the total estimated CO_2 reduction would be 7 million tons. During this time period, the peak annual reduction of CO_2 emissions that are expected to be emitted by power plants in the United States is 0.02 percent. For standard levels 2–8 the reductions are 59 million tons; 2,607 million tons; 2,837 million tons; 2,845 million tons; 3,662 million tons; 3,747 million tons; and 4,113 million tons, respectively. The highest peak annual reduction of these levels is 4.14 percent.

Decreasing future electricity demand is also likely to result in reductions in the demand for oil used in electricity generation. Because virtually all sources of oil, on the margin, are foreign, any reductions in oil demand are likely to be reflected in reductions in oil imports. For standard level 1, the estimated decrease in oil imports is 1.6 million over the years 1996 to 2030. For standard levels 2–8, the reductions in oil imports are estimated to be 24.12, 605.97, 654.55, 677.03, 835.53, 842.83 and 786.97 million barrels, respectively.

5. *Conclusion.* Section 325(l)(2)(A) of the Act specifies that the Department must consider, for amended standards, those standards that "achieve the maximum improvement in energy efficiency which the Secretary determines is technologically feasible and economically justified." Accordingly, the Department first considered the max tech level of efficiency, i.e., standard level 8 for amended water heater standards.

Of the standard levels analyzed, level 8 will save the most energy (54.45 quads between 1996 and 2030). In order to meet this standard, the Department assumes that all electric water heaters will incorporate improved thermal characteristics and an integral heat pump, and all gas water heaters will incorporate improved thermal characteristics and condense the flue gases. However, the payback at this standard level of 18.9 years for gas water heaters exceeds the 14-year life of the product and causes life-cycle cost increases of $437 for gas water heaters, and up to $1,108 for other classes. This level also quadruples the first cost of electric and gas water heaters and drives the short-run manufacturer return on equity from 0.4 percent to negative 32.1 percent.

The Department therefore concludes that the burdens of standard level 8 for water heaters outweigh the benefits, and rejects the standard level.

The next two most stringent standard levels, 7 and 6, are projected to save 45.85 and 44.39 quads of energy, respectively. However, these levels also produce life-cycle cost increases for gas water heaters compared to the base case with payback of 11.2 and 10.1 years, which are more than two thirds of the average product lifetime. The first cost of electric water heaters at these levels is quadrupled from the base case and manufacturer short-run return on equity is reduced from 0.4 percent to negative 18.1 and negative 17.1 percent, respectively.

The Department therefore concludes that the burdens of standards level 7 and 6 for water heaters outweigh the benefits, and rejects these standard levels.

The next most stringent standard level is standard level 5. This standard level is projected to save 34.98 quads of energy. However, this level also produces a life-cycle cost increase for gas water heaters compared to the base case, with a payback of 10.1 years, which is more than two thirds of the average product lifetime.

The Department therefore concludes that the burdens of standard level 5 for water heaters outweigh the benefits, and rejects this standard level.

After carefully considering the analysis, the Department is amending the National Appliance Energy Conservation Act—imposed 1990 standard for water heaters with standard level 4. The Department concludes that standard level 4 for water heaters saves a significant amount of energy and is technologically feasible and economically justified.

There would be significant energy savings at this level of efficiency. During the period 1996–2030, these savings are calculated to be 34.87 quads of primary energy. In addition, the standard could have a positive effect on the environment by reducing the emissions of NO_2 and SO_2 by 5,336,000 tons and 5,890,000 tons, respectively, or by as much as 2.77 and 2.72 percent, respectively, by the year 2030. Furthermore, the standard will reduce emissions of CO_2 by 2,845 million tons, or as much as 2.93 percent, over the forecast period.

The technologies that are necessary to meet this standard are presently available. The Department finds the level to be economically justified. The consumer payback of this standard level is 2.0 and 3.5 years for electric and gas water heaters, respectively. This standard has the lowest life-cycle cost for all classes and is expected to result in a reduction in life-cycle cost of approximately $1,025 and $31 for electric and gas water heaters, respectively. Additionally, the standard is expected to double the prototypical manufacturer's long-run return on equity from 0.4 to 0.8 percent even

[38] See, footnote 37.

though the short-run return on equity is projected to drop to negative 3.5 percent. However, as stated previously, the Department believes that the requirement of heat pumps for electric water heaters will cause other manufacturers, with the stronger financial characteristics of room air conditioner manufacturers, to be drawn into the mix of manufacturers offering electric water heating systems. The Department believes that this mix of manufacturers would have a positive return on equity compared to that projected for existing water heater manufacturers.

The Department recognizes that establishing a standard for electric water heaters that essentially requires the use of heat pumps is a significant change for consumers and manufacturers. However, heat pump water heaters are not a technology that has to be developed; the product already exists in the marketplace. Additionally, the projected energy savings are very large and the forecasted benefits appear to outweigh the burdens. However, the magnitude of some of the changes, such as in first cost and product manufacturing, could make questionable some of the assumptions contained in the analysis and may warrant closer scrutiny. For example, as reported in the Technical Support Document, the Lawrence Berkeley Laboratory Residential Energy Model's computation of appliance turnover rate, i.e., the repair or replace decision, is based on industry data about historical annual shipments and does not explicitly consider the effects of increased first cost. A significant increase in first cost could distort this model. The Department assumes, however, that water heaters are typically replaced because of tank leaks which, because of design features such as glass-lined tanks and foamed-in-place insulation, are essentially non-repairable. Therefore, the Department believes that the impacts on the replacement rate, because of a substantial increase in first cost, is likely to be small. The Department welcomes comment on this assumption and other areas where it might be thought that the magnitude of the first cost increase or manufacturing changes might warrant additional or revised modeling assumptions.

Another possible area of concern regarding this proposed standard is whether heat pump water heaters are physically able to be installed in existing space in the replacement market. The heat pump itself will require some additional space, and as was discussed in the product specific comments regarding classes for water heaters, the Department assumed a sufficient volume would be available to allow air circulation for the proper operation of the heat pump. The Department believes that medium and larger sizes of water heater installations would typically have sufficient space, being usually installed in areas such as basements or garages. For space-restricted applications DOE believes that technical solutions, such as heat pumps with provisions for ducting air flow, are available as well as integrated space conditioning and water heating heat pumps, which are already on the market, and could be used if and when the central heat pump system is replaced. For very small size installations, such as under-the-counter types, where sufficient space for a heat pump may not be readily available or where the economics of a heat pump may not be justified because the water heating loads are well below average, the use of electric instantaneous water heaters would be an effective alternate. A lower limit on the size of electric storage water heaters that the proposed standard would cover may also be a way of minimizing the space and low load concerns. The Department believes there are technical solutions to require the use of heat pump water heaters wherever electric storage water heaters are now used and required. This view was supported at the Hot Water Heat Pump Workshop held in Breckenridge, Colorado on June 30 through July 2, 1993. The proceedings of the workshop are made a part of the record of this notice and are available from the Department's Freedom of Information Reading Room.

Other issues that may warrant further DOE analysis include consumer acceptance of possible increased noise from heat pump water heaters and anticipated increases in maintenance requirements in comparison to electric resistance water heaters. DOE is soliciting public comment on these issues, together with additional data or other information that might assist DOE in better assessing the impacts of this proposed standard on consumers and others.

Because the Department has little information on the space constraints for replacement water heaters or the frequency with which small water heaters experience low annual water heating loads, the cost-effectiveness analysis of the proposed standard does not explicitly consider these factors. The Department believes the analysis is sufficient but would attempt to expand it to include any information on these or other related factors that becomes available during the public comment period. Based on this possible revised analysis, DOE would consider modifying either the proposed standard level for electric water heaters or the definition of the class of water heaters covered by the standard. If the analysis warrants, DOE may establish different classes for two or more sizes of electric water heaters. The Department specifically invites public comment on this expanded analysis and the regulatory alternatives described.

c. Direct Heating Equipment

1. Efficiency Levels Analyzed

The Department examined a range of standard levels for direct heating equipment. In reviewing the design options necessary to achieve those standard levels, the Department determined that a new energy descriptor was needed to adequately address some of the design options in the analysis because the current energy descriptor, annual fuel utilization factor, does not include electrical consumption. For example, design options such as adding an induced draft fan improve thermal efficiency but, at the same time, increase overall electrical consumption which, unless accounted for in the energy descriptor, could lead to higher Annual Fuel Utilization Efficiencies with little or no net energy savings. Because of the above, the Department conducted the analysis, and is proposing the standards, in terms of a new energy descriptor, annual efficiency. The test procedure to determine this energy descriptor is contained in the previously mentioned Notice of Proposed Rulemaking. Table 4–5 presents the five efficiency levels selected for analysis for the 16 classes of direct heating equipment. Level 5 corresponds to the highest efficiency level, max tech, considered in the engineering analysis.

TABLE 4–5.—STANDARD LEVELS ANALYZED FOR DIRECT HEATING EQUIPMENT

[Annual efficiency (percent)]

Product class	Standard level					
	Baseline	1	2	3	4	5
Gas wall fan type up to 42,000 Btu/hour	72.2	72.2	72.2	72.2	75.6	89.2
Gas wall fan type over 42,000 Btu/hour	73.4	73.4	73.4	73.4	76.4	89.9
Gas wall gravity type up to 10,000 Btu/hour	59.0	59.0	59.0	67.7	67.7	81.0
Gas wall gravity type over 10,000 Btu/hour up to 12,000 Btu/hour	60.0	64.1	64.1	67.7	72.9	81.7
Gas wall gravity type over 12,000 Btu/hour up to 15,000 Btu/hour	61.0	64.9	64.9	67.9	73.2	82.1
Gas wall gravity type over 15,000 Btu/hour up to 19,000 Btu/hour	62.0	65.9	65.9	68.2	76.2	82.9
Gas wall gravity type over 19,000 Btu/hour up to 27,000 Btu/hour	63.0	66.8	68.5	73.6	76.5	83.3
Gas wall gravity type over 27,000 Btu/hour up to 46,000 Btu/hour	64.0	67.5	68.7	73.9	76.9	83.8
Gas wall gravity type over 46,000 Btu/hour	65.0	68.2	71.6	74.2	73.4	84.4
Gas floor type up to 37,000 Btu/hour	56.0	61.3	62.7	70.7	75.8	88.6
Gas floor type over 37,000 Btu/hour	57.0	69.3	70.0	70.0	78.8	90.0
Gas room type up to 18,000 Btu/hour	57.0	62.3	64.4	64.4	69.3	85.9
Gas room type over 18,000 Btu/hour up to 20,000 Btu/hour	58.0	65.0	67.4	69.9	74.8	87.3
Gas room type over 20,000 Btu/hour up to 27,000 Btu/hour	63.0	67.1	67.1	67.1	74.9	88.1
Gas room type over 27,000 Btu/hour up to 46,000 Btu/hour	64.0	67.8	71.2	71.2	76.2	88.9
Gas room type over 46,000 Btu/hour	65.0	68.3	71.5	71.5	77.5	89.7

Rather than presenting the results for all classes of direct heating equipment in today's notice, the Department selected a class of direct heating equipment as being representative, or typical, of the product, and is presenting the results only for that class. The results for the other classes can be found in the Technical Support Document in the same sections as those referenced for the representative class. The representative class for direct heating equipment is gravity wall heaters greater than 27 kBtu/hr but less than 46 kBtu/hr, which is one of the more prevalent classes of direct heating equipment. For this representative class, trial standard level 1 accomplishes the above efficiency improvement from the baseline by derating the burner by 20 percent, level 2 adds electronic ignition, level 3 adds a burner box damper, level 4 adds the use of an induced draft fan and electronic ignition to the baseline unit, and level 5 assumes condensation of the flue gases. Similar design options are used to achieve the above efficiencies for the other classes of direct heating equipment and are found tabulated in section 1.4 of the Technical Support Document.

2. Payback Period

Table 4–6 presents the payback period for the efficiency levels analyzed for the representative class of the product. For this representative class, standard level 1 satisfies the rebuttable presumption test, i.e., the additional price of purchasing a product will be less than three times the value of the energy savings that the consumer will receive during the first year. Payback for all classes of direct heating equipment may be found in Tables 4.17 to 4.32 of the Technical Support Document.

TABLE 4–6.—PAYBACK PERIODS OF DESIGN OPTIONS FOR ROOM HEATERS OVER 46 KBTU/HR

[In years]

Standard level	Payback period
1	2.3
2	6.7
3	7.5
4	15.0
5	17.6

3. Significance of Energy Savings

To estimate the base case energy savings by the year 2030 due to revised standards, the energy consumption of new direct heating equipment under the base case is compared to the energy consumption of those sold under the candidate standard levels. For the candidate energy conservation standards, the Lawrence Berkeley Laboratory-Residential Energy Model projects that over the period 1996–2030, the following energy savings would result for all classes of the product:

Level 1—0.04 Quad
Level 2—0.21 Quad
Level 3—0.38 Quad
Level 4—0.23 Quad
Level 5—0.23 Quad

The above energy savings are smaller than anticipated because the Lawrence Berkeley Laboratory-Residential Energy Model predicts fuel switching from gas to electricity at trial standard levels 4 and above as shown in Table 3.3 of the Technical Support Document. However, the Department finds that the increased standards at levels 1 through 4 considered above would result in a significant conservation of energy.

4. Economic Justification

A. Economic impact on manufacturers and consumers. The per-unit increased cost to manufacturers to meet the level 1 efficiency for the representative class is $8.60; to meet levels 2–5, the manufacturers' cost increases are $19.10, $51.80, $157.60, and $227.70, respectively. See Technical Support Document, Table 1.16.

At those levels of efficiency, the incremental consumer price increases are $24.93, $73.60, $171.34, $402.54, and $690.95 for standard levels 1–5, respectively. See Technical Support Document, Table 4.10.

The per-unit reduction in annual cost of operation (energy expense) at level 1 is $10.73 for the representative class; standard level 2 would reduce energy expenses by $17.32; standard level 3 by $29.53; standard level 4 by $35.43; and standard level 5 by $48.24. See Technical Support Document, Table 4.10.

The Lawrence Berkeley Laboratory-Manufacturer Impact Model results for all classes of direct heating equipment show that revised standards would cause a prototypical manufacturer to have slight increases in short-run return on equity from the 7.4 percent in the base case except for the two most stringent levels where short-run return on equity plummets. Standard levels 1 through 5 are projected to produce short-run return on equity's of 7.6 percent, 7.7 percent, 7.6 percent, 5.2 percent and 0.9 percent, respectively. Revised standards have minimal effects on long-run return on equity. Standard levels 1 through 5 are projected to

produce long-run return on equity's of 7.4 percent, 7.4 percent, 7.3 percent, 7.4 percent and 7.1 percent, respectively. See Technical Support Document, Tables 5.1 and 5.2.

Most financial data of the type needed to characterize the prototypical manufacturer are generally not available because most real firms are subsidiaries or divisions of larger parent companies. Hence, DOE assumes that the prototypical firm has largely the same financial characteristics (e.g. debt-equity ratio, interest rate on debt, etc.) as parent firms. Financial data for the parent firms are based on publicly available sources such as Securities and Exchange Commission 10K reports and company annual reports.

B. *Life-cycle cost and net present value.* A life-cycle cost is calculated for a unit meeting each of the candidate standard levels. For the representative class, life-cycle costs at standard levels 1 through 3 are less than the baseline unit. Of the five candidate standard levels, a unit meeting level 3 has the lowest consumer life-cycle cost. See Technical Support Document, Figure 4.10.

However, other than at the max tech level, consumers do not purchase units of the same efficiency. At each candidate standard level, the Department determines the average change in life-cycle costs by considering only those consumers who are being forced by the standard to move from a lower efficiency unit to one which just meets the standard level being considered. This is done by assuming in the base case a distribution of purchases of units meeting the efficiencies of the various standard levels. The base case distribution is based on the distribution of current sales as a function of efficiency. As each standard level is examined, the change in life-cycle cost reported is the average change only for affected consumers. Under this scenario, standard level 1 would cause reductions in life-cycle costs for the average consumer of $79.31 for the representative class of direct heating equipment. Standard levels 2 and 3 would reduce average life-cycle costs by $23.26 and $41.65, respectively. These life-cycle cost reductions indicate that standard levels 1 through 3 would not cause any economic burden on the average consumer. Standard levels 4 and 5 would increase average life-cycle costs by $132.40 and $296.32, respectively. See Technical Support Document, Table 4.26.

The Department examined the effect of different discount rates (4, 6, and 10 percent) on the life-cycle cost curves and generally found little impact. The Department did not consider higher discount rates, since such rates would be beyond the range of real, after-tax rates that consumers would likely face in financing the purchase of direct heating equipment. Similarly, DOE did not consider different energy prices, including regional prices, in the life-cycle cost analysis. Since any standard is to be a national standard, DOE believed that national average energy prices were appropriate.

The net present value analysis, a measure of the net savings to society, indicates that for all classes of direct heating equipment, standard level 1 would produce a net present value of $9 million to consumers. The corresponding net present values for levels 2–5 are $63 million, $113 million, negative $259 million, and negative $930 million, respectively. See Technical Support Document, Table 3.6.

C. *Energy savings.* As indicated above, all standard levels, except level 5, will result in significant savings of energy consumption for direct heating equipment.

D. *Lessening of utility or performance of products.* As indicated above, DOE established classes of products in order to assure that the standards analyzed would not lessen the existing utility or performance of direct heating equipment.

E. *Impact of lessening of competition.* The determination of this factor must be made by the Attorney General.

F. *Need of the nation to save energy.* In 1987, 6.1 percent of residential sector natural gas consumption (or 0.32 quad) was accounted for on a national basis by direct heating equipment.

In addition, decreasing energy use as a result of standards will usually decrease air pollution. However, in the case of direct heating equipment, projected fuel switching from gas to electric resistance heat causes the energy savings to be less than it otherwise would be, and at some of the trial standard levels the impact on the environment is negative, since it takes more primary energy to heat with resistance electric heat than with a gas furnace. See Technical Support Document, Appendix D of Volume A [39]. Evaluating standards for electric direct heating equipment might result in standards requiring the use of heat pump technology which would probably resolve this abnormality, but DOE has not considered adding standards for electric direct heating equipment in this proposed rule. The resulting impact on energy use because of fuel switching was considered in The Department's decision-making as discussed in the conclusion below.

Decreases in air pollution will occur for sulfur oxides (listed in equivalent weight of sulfur dioxide, or SO_2) at level 1. For all classes of direct heating equipment at standard level 1, over the years 1996 to 2030, the total estimated SO_2 reduction would be over 5,000 tons. During this time period, the peak annual reduction of SO_2 emissions that are expected to be emitted by power plants in the United States is close to 0 percent. For standard levels 2 and 3, the reductions are 20,000 tons and 32,000 tons, respectively. For standard levels 4 and 5, SO_2 emissions are projected to increase by 72,000 tons and 320,000 tons, respectively. The highest peak annual increase of these levels is 0.18 percent.

Standards at level 1 would result in a decrease in nitrogen dioxide (NO_2) emissions. For standard level 1, over the years 1996 to 2030, the total estimated NO_2 reduction would be over 4,000 tons. During this time period, the peak annual reduction of NO_2 emissions that are expected to be emitted by power plants during that time in the United States is 0.01 percent. For standard levels 2 and 3, the reductions are 21,000 tons and 37,000 tons, respectively. For standard levels 4 and 5, NO_2 emissions are projected to increase by 27,000 tons and 184,000 tons, respectively. The highest peak annual increase of these levels is 0.13 percent.

Another consequence of the standards will be changes in (CO_2) emissions. For standard levels 1, over the years 1996 to 2030, the total estimated CO_2 reductions would be 2 million tons. During this time period, the peak annual reduction of CO_2 emissions that are expected to be emitted by power plants in the United States is 0.01 percent. For standard levels 2–4 the reductions are 14 million tons, 26 million tons, and 2 million tons, respectively. The highest peak annual reduction of these levels is 0.03 percent. For standard level 5, CO_2 emissions are expected to increase by 60 million tons with a highest peak annual increase of 0.10 percent.

Decreasing future electricity demand is also likely to result in reductions in the demand for oil used in electricity generation. Because virtually all sources of oil, on the margin, are foreign, any reductions in oil demand are likely to be reflected in reductions in oil imports. For standard level 1, the estimated decrease in oil imports is 1.1 million barrels over the years 1996 to 2030. For standard levels 2, the reductions in oil imports are estimated to be 3.5 and 6 million barrels, respectively; while for standard levels 4 and 5 are estimated to

[39] See footnote 37.

result in an increase in oil imports of 15.43 and 70.03 million barrels, respectively.

5. *Conclusion.* Section 325(l)(2)(A) of the Act specifies that the Department must consider, for amended standards, those standards that "achieve the maximum improvement in energy efficiency which the Secretary determines is technologically feasible and economically justified." Accordingly, the Department first considered the max tech level of efficiency, i.e., standard level 5 for amended direct heating equipment standards.

Of the standard levels analyzed, level 5 will save the most energy per unit but, because of fuel switching from gas to electric, this level actually causes an energy increase of 0.23 quad between 1996 and 2030. In order to meet this standard, the Department assumes that all direct heating equipment will be condensing with induced draft and electronic ignition. This level produces increased life-cycle costs compared to the base case for all classes of product and has payback which exceed the average product life for all but two classes. Additionally, this level reduces manufacturer short-run return on equity from 7.4 percent in the base case to 0.9 percent and has a negative net present value of $1.1 billion.

The Department therefore, concludes that the burdens of standard level 5 for direct heating equipment outweigh the benefits, and rejects the standard level.

The next most stringent standard level, level 4, is projected to have energy savings of 0.23 quad, but the savings here are also reduced by fuel switching. This level also produces life-cycle cost increases, compared to the base case, of $132 for the representative class, with similar increases for most classes. The payback at this level is 15.0 years for the representative class, equaling the average product life, with similar payback for most of the other classes. Additionally this level has a negative impact on the environment by increasing two of the three atmospheric emissions studied.

The Department therefore concludes that the burdens of standard level 4 for direct heating equipment outweigh the benefits, and rejects the standard level.

After carefully considering the analysis, the Department is amending the National Appliance Energy Conservation Act—imposed 1990 standard for direct heating equipment with standard level 3. The Department concludes that standard level 3 for direct heating equipment saves a significant amount of energy and is technologically feasible and economically justified.

There would be a significant energy savings at this level of efficiency. During the period 1996–2030, these savings are calculated to be 0.38 quad of primary energy and are essentially not affected by fuel switching. The standard could have a slight positive effect on the environment by reducing the emissions of NO_2 by more than 37,000 tons and SO_2 by almost 32,000 tons by the year 2030. Furthermore, the standard is projected to reduce emissions of CO_2 by 26 million tons over the forecast period.

The technology that is necessary to meet this standard: derated burners, electronic ignition, and burner box dampers or induced draft, is presently available. The Department finds the level to be economically justified. The consumer payback of this standard level is 7.5 years, approximately one-half of the average product life. This standard is expected to result in a reduction in life-cycle cost of approximately $42. Additionally, the standard is expected to have little or no impact on the prototypical manufacturer's return on equity of 7.4 percent and has a net present value of $328 million. Since this standard does not involve substantial redesign or retooling, the Department expects that it will not have negative impacts on smaller competitors.

d. Mobile Home Furnaces

1. Efficiency Levels Analyzed

The Department examined a range of standard levels for mobile home furnaces. In reviewing the design options necessary to achieve those standard levels, the Department determined that a new energy descriptor was needed to adequately address some of the design options in the analysis because the current energy descriptor, annual fuel utilization factor, does not include electrical consumption. For example, to consider improvements in fan motor efficiency, the savings in electrical consumption would have to be accounted for in the descriptor. Furthermore, other design options (for instance, fan-assisted combustion) improve thermal efficiency but, at the same time, increase overall electrical consumption which, unless accounted for in the energy descriptor, could lead to higher annual fuel utilization factors with little or no net energy savings. Lastly, since annual fuel utilization factor is defined in the Act in terms of an isolated combustion system, there are steps that could be taken to obtain a higher annual fuel utilization factor, such as adding jacket insulation, which would have no impact on the efficiency of a furnace installed indoors. Since practically all mobile home furnaces are installed indoors, the current descriptor is not entirely appropriate for this rulemaking. Because of the above, the Department conducted the analysis, and is proposing the standards, in terms of a new energy descriptor, annual efficiency. The test procedure to determine this energy descriptor is contained in the previously mentioned Notice of Proposed Rulemaking. Table 4–7 presents the six efficiency levels selected for analysis for the two classes of mobile home furnaces. Level 6 corresponds to the highest efficiency level, max tech, considered in the engineering analysis.

TABLE 4–7.—STANDARD LEVELS ANALYZED FOR MOBILE HOME FURNACES

[Annual efficiency (percent)]

Product class	Standard level						
	Baseline	1	2	3	4	5	6
Gas Fired	72.7	74.3	77.1	79.0	79.1	87.4	89.5
Oil Fired	72.8	74.7	74.7	76.5	76.5	83.2	85.8

Rather than presenting the results for all classes of mobile home furnaces in today's notice, the Department selected a class of mobile home furnaces as being representative, or typical, of the product, and is presenting the results only for that class. The results for the other classes can be found in the Technical Support Document in the same sections as those referenced for the representative class. The representative class for mobile home furnaces is gas fired mobile home furnaces, which is the most prevalent class of mobile home furnaces. For this representative class,

trial standard level 1 accomplishes the above efficiency improvement from the baseline by the use of improved fan motor efficiency, level 2 adds a burner box damper, level 3 adds an improved heat exchanger, level 4 substitutes fan-assisted combustion and electronic ignition for the burner box damper and improved heat exchanger, level 5 assumes condensing of the flue gases and level 6 adds continuous furnace modulation. Similar design options are used to achieve the above efficiencies for oil-fired mobile home furnaces and are found tabulated in Section 1.5 of the Technical Support Document.

2. Payback Period

Table 4–8 presents the payback period for the efficiency levels analyzed for the representative class of the product. For this representative class, standard levels 1 and 2 satisfy the rebuttable presumption test, i.e., the additional price of purchasing a product will be less than three times the value of the energy savings that the consumer will receive during the first year. Payback for all classes of mobile home furnaces may be found in Tables 4.3 and 4.4 of the Technical Support Document.

TABLE 4–8.—PAYBACK PERIODS OF DESIGN OPTIONS FOR GAS FIRED MOBILE HOME FURNACES

[In years]

Standard level	Payback period
1	0.6
2	3.0
3	6.7
4	7.5
5	7.6
6	13.0

3. Significance of Energy Savings

To estimate the energy savings by the year 2030 due to revised standards, the energy consumption of new mobile home furnaces under the base case is compared to the energy consumption of those sold under the candidate standard levels. For the candidate energy conservation standards, the Lawrence Berkeley Laboratory-Residential Energy Model projects that over the period 1996–2030, the following energy savings would result for all classes of the product:

Level 1—0.02 Quad
Level 2—0.05 Quad
Level 3—0.05 Quad
Level 4—0.03 Quad
Level 5—0.11 Quad
Level 6——0.02 Quad

The above energy savings are smaller than anticipated because the Lawrence Berkeley Laboratory-Residential Energy Model predicts fuel switching from gas to electricity at trial standard levels 2 and above as shown in Table 3.4 of the Technical Support Document. However, the Department finds that each of the increased standards levels considered above except for level 6, the max tech level, would result in a significant conservation of energy.

4. Economic Justification.

A. Economic Impact on Manufacturers and Consumers. The Department is refraining from publishing the per-unit increased cost to manufacturers to meet the trial standard levels for mobile home furnaces due to confidentiality considerations. The Department has determined that the data provided is confidential pursuant to 10 CFR 1004.11. There are only two manufacturers of this product, and they would provide data only if DOE agreed not to publish the data. Today's proposed rule is based upon the Department's consideration of these data, and others, e.g., data from component suppliers, as described in Section 1.5 of the Technical Support Document.

At the considered levels of efficiency, the consumer price increases are $5.74 for level 1 and $76.80, $186.35, $273.71, $569.32, and $1151.56 for standard levels 2–6, respectively. See Technical Support Document, Table 4.1.

The per-unit reduction in annual cost of operation (energy expense) at level 1 is $9.56 for the representative class; standard level 2 would reduce energy expenses by $25.71; standard level 3 by $35.54; standard level 4 by $44.96; standard level 5 by $83.20; and standard level 6 by $100.15. See Technical Support Document, Table 4.1.

The Lawrence Berkeley Laboratory-Manufacturer Impact Model results for all classes of mobile home furnaces show that revised standards would cause a prototypical manufacturer to have some fluctuations in short-run return on equity from the 7.3 percent return in the base case, especially at the two most stringent levels. Standard levels 1 through 6 are projected to produce short-run return on equity's of 7.2 percent, 7.3 percent, 6.8 percent, 7.3 percent, 3.3 percent and 1.9 percent respectively. However, revised standards have little or minimal effect on the prototypical manufacturer's long-run return on equity. Standard levels 1 through 6 are projected to produce long-run return on equity's of 7.3 percent, 7.2 percent, 7.2 percent, 7.2 percent, 6.1 percent and 6.8 percent, respectively. See Technical Support Document, Tables 5.1 and 5.2.

Most financial data of the type needed to characterize the prototypical manufacturer are generally not available because most real firms are subsidiaries or divisions of larger parent companies. Hence, DOE assumes that the prototypical firm has largely the same financial characteristics (e.g. debt-equity ratio, interest rate on debt, etc.) as parent firms. Financial data for the parent firms are based on publicly available sources such as Securities and Exchange Commission 10K reports and company annual reports.

B. Life-cycle cost and net present value. A life-cycle cost is calculated for a unit meeting each of the candidate standard levels. For the representative class, life-cycle costs at all standard levels other than level 6, the max tech level, are less than the baseline unit. Of the six candidate standard levels, a unit meeting level 5 has the lowest consumer life-cycle cost. See Technical Support Document, Figure 4.1.

However, other than at the max tech level, consumers do not purchase units of the same efficiency. At each candidate standard level, the Department determines the average change in life-cycle costs by considering only those consumers who are being forced by the standard to move from a lower efficiency unit to one which just meets the standard level being considered. This is done by assuming in the base case a distribution of purchases of units meeting the efficiencies of the various standard levels. The base case distribution is based on the distribution of current sales as a function of efficiency. As each standard level is examined, the change in life-cycle cost reported is the average change only for affected consumers. Under this scenario, standard level 1 would cause reductions in life-cycle costs for the average affected consumer of $100.83 for the representative class of mobile home furnace; standard level 2 would reduce average life-cycle costs by $210.08; standard level 3, by $210.16; standard level 4, by $227.91; and standard level 5, by $358.96. These life-cycle cost reductions indicate that no standard level, other than max tech, would cause any economic burden on the average consumer. At standard level 6, the average life-cycle costs are projected to increase by $34.33, compared to the base case. See Technical Support Document, Table 4.3.

The Department examined the effect of different discount rates (4, 6, and 10 percent) on the life-cycle cost curves and generally found little impact. The Department did not consider higher discount rates, since such rates would be beyond the range of real, after-tax

rates that consumers would likely face in financing the purchase of mobile home furnaces. Similarly, DOE did not consider different energy prices, including regional prices, in the life-cycle cost analysis. Since any standard is to be a national standard, DOE believed that national average energy prices were appropriate.

The net present value analysis, a measure of the net savings to society, indicates that for all classes of mobile home furnaces, standard level 1 would produce a net present value of $12 million to consumers. The corresponding 0net present values for standard levels 2–6 are all negative at $175 million, $839 million, $1.39 billion, $2.86 billion and $5.4 billion, respectively. See Technical Support Document, Table 3.6.

C. Energy savings. As indicated above, standards will result in significant savings of energy consumption for mobile home furnaces.

D. Lessening of utility or performance of products. As indicated above, DOE established classes of products in order to assure that the standards analyzed would not lessen the existing utility or performance of mobile home furnaces.

E. Impact of lessening competition. The determination of this factor must be made by the Attorney General.

F. Need to save energy. In 1987, 1.9 percent of residential sector natural gas consumption (or 0.1 quad) was accounted for on a national basis by mobile home furnaces.

In addition, decreasing energy use as a result of standards will usually decrease air pollution. However, in the case of mobile home furnaces, projected fuel switching from gas to electric resistance heat causes the energy savings to be less than it otherwise would be, and at most of the higher trial standard levels the impact on the environment is negative, since it takes more primary energy to heat with resistance electric heat than with a gas furnace. See Technical Support Document, Appendix D of Volume A.[40] Evaluating standards for electric mobile home furnaces might result in standards requiring the use of heat pump technology which would probably resolve this abnormality, but DOE has not considered adding standards for electric mobile home furnaces in this proposed rule. The resulting impact on energy use because of fuel switching was considered in The Department's decision-making as discussed in the conclusion below.

Decreases in air pollution will occur for sulfur oxides (listed in equivalent weight of sulfur dioxide, or SO_2) at level 1. For all classes of mobile home furnaces at standard level 1, over the years 1996 to 2030, the total estimated SO_2 reduction would be approximately 1,000 tons. During this time period, the peak annual reduction of SO_2 emissions that are expected to be emitted by power plants in the United States is less than 0.01 percent. For standard levels 2–6, SO_2 emissions are projected to increase by 5,000 tons; 29,000 tons; 54,000 tons; 122,000 tons; and 270,000 tons, respectively. The highest peak annual increase of these levels is 0.18 percent.

Standards at levels 1 and 2 would result in a decrease in nitrogen dioxide (NO_2) emissions. For standard level 1, over the years 1996 to 2030, the total estimated NO_2 reduction would be over 1,000 tons. During this time period, the peak annual reduction of NO_2 emissions that are expected to be emitted by power plants in the United States is less than 0.01 percent. For standard level 2, the total estimated NO_2 reduction would be less than 1,000 tons. For standard levels 3–6, NO_2 emissions are projected to increase by 7,000 tons; 16,000 tons; 34,000 tons; and 87,000 tons, respectively. The highest peak annual increase of these levels is 0.05 percent.

Another consequence of the standards will be the reduction of carbon dioxide (CO_2) emissions at levels 1 and 2. For either of these levels, over the years 1996 to 2030, the total estimated CO_2 reduction would be approximately 1 million tons. During this time period, the peak annual reduction of CO_2 emissions that are expected to be emitted by power plants in the United States is less than 0.01 percent. For standard levels 3–6, CO_2 emissions are increased by 2 million tons; 8 million tons; 15 million tons; and 49 million tons, respectively. The highest peak annual increase of these levels is 0.05 percent.

Decreasing future electricity demand is also likely to result in reductions in the demand for oil used in electricity generation. Because virtually all sources of oil, on the margin, are foreign, any reductions in oil demand are likely to be reflected in reductions in oil imports. For standard level 1, the estimated decrease in oil imports is 0.75 million barrels over the years 1996 to 2030. Standard levels 2–6, are estimated to result in an increase in oil imports of 2.87, 18.14, 35.16, 77.82 and 174.02 million barrels, respectively.

5. Conclusion

Section 325(l)(2)(A) of the Act specifies that the Department must consider, for amended standards, those standards that "achieve the maximum improvement in energy efficiency which the Secretary determines is technologically feasible and economically justified." Accordingly, the Department first considered the max tech level of efficiency, i.e., standard level 6 for amended mobile home furnace standards.

Of the standard levels analyzed, level 6 will save the most energy per unit but, because of fuel switching from gas to electric, this level has negative overall energy savings (−0.02 quad between 1996 and 2030). In order to meet this standard, the Department assumes that all mobile home furnaces will be condensing furnaces with full modulation. At nearly triple the purchase price to consumers, this level produces negative life-cycle cost savings compared to the base case of $154 and has a payback of 13.0 years, which is more than half of the average product lifetime. The level also reduces manufacturer short-run return on equity by over 70 percent and has a negative net present value of $8.9 billion, as well as increasing all three environmental atmospheric emissions studied.

The Department therefore, concludes that the burdens of standard level 6 for mobile home furnaces outweigh the benefits, and rejects the standard level.

The next most stringent standard level is standard level 5. This standard level is projected to save the most energy of any of the mobile home furnace trial standard levels, 0.11 quad, but the savings here are also reduced by fuel switching. This level produces the highest life-cycle cost savings compared to the base case of $239 and has a payback of 7.6 years, which is slightly more than one third of the average product lifetime. However, the level reduces manufacturer short-run return on equity by over 50 percent and has a negative net present value of $4.6 billion, as well as increasing all three atmospheric emissions studied.

The Department therefore concludes that the burdens of standard level 5 for mobile home furnaces outweigh the benefits, and rejects the standard level.

The three next most stringent standard levels, 4, 3, and 2, are projected to have energy savings ranging from .03 to .05 quad, but the savings here are also reduced by fuel switching. These levels also produce life-cycle cost savings compared to the base case ranging from $108 to $210 with payback ranging from 7.5 to 3.0 years and have little or no impact on manufacturer return on equity. However, these levels all have negative net present values ranging from negative $1.39 billion to negative $.175 billion, as well as

[40] See footnote 37.

increasing one or more of the three atmospheric emissions studied.

The Department therefore concludes that the burdens of standard levels 4, 3 and 2 for mobile home furnaces outweigh their benefits, and rejects the standard levels.

After carefully considering the analysis, the Department is amending the National Appliance Energy Conservation Act-imposed 1990 standard for mobile home furnaces with standard level 1 for mobile home furnaces. The Department concludes that standard level 1 for mobile home furnaces saves a significant amount of energy and is technologically feasible and economically justified.

There would be small but significant energy savings at this level of efficiency. During the period 1996–2030, these savings are calculated to be 0.02 quad of primary energy and are essentially not affected by fuel switching. In addition, the standard could have a slight positive effect on the environment by reducing the emissions of NO_2 and SO_2 by as much as 1,000 tons each by the year 2030. Furthermore, the standard will reduce emissions of CO_2 by 1 million tons over the forecast period.

The technology that is necessary to meet this standard, improved fan motor efficiency, is presently available. The Department finds the level to be economically justified. The consumer payback of this standard level is 0.6 years. This standard is expected to result in a reduction in life-cycle cost of approximately $102. Additionally, the standard is expected to have 'essentially no impact on the prototypical manufacturer's return on equity of 7.3 percent. Since this standard does not involve substantial redesign or retooling, the Department expects that it will not have negative impacts on the two competitors.

e. Kitchen Ranges and Ovens

1. Efficiency Levels Analyzed

The Department examined a range of standard levels for kitchen ranges and ovens. Table 4–9 presents the five efficiency levels that had been selected for analysis for the eight classes of kitchen ranges and ovens. Level 5 corresponds to the highest efficiency level, max tech, considered in the engineering analysis.

TABLE 4–9.—STANDARD LEVELS ANALYZED FOR KITCHEN RANGES AND OVENS

[Annual energy use]

Product class	Standard level					
	Baseline	1	2	3	4	5
Electric ovens, self-cleaning (kWh)	346.7	346.7	328.7	287.3	266.8	209.2
Electric ovens, non-self-cleaning (kWh)	327.2	278.3	256.8	217.5	217.5	157.3
Gas ovens, self-cleaning (MMBtu)	2.16	2.16	1.98	1.89	1.64	1.42
Gas ovens, non-self-cleaning (MMBtu)	3.58	2.05	1.38	1.14	1.14	1.07
Microwave ovens (kWh)	270.0	239.0	236.0	233.3	230.0	228.2
Electric cooking top, coil element (kWh)	271.1	271.1	260.2	257.7	257.7	257.7
Electric cooking top, smooth element (kWh)	293.7	293.7	293.7	293.7	289.2	258.5
Gas cooking top (MMBtu)	3.88	3.76	1.71	1.63	1.63	1.63

For analytical purposes the Department segmented the above classes into three groups: Conventional ovens, conventional cooking tops and microwave ovens. Rather than presenting the results for all classes of ranges and ovens in today's notice, the Department selected a class or classes of ranges and ovens as being representative, or typical, of each group of the product, and is presenting the results only for those classes. The results for the other classes can be found in the Technical Support Document in the same sections as those referenced for the representative class. The results and conclusions for each group are presented separately below.

Efficiency levels analyzed for conventional ovens. The Department selected two classes of conventional ovens, non-self-cleaning electric ovens and non-self-cleaning gas ovens, as being representative of conventional ovens. For non-self-cleaning electric ovens, trial standard level 1 accomplishes the above efficiency improvement from the baseline by improved door seals, reduced venting, reflective surfaces and by not having an oven door window; level 2 increases insulation; levels 3 and 4 add convection and reduced thermal mass, and level 5 adds improved insulation, reduced conduction losses, and an oven separator and is a biradiant oven. For non-self-cleaning gas ovens, trial standard level 1 accomplishes the above efficiency improvement from the baseline by incorporating an electric ignition and by not having an oven door window; level 2 adds improved door seals, reduced venting, reflective surfaces and increased insulation; levels 3 and 4 add convection, reduced thermal mass and improved insulation, and level 5 adds an oven separator and reduced conduction losses.

Efficiency levels analyzed for conventional cooking tops. The Department selected two classes of conventional cooking tops, electric-coil cooking tops and gas cooking tops, as being representative of conventional cooking tops. For electric-coil cooking tops, trial standard level 1 remains at the baseline while level 2 accomplishes the above efficiency improvement from the baseline by improved heating element contact, level 3 adds reflective surfaces, and levels 4 and 5 for this class are the same as level 3. For gas cooking tops, trial standard level 1 accomplishes the above efficiency improvement from the baseline by having reduced burner excess air, level 2 adds electronic ignition, level 3 adds sealed burners and reflective surfaces, and levels 4 and 5 for this class are the same as level 3.

Efficiency levels analyzed for microwave ovens. The Department considers microwave ovens to comprise one class. For microwave ovens, trial standard level 1 accomplishes the above efficiency improvement from the baseline by incorporating a more efficient power supply, level 2 assumes a more efficient fan, in level 3 the wave guide is modified, level 4 assumes an improved magnetron, and level 5 adds reflective surfaces.

2. Payback Period for Conventional Ovens

Table 4–10 presents the payback period for the efficiency levels analyzed for the representative classes of conventional ovens. For both representative classes, standard level 1 satisfies the rebuttable presumption test, i.e., the additional price of purchasing a product will be less than three times the value of the energy savings that the

consumer will receive during the first year.

TABLE 4–10.—PAYBACK PERIODS OF DESIGN OPTIONS FOR CONVENTIONAL OVENS

[In years]

Standard level	Payback period	
	Gas	Electric
1	1.8	2.7
2	3.7	3.7
3	7.5	4.9
4	7.5	4.9
5	18.9	15.7

Payback period for conventional cooking tops. Table 4–11 presents the payback period for the efficiency levels analyzed for the representative classes of conventional cooking tops. For the gas representative class, standard level 1 satisfies the rebuttable presumption test, i.e., the additional price of purchasing a product will be less than three times the value of the energy savings that the consumer will receive during the first year.

TABLE 4–11.—PAYBACK PERIODS OF DESIGN OPTIONS FOR CONVENTIONAL COOKING TOPS

[In years]

Standard level	Payback period	
	Gas	Electric
1	1.7	N/A
2	7.0	5.2
3	10.1	9.8
4	10.1	9.8
5	10.1	9.8

Payback period for microwave ovens. Table 4–12 presents the payback period for the efficiency levels analyzed for microwave ovens. Levels 1 through 3 satisfy the rebuttable presumption test, i.e., the additional price of purchasing a product will be less than three times the value of the energy savings that the consumer will receive during the first year.

TABLE 4–12.—PAYBACK PERIODS OF DESIGN OPTIONS FOR MICROWAVE OVENS

[In years]

Standard level	Payback period
1	2.1
2	2.3
3	2.9
4	7.4
5	13.0

3. Significance of Energy Savings for Conventional Ovens

To estimate the energy savings by the year 2030 due to revised standards, the energy consumption of new conventional ovens under the base case is compared to the energy consumption of those sold under the candidate standard levels. For the candidate energy conservation standards, the Lawrence Berkeley Laboratory-Residential Energy Model projects that over the period 1996–2030, the following energy savings would result for all classes of product:

Level 1—0.69 Quad
Level 2—1.41 Quads
Level 3—2.40 Quads
Level 4—2.69 Quads
Level 5—3.88 Quads

The Department finds that each of the increased standards levels considered above would result in a significant conservation of energy.

Significance of energy savings for conventional cooking tops. To estimate the energy savings by the year 2030 due to revised standards, the energy consumption of new conventional cooking tops under the base case is compared to the energy consumption of those sold under the candidate standard levels. For the candidate energy conservation standards, the Lawrence Berkeley Laboratory-Residential Energy Model projects that over the period 1996–2030, the following energy savings would result for all classes of product:

Level 1—0.02 Quad
Level 2—2.54 Quads
Level 3—2.68 Quads
Level 4—2.85 Quads
Level 5—3.04 Quads

The Department finds that each of the increased standards levels considered above would result in a significant conservation of energy.

Significance of energy savings for microwave ovens. To estimate the energy savings by the year 2030 due to revised standards, the energy consumption of new microwave ovens under the base case is compared to the energy consumption of those sold under the candidate standard levels. For the candidate energy conservation standards, the Lawrence Berkeley Laboratory-Residential Energy Model projects that over the period 1996–2030, the following energy savings would result:

Level 1—0.46 Quad
Level 2—0.57 Quad
Level 3—0.67 Quad
Level 4—0.77 Quad
Level 5—0.84 Quad

The Department finds that each of the increased standards levels considered above would result in a significant conservation of energy.

4. Economic Justification

A. Economic impact on manufacturers and consumers. Conventional ovens. The per-unit increased cost to manufacturers to meet the level 1 efficiency for gas non-self-cleaning ovens is $5.92; to meet level 2, the manufacturers' cost increase is $14.40, levels 3 and 4 are $29.75, and level 5 is $61.64. The per-unit increased cost to manufacturers to meet the level 1 efficiency for electric non-self-cleaning ovens is $4.21; to meet level 2, the manufacturers' cost increase is $8.45, levels 3 and 4 are $19.11, and level 5 is $100.12. See Technical Support Document, Tables 1.9 and 1.11

At those levels of efficiency, the consumer price increase for gas non-self-cleaning ovens at level 1 is $13.84; to meet level 2, the cost increase is $36.56, levels 3 and 4 are $69.00, and level 5 is $161.09. For electric non-self-cleaning ovens the cost at level 1 is $8.84; to meet level 2, the cost increase is $18.73, levels 3 and 4 are $41.30, and level 5 is $213.80. See Technical Support Document, Tables 4.4 and 4.6.

The per-unit reduction in annual cost of operation (energy expense) at level 1 is $8.38 for gas non-self-cleaning ovens; standard level 2 would reduce energy expenses by $13.32; standard levels 3 and 4 by $14.82; and standard level 5 by $15.35. For electric non-self-cleaning ovens level 1 would reduce energy expenses by $4.22; standard level 2 by $6.07; levels 3 and 4 by $9.45; and level 5 by $14.63. See Technical Support Document, Tables 4.4 and 4.6.

The Lawrence Berkeley Laboratory-Manufacturer Impact Model results for all classes of conventional ovens show that revised standards would have little or no effect on a prototypical manufacturer's short-run return on equity from the 8.6 percent in the base case. Standard levels 1 through 5 are projected to produce short-run returns on equity of 8.6 percent, 8.6 percent, 8.6 percent, 8.5 percent and 8.1 percent, respectively. Revised standards have similar effects on long-run return on equity. Standard levels 1 through 5 are projected to produce long-run return on equity's of 8.6 percent, 8.6 percent, 8.6 percent, 8.6 percent and 9.1 percent, respectively. See Technical Support Document, Tables 5.1 and 5.2.

Most financial data of the type needed to characterize the prototypical manufacturer are generally not available because most real firms are subsidiaries or divisions of larger parent companies. Hence, DOE assumes that the prototypical firm has largely the same

financial characteristics (e.g. debt-equity ratio, interest rate on debt, etc.) as parent firms. Financial data for the parent firms are based on publicly available sources such as Securities and Exchange Commission 10K reports and company annual reports.

Conventional cooking tops. The per-unit increased cost to manufacturers to meet the level 1 efficiency for gas cooking tops is $0.78; to meet level 2, the manufacturers' cost increase is $15.57, and levels 3, 4 and 5 are $41.71. The per-unit increased cost to manufacturers to meet the level 1 efficiency for electric-coil cooking tops is zero, since for this class level 1 is the same as the baseline; to meet level 2, the manufacturers' cost increase is $2.28, and levels 3, 4 and 5 are $5.31. See Technical Support Document, Tables 1.4 and 1.6.

At those levels of efficiency, the consumer price increase for gas cooking tops at level 1 is $1.63; to meet level 2, the cost increase is $113.38 and levels 3, 4 and 5 are $168.08. For electric-coil cooking tops, the cost at level 1 is unchanged, since it is at the baseline; to meet level 2, the cost increase is $4.79, and levels 3, 4 and 5 are $11.24. See Technical Support Document, Tables 4.1 and 4.3.

The per-unit reduction in annual cost of operation (energy expense) at level 1 is $0.95 for gas cooking tops; standard level 2 would reduce energy expenses by $16.09 and standard levels 3, 4 and 5 by $16.68. For electric-coil cooking tops, level 1 would not reduce energy expenses since it is at the baseline; standard level 2 would reduce energy expenses by $0.93 and levels 3, 4 and 5 by $1.15. See Technical Support Document, Tables 4.1 and 4.3.

The Lawrence Berkeley Laboratory-Manufacturer Impact Model results for all classes of conventional cooking tops show that revised standards would have slight impacts on a prototypical manufacturer's short-run return on equity from the 8.6 percent in the base case. Standard levels 1 through 5 are projected to produce short-run returns on equity of 8.6 percent, 8.4 percent, 8.6 percent, 8.7 percent and 8.7 percent, respectively. Revised standards have similar effects on long-run return on equity, with some increases at the higher standard levels. Standard levels 1 through 5 are projected to produce long-run returns on equity of 8.6 percent, 8.2 percent, 8.8 percent, 9.5 percent and 10.0 percent, respectively. See Technical Support Document, Tables 5.1 and 5.2.

Most financial data of the type needed to characterize the prototypical manufacturer are generally not available because most real firms are subsidiaries or divisions of larger parent companies. Hence, DOE assumes that the prototypical firm has largely the same financial characteristics (e.g. debt-equity ratio, interest rate on debt, etc.) as parent firms. Financial data for the parent firms are based on publicly available sources such as Securities and Exchange Commission 10K reports and company annual reports.

Microwave ovens. The per-unit increased cost to manufacturers to meet the level 1 efficiency for microwave ovens is $5.00; to meet level 2, the manufacturers' cost increase is $6.05; level 3 is $7.90; level 4 is $20.40; and level 5 is $36.80. See Technical Support Document, Table 1.15.

At those levels of efficiency, the consumer price increase for microwave ovens at level 1 is $5.49; to meet level 2, the cost increase is $6.78; level 3 is $9.14; level 4 is $25.38, and level 5 is $46.80. See Technical Support Document, Table 4.8.

The per-unit reduction in annual cost of operation (energy expense) at level 1 is $2.67 for microwave ovens; standard level 2 would reduce energy expenses by $2.93; standard level 3 by $3.16; level 4 by $3.44; and level 5 by $3.60. See Technical Support Document, Table 4.8.

The Lawrence Berkeley Laboratory-Manufacturer Impact Model results for microwave ovens show that revised standards would have little effect, except at the max tech, on a prototypical manufacturer's short-run return on equity from the 8.6 percent in the base case. Standard levels 1 through 5 are projected to produce short-run returns on equity of 9.0 percent, 9.0 percent, 8.8 percent, 8.0 percent and 6.8 percent, respectively. Revised standards have almost no effect on long-run return on equity. Standard levels 1 through 5 are projected to produce long-run returns on equity of 8.6 percent, 8.6 percent, 8.6 percent, 8.7 percent and 8.8 percent, respectively. See Technical Support Document, Tables 5.1 and 5.2.

Most financial data of the type needed to characterize the prototypical manufacturer are generally not available because most real firms are subsidiaries or divisions of larger parent companies. Hence, DOE assumes that the prototypical firm has largely the same financial characteristics (e.g. debt-equity ratio, interest rate on debt, etc.) as parent firms. Financial data for the parent firms are based on publicly available sources such as Securities and Exchange Commission 10K reports and company annual reports.

B. Life-cycle cost and net present value. Conventional ovens. A life-cycle cost is calculated for a unit meeting each of the candidate standard levels. For the representative classes, life-cycle costs at all standard levels other than level 5, the max tech level, for electric non-self-cleaning ovens, are less than the baseline unit. Of the five candidate standard levels, units meeting level 3 or 4 have the lowest consumer life-cycle cost for electric non-self-cleaning ovens whereas for gas non-self-cleaning ovens, the lowest life-cycle cost occurred for a unit meeting level 2. See Technical Support Document, Tables 4.4 and 4.6.

However, other than at the max tech level, consumers do not purchase units of the same efficiency. At each candidate standard level, the Department determines the average change in life-cycle costs by considering only those consumers who are being forced by the standard to move from a lower efficiency unit to one which just meets the standard level being considered. This is done by assuming in the base case a distribution of purchases of units meeting the efficiencies of the various standard levels. The base case distribution is based on the distribution of current sales as a function of efficiency. As each standard level is examined, the change in life-cycle cost reported is the average change only for affected consumers. Under this scenario, standard level 1 would cause reductions in life-cycle costs for the average affected consumer of $73.09 for the representative class of gas non-self-cleaning ovens; standard level 2 would reduce average life-cycle costs by $42.07; standard levels 3 and 4, by $26.37; while standard level 5 would result in an increase of $59.83. For the representative class of electric non-self-cleaning ovens, standard level 1 would cause reductions in life-cycle costs for the average consumer of $27.29; standard level 2 would reduce average life-cycle costs by $38.05; standard levels 3 and 4, by $53.25; while standard level 5 would result in an increase of $61.41. The life-cycle cost reductions indicate that no standard level, other than max tech, would cause any economic burden on the average consumer. See Technical Support Document, Tables 4.12 and 4.14.

The Department examined the effect of different discount rates (4, 6, and 10 percent) on the life-cycle cost curves and generally found little impact. The Department did not consider higher discount rates, since such rates would be beyond the range of real, after-tax rates that consumers would likely face in financing the purchase of ovens. Similarly, DOE did not consider different energy prices, including regional prices, in the life-cycle cost

analysis. Since any standard is to be a national standard, DOE believed that national average energy prices were appropriate.

The net present value analysis, a measure of the net savings to society, indicates that for all classes of conventional ovens, standard level 1 would produce a net present value of $1.20 billion to consumers. The corresponding net present values for levels 2–5 are $0.52 billion, $1.09 billion, $1.12 billion, and negative $2.38 billion, respectively. See Technical Support Document, Table 3.6.

Conventional cooking tops. A life-cycle cost is calculated for a unit meeting each of the candidate standard levels. For the representative classes, life-cycle costs at all standard levels are less than the baseline unit. However, it should be noted that for another class, electric smooth element cooking tops, there are life-cycle cost increases for units meeting levels 4 and 5. Of the five candidate standard levels, units meeting level 2 have the lowest consumer life-cycle costs for the representative classes. See Technical Support Document, Tables 4.1 to 4.3.

However, other than at the max tech level, consumers do not purchase units of the same efficiency. At each candidate standard level, the Department determines the average change in life-cycle costs by considering only those consumers who are being forced by the standard to move from a lower efficiency unit to one which just meets the standard level being considered. This is done by assuming in the base case a distribution of purchases of units meeting the efficiencies of the various standard levels. The base case distribution is based on the distribution of current sales as a function of efficiency. As each standard level is examined, the change in life-cycle cost reported is the average change only for affected consumers. Under this scenario, standard level 1 would cause reductions in life-cycle costs for the average affected consumer of $8.96 for the representative class of gas cooking tops; standard level 2 would reduce average life-cycle costs by $66.08 and standard levels 3, 4 and 5, by $18.05. For the representative class of electric-coil cooking tops, standard level 1 would cause no change in life-cycle costs for the average consumer since it is the same as the baseline; standard level 2 would reduce average life-cycle costs by $5.69 and standard levels 3, 4, and 5 by $1.64. These life-cycle cost reductions indicate that no standard level would cause any economic burden on the average consumer. See Technical Support Document, Tables 4.9 and 4.11.

The Department examined the effect of different discount rates (4, 6, and 10 percent) on the life-cycle cost curves and generally found little impact. The Department did not consider higher discount rates, since such rates would be beyond the range of real, after-tax rates that consumers would likely face in financing the purchase of ovens. Similarly, DOE did not consider different energy prices, including regional prices, in the life-cycle cost analysis. Since any standard is to be a national standard, DOE believed that national average energy prices were appropriate.

The net present value analysis, a measure of the net savings to society, indicates that for all classes of conventional cooking tops, standard level 1 would produce a net present value of $10 million, whereas there would be net present value savings for levels 2–5 of $3.01 billion, $1.57 billion, negative $1.62 billion, and negative $3.39 billion, respectively. See Technical Support Document, Table 3.6.

Microwave ovens. A life-cycle cost is calculated for a unit meeting each of the candidate standard levels. For microwave ovens, life-cycle costs at all standard levels other than level 4 and level 5, the max tech level, are less than the baseline unit. Of the five candidate standard levels, units meeting level 2 had the lowest consumer life-cycle cost for microwave ovens. See Technical Support Document, Table 4.8.

However, other than at the max tech level, consumers do not purchase units of the same efficiency. At each candidate standard level, the Department determines the average change in life-cycle costs by considering only those consumers who are being forced by the standard to move from a lower efficiency unit to one which just meets the standard level being considered. This is done by assuming in the base case a distribution of purchases of units meeting the efficiencies of the various standard levels. The base case distribution is based on the distribution of current sales as a function of efficiency. As each standard level is examined, the change in life-cycle cost reported is the average change only for affected consumers. Under this scenario, standard level 1 would cause reductions in life-cycle costs for the average affected consumer of $14.15 for microwave ovens; standard level 2 would reduce average life-cycle costs by $14.77 and standard level 3 by $14.12. These life-cycle cost reductions indicate that standard levels 1 through 3 would not cause any economic burden on the average consumer. Standard levels 4 and 5 would increase average life-cycle costs by $.03 and $20.31, respectively. See Technical Support Document, Table 4.16.

The Department examined the effect of different discount rates (4, 6, and 10 percent) on the life-cycle cost curves and generally found little impact. The Department did not consider higher discount rates, since such rates would be beyond the range of real, after-tax rates that consumers would likely face in financing the purchase of microwave ovens. Similarly, DOE did not consider different energy prices, including regional prices, in the life-cycle cost analysis. Since any standard is to be a national standard, DOE believed that national average energy prices were appropriate.

The net present value analysis, a measure of the net savings to society, indicates that for microwave ovens, standard level 1 would produce a net present value of $0.74 billion to consumers. The corresponding net present values for levels 2–5 are $0.78 billion, $0.70 billion, negative $0.67 billion, and negative $2.64 billion, respectively. See Technical Support Document, Table 3.6.

C. Energy savings. As indicated above, standards will result in significant savings of energy consumption for conventional ovens, conventional cooking tops and microwave ovens.

D. Lessening of utility or performance of products. As indicated above, DOE established classes of products in order to assure that the standards analyzed would not lessen the existing utility or performance of conventional ovens, conventional cooking tops, and microwave ovens.

E. Impact of lessening of competition. The determination of this factor must be made by the Attorney General.

F. Need of the nation to save energy. Conventional ovens. Conventional ovens use electricity and gas directly. In 1987, 4.0 percent of residential sector source electricity (or 0.42 quad) and 4.4 percent of natural gas consumption (or 0.23 quad) were accounted for on a national basis by conventional ovens.

In addition, decreasing future energy demand as a result of standards will decrease air pollution. See Technical Support Document, Appendix D of Volume A.[41] Decreases in air pollution will occur for sulfur oxides (listed in equivalent weight of sulfur dioxide, or SO_2). For all classes of conventional ovens at standard level 1, over the years 1996 to 2030, the total estimated SO_2 reduction would be over 51,000 tons. During this time period, the peak annual reduction of SO_2 emissions that are

[41] See footnote 37.

expected to be emitted by power plants in the United States is 0.03 percent. For standard levels 2–5, the reductions are 92,000 tons; 202,000 tons; 239,000 tons; and 405,000 tons, respectively. The highest peak annual reduction of these levels is 0.20 percent.

Standards will also result in a decrease in nitrogen dioxide (NO_2) emissions. For standard level 1, over the years 1996 to 2030, the total estimated NO_2 reduction would be 67,000 tons. During this time period, the peak annual reduction of NO_2 emissions that are expected to be emitted by power plants during that time in the United States is 0.04 percent. For standard levels 2–5, the reductions are 130,000 tons; 249,000 tons; 287,000 tons; and 451,000 tons, respectively. The highest peak annual reduction of these levels is 0.24 percent.

Another consequence of the standards will be the reduction of carbon dioxide (CO_2) emissions. For standard level 1, over the years 1996 to 2030, the total estimated CO_2 reduction would be 46 million tons. During this time period, the peak annual reduction of CO_2 emissions that are expected to be emitted by power plants in the United States is 0.05 percent. For standard levels 2–5, the reductions are 93 million tons; 165 million tons; 187 million tons; and 280 million tons, respectively. The highest peak annual reduction of these levels is 0.29 percent.

Conventional cooking tops. Conventional cooking tops use electricity and gas directly. In 1987, 3.7 percent of source electricity (or 0.39 quad) and 5.0 percent of natural gas consumption (or 0.26 quad) were accounted for on a national basis by conventional cooking tops.

In addition, decreasing future energy demand as a result of standards will decrease air pollution. See Technical Support Document, Appendix D.[42] Decreases in air pollution will occur for sulfur oxides (listed in equivalent weight of sulfur dioxide, or SO_2). For all classes of conventional cooking tops at standard level 1, over the years 1996 to 2030, the total estimated SO_2 reduction would be less than 500 tons. During this time period, the peak annual reduction of SO_2 emissions that are expected to be emitted by power plants in the United States is less than 0.01 percent. For standard levels 2–5, the reductions are 30,000 tons; 17,000 tons; 156,000 tons; and 92,000 tons, respectively. The highest peak annual reduction of these levels is 0.07 percent.

Standards will also result in a decrease in nitrogen dioxide (NO_2) emissions. For standard level 1, over the years 1996 to 2030, the total estimated NO_2 reduction would be 1,000 tons. During this time period, the peak annual reduction of NO_2 emissions that are expected to be emitted by power plants in the United States is less than 0.01 percent. For standard levels 2–5, the reductions are 151,000 tons; 151,000 tons; 255,000 tons; and 206,000 tons, respectively The highest peak annual reduction of these levels is 0.13 percent.

Another consequence of the standards will be the reduction of carbon dioxide (CO_2) emissions. For standard level 1, over the years 1996 to 2030, the total estimated CO_2 reduction would be 1 million tons. During this time period, the peak annual reduction of CO_2 emissions that are expected to be emitted by power plants in the United States is less than 0.01 percent. For standard levels 2–5, the reductions are 144 million tons; 150 million tons; 193 million tons; and 172 million tons, respectively. The highest peak annual reduction of these levels is 0.20 percent.

Microwave ovens. Microwave ovens use electricity directly. In 1987, 1.5 percent of source electricity (or 0.16 quad) were accounted for on a national basis by microwave ovens.

In addition, decreasing future energy demand as a result of standards will decrease air pollution. See Technical Support Document, Appendix D.[43] Decreases in air pollution will occur for sulfur oxides (listed in equivalent weight of sulfur dioxide, or SO_2). For microwave ovens at standard level 1, over the years 1996 to 2030, the total estimated SO_2 reduction would be over 118,000 tons. During this time period, the peak annual reduction of SO_2 emissions that are expected to be emitted by power plants in the United States is 0.09 percent. For standard levels 2–5, the reductions are 138,000 tons; 156,000 tons; 178,000 tons; and 190,000 tons, respectively. The highest peak annual reduction of these levels is 0.12 percent.

Standards will also result in a decrease in nitrogen dioxide (NO_2) emissions. For standard level 1, over the years 1996 to 2030, the total estimated NO_2 reduction would be 94,000 tons. During this time period, the peak annual reduction of NO_2 emissions that are expected to be emitted by power plants in the United States is 0.09 percent. For standard levels 2–5, the reductions are 112,000 tons; 128,000 tons; 147,000 tons; and 158,000 tons, respectively. The highest peak annual reduction of these levels is 0.12 percent.

Another consequence of the standards will be the reduction of carbon dioxide (CO_2) emissions. For standard level 1, over the years 1996 to 2030, the total estimated CO_2 reduction would be 39 million tons. During this time period, the peak annual reduction of CO_2 emissions that are expected to be emitted by powerplants in the United States is 0.09 percent. For standard levels 2–5, the reductions are 48 million tons; 56 million tons; 65 million tons; and 71 million tons, respectively. The highest peak annual reduction of these levels is 0.12 percent.

Decreasing future electricity demand is also likely to result in reductions in the demand for oil used in electricity generation. Because virtually all sources of oil, on the margin, are foreign, any reductions in oil demand are likely to be reflected in reductions in oil imports. For standard level 1, the estimated decrease in oil imports is 12.74 million barrels over the years 1996 to 2030. For standard levels 2–5, the reductions in oil imports are estimated to be 21.33, 32.68, 51.88, and 63.07 million barrels, respectively.

5. Conclusion

Conventional ovens. Section 325(l)(2)(A) of the Act specifies that the Department must consider, for amended standards, those standards that "achieve the maximum improvement in energy efficiency which the Secretary determines is technologically feasible and economically justified." Accordingly, the Department first considered the max tech level of efficiency, i.e., standard level 5 for amended conventional oven standards.

Of the standard levels analyzed, level 5 will save the most energy (3.88 quads between 1996 and 2030). In order to meet this standard, the Department assumes that all conventional ovens will not have an oven door window and will incorporate improved door seals, reduced venting, reflective surfaces, increased and improved insulation, convection and an oven separator, and reduced thermal mass and conduction losses. Additionally, electric ovens would be biradiant, and gas ovens would incorporate an electronic ignition. However, the payback at this standard level of 18.9 years and 15.7 years for the gas and electric representative classes is roughly equal to the 19-year product life and ranges up to 55 years for other classes. At this standard level, all classes have increased life-cycle costs.

The Department therefore concludes that the burdens of standard level 5 for conventional ovens outweigh the benefits, and rejects the standard level.

After carefully considering the analysis, the Department is amending

[42] See, footnote 37.

[43] See, footnote 37.

the National Appliance Energy Conservation Act-imposed 1990 standard for the conventional oven portion of kitchen ranges and ovens with standard level 4 for conventional ovens. The Department concludes that standard level 4 for conventional ovens saves a significant amount of energy and is technologically feasible and economically justified.

There would be significant energy savings at this level of efficiency. During the period 1996–2030, these savings are calculated to be 2.69 quads of primary energy. In addition, the standard could have a positive effect on the environment by reducing the emissions of NO_2 and SO_2 by 267,000 tons and 239,000 tons, respectively, or by as much as 0.15 and 0.12 percent, respectively, by the year 2030. Furthermore, the standard will reduce emissions of CO_2 by 187 million tons, or 0.20 percent, over the forecast period.

The technologies that are necessary to meet this standard are presently available. The Department finds the level to be economically justified. The consumer payback of this standard level is 7.5 years and 4.9 years for the representative gas and electric classes, respectively, with a payback no higher than 10.4 years, or roughly half of the 19-year product life, for any class. This standard has the lowest life-cycle cost for the electric representative class and is expected to result in a reduction in life-cycle cost of approximately $53 for that class. Life-cycle cost savings are $26 for the gas representative class and are positive for all other classes. Additionally, the standard is expected to have almost no impact on the prototypical manufacturer's return on equity of 8.6 percent. Since this standard does not involve substantial redesign or retooling, the Department expects that it will not have negative impacts on smaller competitors.

Conventional cooking tops. Section 325(l)(2)(A) of the Act specifies that the Department must consider, for amended standards, those standards that "achieve the maximum improvement in energy efficiency which the Secretary determines is technologically feasible and economically justified." Accordingly, the Department first considered the max tech level of efficiency, i.e., standard level 5 for amended conventional cooking top standards.

Of the standard levels analyzed, level 5 will save the most energy (3.04 quads between 1996 and 2030). In order to meet this standard, the Department assumes that all representative classes of conventional cooking tops will have reflective surfaces. Additionally, electric-coil cooking tops would have improved element contact, and gas cooking tops would incorporate reduced burner excess air, electronic ignition and sealed burners. It should also be noted that the design options for the representative classes are the same for levels 5, 4 and 3,—i.e., max tech,— with the differences in those levels having to do with design options for electric smooth element cooking tops. At level 5, the max tech level for all classes, electric smooth element cooking tops require the use of induction elements. However, the payback at this standard level for electric smooth element cooking tops is 193 years, with a $550 increase in life-cycle costs.

The Department therefore concludes that the burdens of standard level 5 for conventional cooking tops outweigh the benefits, and rejects the standard level.

The next most stringent standard level is standard level 4. This standard level is projected to save 2.85 quads of energy. As discussed above, the representative classes are still at their max tech level, while electric smooth element cooking tops require the use of halogen elements. The payback at this standard level for electric smooth element cooking tops is 890 years, with a $343 increase in life-cycle costs.

The Department, therefore concludes that the burdens of standard level 4 for conventional cooking tops outweigh the benefits, and rejects the standard level.

The next most stringent standard level is standard level 3. This standard level is projected to save 2.68 quads of energy. As discussed above, the representative classes are still at their max tech level, while electric smooth element cooking tops are at the baseline. The payback at this standard level for the representative gas and electric classes are 10.1 and 9.8 years, respectively, which slightly exceeds half of the product life. Additionally, the Department is concerned about the longevity of the design option, reflective surfaces, required to meet this standard level.

The Department therefore concludes that the questionable technology and economic burdens of standard level 3 for conventional cooking tops outweigh the benefits, and rejects the standard level.

After carefully considering the analysis, the Department is amending the National Appliance Energy Conservation Act-imposed 1990 standard for the conventional cooking top portion of kitchen ranges and ovens with standard level 2 for conventional cooking tops. The Department concludes that standard level 2 for conventional cooking tops saves a significant amount of energy and is technologically feasible and economically justified.

There would be significant energy savings at this level of efficiency. During the period 1996–2030, these savings are calculated to be 2.54 quads of primary energy. In addition, the standard could have a positive effect on the environment by reducing the emissions of NO_2 and SO_2 by 151,000 tons and 30,000 tons, respectively, or by as much as 0.09 and 0.02 percent, respectively, by the year 2030. Furthermore, the standard will reduce emissions of CO_2 by 144 million tons, or 0.15 percent, over the forecast period.

The technologies that are necessary to meet this standard are presently available. The Department finds the level to be economically justified. The consumer payback of this standard level is 7.0 years and 5.2 years for the representative gas and electric classes, respectively, or roughly one-third of the 19-year product life. This standard lowers the life-cycle cost for the representative gas and electric classes by $66 and $6, respectively. Additionally, the standard is expected to have only a slight reduction of the prototypical manufacturer's return on equity of 8.6 percent. Since this standard does not involve substantial redesign or retooling, the Department expects that it will not have negative impacts on smaller competitors.

Microwave ovens. Section 325(l)(2)(A) of the Act specifies that the Department must consider, for amended standards, those standards that "achieve the maximum improvement in energy efficiency which the Secretary determines is technologically feasible and economically justified." Accordingly, the Department first considered the max tech level of efficiency, i.e., standard level 5 for amended microwave oven standards.

Of the standard levels analyzed, level 5 will save the most energy (0.84 quad between 1996 and 2030). In order to meet this standard, the Department assumes that all microwave ovens will have more efficient power supplies, fans and magnetrons; modified wave guides and reflective surfaces. However, the payback at this standard level of 13.0 years exceeds the 10-year product life, and this level produces increased life-cycle costs.

The Department therefore concludes that the burdens of standard level 5 for microwave ovens outweigh the benefits, and rejects the standard level.

The next most stringent standard level is standard level 4. This standard level is projected to save 0.77 quad of energy. However, the payback at this standard

level of 7.4 years is nearly three quarters of the product life and produces an increase in life-cycle costs.

The Department therefore concludes that the burdens of standard level 4 for microwave ovens outweigh the benefits, and rejects the standard level.

After carefully considering the analysis, the Department is amending the National Appliance Energy Conservation Act-imposed 1990 standard for the microwave oven portion of kitchen ranges and ovens with standard level 3 for microwave ovens. The Department concludes that standard level 3 for microwave ovens saves a significant amount of energy and is technologically feasible and economically justified.

There would be significant energy savings at this level of efficiency. During the period 1996–2030, these savings are calculated to be 0.67 quad of primary energy. In addition, the standard could have a positive effect on the environment by reducing the emissions of NO_2 and SO_2 by 128,000 tons and 156,000 tons, respectively, or by as much as 0.10 percent each by the year 2030. Furthermore, the standard will reduce emissions of CO_2 by 56 million tons, or 0.10 percent, over the forecast period.

The technologies that are necessary to meet this standard are presently available. The Department finds the level to be economically justified. The consumer payback of this standard level is 2.9 years, which meets the rebuttable presumption test of economic justification. This standard is close to the lowest life-cycle cost for microwave ovens and is expected to result in a reduction in life-cycle cost of approximately $14. Additionally, the standard is expected to have almost no impact on the prototypical manufacturer's return on equity of 8.6 percent. Since this standard does not involve substantial redesign or retooling, the Department expects that it will not have negative impacts on smaller competitors.

f. Pool Heaters

1. Efficiency Levels Analyzed

The Department examined a range of standard levels for pool heaters. In reviewing the design options necessary to achieve those standard levels, the Department determined that a new energy descriptor was needed to adequately address some of the design options in the analysis because the current energy descriptor, Thermal Efficiency, does not include pilot light usage or electrical consumption. For example, to consider electronic ignition, the savings in pilot light gas consumption would have to be accounted for in the descriptor. Furthermore, other design options, for instance, fan-assisted combustion, improve thermal efficiency but, at the same time, increase overall electrical consumption which, unless accounted for in the energy descriptor, could lead to higher Thermal Efficiency with little or no net energy savings. Because of the above, the Department conducted the analysis, and is proposing the standards, in terms of a new energy descriptor, annual efficiency. The test procedure to determine this energy descriptor is contained in the previously mentioned Notice of Proposed Rulemaking. Table 4–13 presents the four efficiency levels that had been selected for analysis for pool heaters. Level 4 corresponds to the highest efficiency level, max tech, considered in the engineering analysis.

TABLE 4–13.—STANDARD LEVELS ANALYZED FOR POOL HEATERS ANNUAL EFFICIENCY
[In percent]

Product class	Standard level				
	Baseline	1	2	3	4
Gas Fired	66.8	78.0	82.2	90.7	95.7

The Department considered one class of pool heaters, gas-fired pool heaters. For gas-fired pool heaters, trial standard level 1 accomplishes the above efficiency improvement from the baseline by incorporating an electronic ignition, level 2 assumes heat exchanger efficiency at the noncondensing limit, level 3 assumes condensing flue gases with a fan-assisted combustion system, and level 4 assumes condensing flue gases utilizing pulse combustion.

2. Payback Period

Table 4–14 presents the payback period for the efficiency levels analyzed. Standard level 1 satisfies the rebuttable presumption test, i.e., the additional price of purchasing a product will be less than three times the value of the energy savings that the consumer will receive during the first year.

TABLE 4–14.—PAYBACK PERIODS OF DESIGN OPTIONS FOR POOL HEATERS
[In years]

Standard level	Payback period
1	2.7
2	5.0
3	17.2
4	27.0

3. Significance of Energy Savings

To estimate the energy savings by the year 2030 due to revised standards, the energy consumption of new pool heaters under the base case is compared to the energy consumption of those sold under the candidate standard levels. For the candidate energy conservation standards, the Lawrence Berkeley Laboratory-Residential Energy Model projects that over the period 1996–2030, the following energy savings could result for each:

Level 1—0.07 Quad
Level 2—0.23 Quad
Level 3—0.58 Quad
Level 4—0.78 Quad

The Department finds that each of the increased standards levels considered above would result in a significant conservation of energy.

4. Economic Justification

A. Economic impact on manufacturers and consumers The per-unit increased cost to manufacturers to meet the level 1 efficiency is $39.39; to meet levels 2–4, the manufacturers' incremental cost increases are $95.05, $405.68, and $760.68, respectively. See Technical Support Document, Table 1.3, "Manufacturers Cost for Gas-Fired Pool and Spa Heaters."

At those levels of efficiency, the incremental consumer price increases are $87.13, $213.97, $1,025.41, and $1,839.60 for standard levels 1–4, respectively. See Technical Support Document, Table 4.1.

The per-unit reduction in annual cost of operation (energy expense) at level 1 is $32.77; standard level 2 would reduce

energy expenses by $42.51; standard level 3 by $59.53; and standard level 4 by $68.16. See Technical Support Document, Table 4.1.

The Lawrence Berkeley Laboratory-Manufacturer Impact Model results for pool heaters show that revised standards would result in increases in a prototypical manufacturer's short-run return on equity from the 17.9 percent in the base case. Standard levels 1 through 4 are projected to produce short- run return on equity's of 18.0 percent, 18.4 percent, 19.7 percent and 19.9 percent, respectively. Revised standards have even greater increases in long- run return on equity. Standard levels 1 through 4 are projected to produce long-run return on equity's of 18.7 percent, 20.1 percent, 26.0 percent and 29.9 percent, respectively. See Technical Support Document, Tables 5.1 and 5.2.

Most financial data of the type needed to characterize the prototypical manufacturer are generally not available because most real firms are subsidiaries or divisions of larger parent companies. Hence, DOE assumes that the prototypical firm has largely the same financial characteristics (e.g. debt-equity ratio, interest rate on debt, etc.) as parent firms. Financial data for the parent firms are based on publicly available sources such as Securities and Exchange Commission 10K reports and company annual reports.

B. *Life-cycle cost and net present value.* A life-cycle cost is calculated for a unit meeting each of the candidate standard levels. For pool heaters, life-cycle costs at all standard levels other than level 3 and level 4, the max tech level, are less than the baseline unit. Of the four candidate standard levels, a unit meeting level 1 has the lowest consumer life-cycle cost. See Technical Support Document, Table 4.2.

However, other than at the max tech level, consumers do not purchase units of the same efficiency. At each candidate standard level, the Department determines the average change in life-cycle costs by considering only those consumers who are being forced by the standard to move from a lower efficiency unit to one which just meets the standard level being considered. This is done by assuming in the base case a distribution of purchases of units meeting the efficiencies of the various standard levels. The base case distribution is based on the distribution of current sales as a function of efficiency. As each standard level is examined, the change in life-cycle cost reported is the average change only for affected consumers. Under this scenario, standard level 1 would cause reductions in life-cycle costs for the average affected consumer of $231.13 and standard level 2 would reduce average life-cycle costs by $198.94. These life-cycle cost reductions indicate that standard levels 1 and 2 would not cause any economic burden on the average consumer. Standard level 3 would increase average life-cycle costs by $447.19, and standard level 4 would increase average life-cycle costs by $1,177.57. See Technical Support Document, Table 4.2.

While DOE examined the effect of different discount rates (4, 6, and 10 percent) on the life-cycle cost curves and generally found little impact, the Department did not consider higher discount rates, since such rates would be beyond the range of real, after-tax rates that consumers would likely face in financing the purchase of pool heaters. Similarly, DOE did not consider different energy prices, including regional prices, in the life-cycle cost analysis. Since any standard is to be a national standard, DOE believed that national average energy prices were appropriate.

The net present value analysis, a measure of the net savings to society, indicates that standard level 1 would produce a net present value of $0.14 billion to consumers. The corresponding net present values for levels 2–4 are $0.13 billion, negative $1.09 billion, and negative $2.44 billion, respectively. See Technical Support Document, Table 3.6.

C. *Energy savings.* As indicated above, standards will result in significant savings of electricity consumption for pool heaters.

D. *Lessening of utility or performance of products.* As indicated above, DOE established classes of products in order to assure that the standards analyzed would not lessen the existing utility or performance of pool heaters.

E. *Impact of lessening of competition.* The determination of this factor must be made by the Attorney General.

F. *Need of the nation to save energy.* In 1987, 0.8 percent of residential sector natural gas consumption (or 0.04 quad) was accounted for on a national basis by pool heaters.

In addition, decreasing future energy demand as a result of standards will decrease air pollution. See Technical Support Document, Appendix D of Volume A.[44] Decreases in air pollution will occur for nitrogen dioxide (NO_2) emissions. For standard level 1, over the years 1996 to 2030, the total estimated NO_2 reduction would be 4,000 tons. During this time period, the peak annual reduction of NO_2 emissions that are expected to be emitted by power plants in the United States is less than 0.01 percent. For standard levels 2–4 the reductions are 12,000 tons; 31,000 tons and 41,000 tons, respectively. The highest peak annual reduction of these levels is 0.03 percent.

Another consequence of the standards will be the reduction of carbon dioxide (CO_2) emissions. For standard level 1, over the years 1996 to 2030, the total estimated CO_2 reduction would be 4 million tons. During this time period, the peak annual reduction of CO_2 emissions that are expected to be emitted by power plants in the United States is 0.01 percent. For standard levels 2–4 the reductions are 12 million tons; 32 million tons and 43 million tons, respectively. The highest peak annual reduction of these levels is 0.04 percent.

Decreasing future electricity demand is also likely to result in reductions in the demand for oil used in electricity generation. Because virtually all sources of oil, on the margin, are foreign, any reductions in oil demand are likely to be reflected in reductions in oil imports. Standard for pool heaters, standard levels 1–4, are not expected to affect oil consumption.

5. *Conclusion.* Section 325(l)(2)(A) of the Act specifies that the Department must consider, for amended standards, those standards that "achieve the maximum improvement in energy efficiency which the Secretary determines is technologically feasible and economically justified." Accordingly, the Department first considered the max tech level of efficiency, i.e., standard level 4 for amended pool heater standards.

Of the standard levels analyzed, level 4 will save the most energy (0.78 quad between 1996 and 2030). In order to meet this standard, the Department assumes that all pool heaters will be condensing pulse combustion pool heaters. However, the payback at this standard level of 27.0 years exceeds the 15-year life of the product and causes life-cycle cost increases of $1,178.

The Department therefore concludes that the burdens of standard level 4 for pool heaters outweigh the benefits, and rejects the standard level.

The next most stringent standard level is standard level 3. This standard level is projected to save 0.58 quads of energy. However, the payback at this standard level of 17.2 years also exceeds the product's life and produces an increase in life-cycle costs.

The Department therefore concludes that the burdens of standard level 3 for pool heaters outweigh the benefits, and rejects the standard level.

[44] See. footnote 37.

After carefully considering the analysis, the Department is amending the National Appliance Energy Conservation Act-imposed 1990 standard for pool heaters with standard level 2 for pool heaters. The Department concludes that standard level 2 for pool heaters saves a significant amount of energy and is technologically feasible and economically justified.

There would be significant energy savings at this level of efficiency. During the period 1996—2030, these savings are calculated to be 0.23 quads of primary energy. In addition, the standard could have a positive effect on the environment by reducing the emissions of NO_2 by as much as 12,000 tons, or 0.01 percent by the year 2030. Furthermore, the standard will reduce emissions of CO_2 by 12 million tons, or 0.02 percent, over the forecast period.

The technologies that are necessary to meet this standard are presently available. The Department finds the level to be economically justified. The consumer payback of this standard level is 5.0 years or one-third of the product life. This standard is expected to result in a reduction in life- cycle cost of approximately $199. Additionally, the standard is expected to increase the prototypical manufacturer's return on equity from 17.9 percent in the base case to 18.4 percent in the short run and to 20.1 percent in the long run. Since this standard does not involve substantial redesign or retooling, the Department expects that it will not have negative impacts on smaller competitors.

g. Fluorescent Lamp Ballasts

1. Efficiency Levels Analyzed

The Department examined a range of standard levels for fluorescent lamp ballasts. Table 4–15 presents the three efficiency levels selected for analysis for the 10 classes of fluorescent lamp ballasts. Level 3 corresponds to the highest efficiency level, max tech, considered in the engineering analysis.

TABLE 4–15.—STANDARD LEVELS ANALYZED FOR FLUORESCENT LAMP BALLASTS

Product class	Standard level			
	Baseline	1	2	3
One F40 lamp	2.02	2.11	2.50	2.50
Two F40 lamps	1.09	1.15	1.28	1.28
Three F40 lamps	0.71	0.74	0.87	0.87
Four F40 lamps	0.55	0.57	0.67	0.67
Two F96 lamps	0.60	0.72	0.72	0.72
Two F96H0 lamps	0.40	0.50	0.50	0.50
One F32T8 lamp	2.57	2.71	2.97	3.17
Two F32T8 lamps	1.28	1.36	1.48	1.58
Three F32T8 lamps	0.85	0.90	1.00	1.06
Four F32T8 lamps	0.64	0.68	0.72	0.76

Rather than presenting the results for all classes of fluorescent lamp ballasts in today's notice, the Department selected a class of fluorescent lamp ballasts as being representative, or typical, of the product, and is presenting the results only for that class. The results for the other classes can be found in the Technical Support Document in the same sections as those referenced for the representative class. The representative class for fluorescent lamp ballasts is ballasts for two F40 lamps, which is the most prevalent class. For this representative class, trial standard level 1 accomplishes the above efficiency improvement from the baseline by assuming energy-efficient magnetic ballasts with a heater cutout; levels 2 and 3 correspond to efficiencies achieved by rapid start electronic ballasts. Similar design options are used to achieve the above efficiencies for the other classes, except that for the F–32 classes level 3 corresponds to efficiencies achieved by instant start electronic ballasts.

2. Payback Period

Table 4–16 presents the payback period for the efficiency levels analyzed for the representative class of fluorescent lamp ballast. For this representative class, standard levels 2 and 3 satisfy the rebuttable presumption test, i.e., the additional price of purchasing a product will be less than three times the value of the energy savings that the consumer will receive during the first year. Payback for all classes of fluorescent lamp ballasts may be found in Tables 4.11d–4.20d of the Technical Support Document.

TABLE 4–16.—PAYBACK PERIODS OF DESIGN OPTIONS FOR REPRESENTATIVE CLASS OF FLUORESCENT LAMP BALLASTS

[In years]

Standard level	Payback period
1	4.4
2	2.4
3	2.4

3. Significance of Energy Savings

To estimate the base case energy savings by the year 2030 due to revised standards, the energy consumption of new fluorescent lamp ballasts under the base case is compared to the energy consumption of those sold under the candidate standard levels. For the candidate energy conservation standards, Commercial Energy End-Use Model projects over the period 1996–2030, the following energy savings could result for each:

Level 1—13.7 Quads
Level 2—15.9 Quads
Level 3—17.0 Quads

The Department finds that each of the increased standards levels considered above would result in a significant conservation of energy.

4. Economic Justification

A. *Economic impact on manufacturers and consumers.* The per-unit increased cost to manufacturers to meet the level 1 efficiency for the representative class is $2.00; to meet levels 2 and 3, the manufacturers' cost increase is $7.00. See Technical Support Document, Table 1.6.

At those levels of efficiency, the consumer price increases are $4.91 and $8.95 for standard levels 1 and 2/3, respectively. See Technical Support Document, Table 4.2.

The per-unit reduction in annual cost of operation (energy expense) at level 1 is $1.11 for the representative class; standard levels 2 and 3 would reduce energy expenses by $3.62. See Technical Support Document, Table 4.12a.

The Lawrence Berkeley Laboratory-Manufacturer Impact Model results for fluorescent lamp ballasts show that revised standards would result in increases in a prototypical manufacturer's short-run return on equity from the 15.5 percent in the base case. Standard levels 1 through 3 are projected to produce short-run return on equity's of 23.7 percent, 24.5 percent and 24.7 percent, respectively. Revised standards are projected to slightly increase long-run return on equity. Standard levels 1 through 3 are projected to produce long-run return on equity's of 16.0 percent, 16.1 percent and 16.1 percent, respectively. See Technical Support Document, Tables 5.1 and 5.2.

Most financial data of the type needed to characterize the prototypical manufacturer are generally not available because most real firms are subsidiaries or divisions of larger parent companies. Hence, DOE assumes that the prototypical firm has largely the same financial characteristics (e.g. debt-equity ratio, interest rate on debt, etc.) as parent firms. Financial data for the parent firms are based on publicly available sources such as Securities and Exchange Commission 10K reports and company annual reports.

B. *Life-cycle cost and net present value.* A life-cycle cost is calculated for a unit meeting each of the candidate standard levels. For the representative class, life-cycle costs at all standard levels are less than the baseline unit. Of the three candidate standard levels, a unit meeting levels 2 or 3 had the lowest consumer life-cycle costs. See Technical Support Document, Table 4.2.

However, other than at the max tech level, consumers do not purchase units of the same efficiency. At each candidate standard level, the Department determines the average change in life-cycle costs by considering only those consumers who are being forced by the standard to move from a lower efficiency unit to one which just meets the standard level being considered. This is done by assuming in the base case a distribution of purchases of units meeting the efficiencies of the various standard levels. The base case distribution is based on the distribution of current sales as a function of efficiency. As each standard level is examined, the change in life-cycle cost reported is the average change only for affected consumers. Under this scenario, standard level 1 would cause reductions in life-cycle costs for the average consumer of $7.48 for the representative class, and standard levels 2 and 3 would reduce average life-cycle costs by $30.23. These life-cycle cost reductions indicate that no standard level would cause any economic burden on the average consumer. See Technical Support Document, Table 4.12d.

While DOE examined the effect of different discount rates (2, 4, and 10 percent) on the life-cycle cost curves and generally found little impact, the Department did not consider higher discount rates, since such rates would be beyond the range of real, after-tax rates that consumers would likely face in financing the purchase of fluorescent lamp ballasts. Similarly, DOE did not consider different energy prices, including regional prices, in the life-cycle cost analysis. Since any standard is to be a national standard, DOE believed that national average energy prices were appropriate.

The net present value analysis, a measure of the net savings to society, indicates that standard level 1 would produce a net present value of $22.3 billion to consumers. The corresponding net present values for levels 2 and 3 are $25.4 billion and $27.3 billion, respectively. See Technical Support Document, Table 3.6.

C. *Energy savings.* As indicated above, standards will result in significant savings of electricity consumption for fluorescent lamp ballasts.

D. *Lessening of utility or performance of products.* As indicated above, DOE established classes of products in order to assure that the standards analyzed would not lessen the existing utility or performance of fluorescent lamp ballasts.

E. *Impact of lessening of competition.* The determination of this factor must be made by the Attorney General.

F. *Need of the Nation to save energy.* Fluorescent lamp ballasts use electricity directly. In 1987, 27 percent of commercial sector source electricity (or 2.17 quads) was accounted for on a national basis by fluorescent lamp ballasts.

In addition, decreasing future energy demand as a result of standards will decrease air pollution. See Technical Support Document, Appendix D of Volume A.[45] Decreases in air pollution will occur for sulfur oxides (listed in equivalent weight of sulfur dioxide, or SO_2). For fluorescent lamp ballasts at standard level 1, over the years 1996 to 2030, the total estimated SO_2 reduction would be over 2,417,000 tons. During this time period, the peak annual reduction of SO_2 emissions that are expected to be emitted by power plants in the United States is 1.20 percent. For standard levels 2 and 3, the reductions are 2,797,000 tons and 2,986,000 tons, respectively. The highest peak annual reduction of these levels is 1.47 percent.

Standards will also result in a decrease in nitrogen dioxide (NO_2) emissions. For standard level 1, over the years 1996 to 2030, the total estimated NO_2 reduction would be 2,218,000 tons. During this time period, the peak annual reduction of NO_2 emissions that are expected to be emitted by power plants in the United States is 1.19 percent. For standard levels 2 and 3, the reductions are 2,566,000 tons and 2,739,000 tons, respectively. The highest peak annual reduction of these levels is 1.47 percent.

Another consequence of the standards will be the reduction of carbon dioxide (CO_2) emissions. For standard level 1, over the years 1996 to 2030, the total estimated CO_2 reduction would be 1,174 million tons. During this time period, the peak annual reduction of CO_2 emissions that are expected to be emitted by power plants in the United States are 1.17 percent. For standard levels 2 and 3, the reductions are 1,358 million tons and 1,450 million tons, respectively. The highest peak annual reduction of these levels is 1.44 percent.

Decreasing future electricity demand is also likely to result in reductions in the demand for oil used in electricity generation. Because virtually all sources of oil, on the margin, are foreign, any reductions in oil demand are likely to be reflected in reductions in oil imports. For standard level 1, the estimated decrease in oil imports is 230.41 million barrels over the years 1996 to 2030. For standard levels 2 and 3, the reductions in oil imports are estimated to be 266.97 and 285.05 million barrels, respectively.

5. Conclusion

Section 325(l)(2)(A) of the Act specifies that the Department must consider, for amended standards, those standards that "achieve the maximum improvement in energy efficiency which the Secretary determines is technologically feasible and economically justified." Accordingly, the Department first considered the max tech level of efficiency, i.e., standard level 3 for amended fluorescent lamp ballast standards.

Of the standard levels analyzed, level 3 will save the most energy (17.0 quads between 1996 and 2030). In order to meet this standard, the Department assumes that all fluorescent lamp ballasts will be electronic rapid or instant start.

After carefully considering the analysis, the Department is amending the National Appliance Energy Conservation Act–1988 imposed 1990 standard for fluorescent lamp ballasts with standard level 3 for fluorescent

[45] See footnote 37.

lamp ballasts. The Department concludes that standard level 3 for fluorescent lamp ballasts saves a significant amount of energy and is technologically feasible and economically justified.

There would be significant energy savings at this level of efficiency. During the period 1996–2025, these savings are calculated to be 17.0 quads of primary energy. In addition, the standard could have a positive effect on the environment by reducing the emissions of NO_2 and SO_2 by 2,739,000 tons and 2,986,000 tons, respectively, or by as much as 1.47 percent each by the year 2030. Furthermore, the standard will reduce emissions of CO_2 by 1,450 million tons, or 1.44 percent, over the forecast period.

The technologies that are necessary to meet this standard are presently available. The Department finds the level to be economically justified. The consumer payback of this standard level is 2.4 years for the representative class and no more than 5.3 years for any class. This standard has the lowest life-cycle cost for all classes and is expected to result in a reduction in life-cycle cost of approximately $30 for the representative class. Additionally, the standard is expected to increase both the short- and long-run prototypical manufacturer's return on equity of 15.5 percent. Since this standard does not involve substantial redesign or retooling, the Department expects that it will not have negative impacts on smaller competitors.

h. Television Sets

1. Efficiency Levels Analyzed

The Department examined a range of standard levels for color television sets. Table 4–17 presents the efficiency levels that have been selected for analysis. Level 3 corresponds to the highest efficiency level, max tech, considered in the engineering analysis. For level 3, the annual energy use in kWh per year can be expressed as E=20.5+6.1D, where D equals the screen size in inches.

TABLE 4–17.—STANDARD LEVELS ANALYZED FOR TELEVISION SETS

[Annual energy use]

Product class	Standard levels—KWH/YR			
	Baseline	1	2	3
19"/20" color TV sets	205	184	171	138.5

Trial standard level 1 accomplishes the above efficiency improvement from the baseline by reducing standby power usage to 2 watts; level 2 corresponds to an efficiency achieved by reducing standby power to 2 watts and by reducing the white and black screen power each by 6 watts; level 3 corresponds to an efficiency achieved by reducing the standby power to two watts, white screen power to 73 watts and black screen power to 41 watts.

2. Payback Period

Table 4–18 presents the payback period for the efficiency levels analyzed for 19"/20" color television sets. Standard levels 1 and 2 satisfy the rebuttable presumption test, i.e., the additional price of purchasing a product will be less than three times the value of the energy savings that the consumer will receive during the first year.

TABLE 4–18.—PAYBACK PERIODS OF DESIGN OPTIONS FOR TELEVISION SETS

[In years]

Standard level	Payback period
1	2.1
2	2.2
3	3.5

3. Significance of Energy Savings.

To estimate the energy savings by the year 2030 due to revised standards, the energy consumption of new television sets under the base case is compared to the energy consumption of those sold under the candidate standard levels. For the candidate energy conservation standards, the Lawrence Berkeley Laboratory-Residential Energy Model projects that over the period 19962030, the following energy savings would result for each:

Level 1—0.52 Quad
Level 2—1.28 Quads
Level 3—3.13 Quads

The Department finds that each of the increased standards levels considered above would result in a significant conservation of energy.

4. Economic Justification

A. Economic impact on manufacturers and consumers. The per-unit increased cost to manufacturers to meet the level 1 efficiency is $2.15; to meet levels 2 and 3 the manufacturers' cost increases are $3.65 and $10.25, respectively. See Technical Support Document, Table 1.4.

At those levels of efficiency, the incremental consumer price increases are $3.76, $6.39 and $19.37 for standard levels 13, respectively. See Technical Support Document, Table 4.1.

The per-unit reduction in annual cost of operation (energy expense) at level 1 is $1.81, standard level 2 would reduce energy expenses by $2.95 and standard level 3 by $5.71. See Technical Support Document, Table 4.1.

The Lawrence Berkeley Laboratory-Manufacturer Impact Model results for television sets show that the prototypical manufacturer has a negative return on equity of 1.9 percent in the absence of standards and that standards cause slight but further reductions in both short- and long-run return on equity. Standard levels 1 through 3 are projected to produce negative short-run return on equitys of 2.0 percent, 2.0 percent and 3.3 percent, respectively. Long-run return on equitys are projected to be negative 1.9 percent, 2.0 percent and 2.2 percent, respectively. See Technical Support Document, Tables 5.1 and 5.2.

Most financial data of the type needed to characterize the prototypical manufacturer are generally not available because most real firms are subsidiaries or divisions of larger parent companies. Hence, DOE assumes that the prototypical firm has largely the same financial characteristics (e.g. debt-equity ratio, interest rate on debt, etc.) as parent firms. Financial data for the parent firms are based on publicly available sources such as Securities and Exchange Commission 10K reports and company annual reports.

B. *Life-cycle cost and net present value.* A life-cycle cost is calculated for a unit meeting each of the candidate standard levels. For color television sets, life-cycle costs at all standard levels are less than the baseline unit. Of the three candidate standard levels, a unit meeting level 3 has the lowest consumer life-cycle cost. See Technical Support Document, Table 4.1.

However, other than at the max tech level, consumers do not purchase units

of the same efficiency. At each candidate standard level, the Department determines the average change in life-cycle costs by considering only those consumers who are being forced by the standard to move from a lower efficiency unit to one which just meets the standard level being considered. This is done by assuming in the base case a distribution of purchases of units meeting the efficiencies of the various standard levels. The base case distribution is based on the distribution of current sales as a function of efficiency. As each standard level is examined, the change in life-cycle cost reported is the average change only for affected consumers. Under this scenario, standard level 1 would cause reductions in life-cycle costs for the average consumer of $10.97, standard level 2 would reduce average life-cycle costs by $14.52, and standard level 3 by $24.06. The lower life-cycle costs indicate that no standard level would cause any economic burden on the average consumer. See Technical Support Document, Table 4.2.

While DOE examined the effect of different discount rates (4, 6, and 10 percent) on the life-cycle cost curves and generally found little impact, the Department did not consider higher discount rates, since such rates would be beyond the range of real, after-tax rates that consumers would likely face in financing the purchase of television sets. Similarly, DOE did not consider different energy prices, including regional prices, in the life-cycle cost analysis. Since any standard is to be a national standard, DOE believed that national average energy prices were appropriate.

The net present value analysis, a measure of the net savings to society, indicates that standard level 1 would produce a net present value of $0.64 billion to consumers. The corresponding net present values for levels 2 and 3 are $1.35 billion and $1.67 billion, respectively. See Technical Support Document, Table 3.6.

C. *Energy savings.* As indicated above, standards will result in significant savings of electricity consumption for television sets.

D. *Lessening of utility or performance of products.* As indicated above, DOE established classes of products in order to assure that the standards analyzed would not lessen the existing utility or performance of television sets.

E. Impact of lessening of competition. The determination of this factor must be made by the Attorney General.

F. *Need of the nation to save energy.* Television sets use electricity directly. In 1987, 2.1 percent of residential sector source electricity (or 0.22 quads) was accounted for on a national basis by television sets.

In addition, decreasing future energy demand as a result of standards will decrease air pollution. See Technical Support Document, Appendix D of Volume A.[46] Decreases in air pollution will occur for sulfur oxides (listed in equivalent weight of sulfur dioxide, or SO_2). For television sets at standard level 1, over the years 1996 to 2030, the total estimated SO_2 reduction would be 120,000 tons. During this time period, the peak annual reduction of SO_2 emissions that are expected to be emitted by power plants in the United States is 0.07 percent. For standard levels 2 and 3, the reductions are 261,000 tons and 599,000 tons, respectively. The highest peak annual reduction of these levels is 0.29 percent.

Standards will also result in a decrease in nitrogen dioxide (NO_2) emissions. For standard level 1, over the years 1996 to 2030, the total estimated NO_2 reduction would be 99,000 tons. During this time period, the peak annual reduction of NO_2 emissions that are expected to be emitted by power plants in the United States is 0.07 percent. For standard levels 2 and 3, the reductions are 225,000 tons and 528,000 tons, respectively. The highest peak annual reduction of these levels is 0.29 percent.

Another consequence of the standards will be the reduction of carbon dioxide (CO_2) emissions. For standard level 1, over the years 1996 to 2030, the total estimated CO_2 reduction would be 43 million tons. During this time period, the peak annual reduction of CO_2 emissions that are expected to be emitted by power plants in the United States is 0.07 percent. For standard levels 2 and 3, the reductions are 108 million tons and 263 million tons, respectively. The highest peak annual reduction of these levels is 0.29 percent.

Decreasing future electricity demand is also likely to result in reductions in the demand for oil used in electricity generation. Because virtually all sources of oil, on the margin, are foreign, any reductions in oil demand are likely to be reflected in reductions in oil imports. For standard level 1, the estimated decrease in oil imports is 8.86 million barrels over the years 1996 to 2030. For standard levels 2 and 3, the reductions in oil imports are estimated to be 22.05 and 53.88, respectively.

5. Conclusion

Section 325(l)(2)(A) of the Act specifies that the Department must consider, for amended standards, those standards that "achieve the maximum improvement in energy efficiency which the Secretary determines is technologically feasible and economically justified." Accordingly, the Department first considered the max tech level of efficiency, i.e., standard level 3 for amended television set standards.

Of the standard levels analyzed, level 3 will save the most energy (3.13 quads between 1996 and 2030). In order to meet this standard, the Department assumes that all television sets will have reduced standby power and reduced white/black screen power.

After carefully considering the analysis, the Department is establishing a standard for television sets. The Department concludes that standard level 3 for television sets saves a significant amount of energy and is technologically feasible and economically justified.

There would be significant energy savings at this level of efficiency. During the period 1996–2030, these savings are calculated to be 3.13 quads of primary energy. In addition, the standard could have a positive effect on the environment by reducing the emissions of NO_2 and SO_2 by 528,000 tons and 599,000 tons, respectively, or by as much as 0.29 percent each by the year 2030. Furthermore, the standard will reduce emissions of CO_2 by 263 million tons, or 0.29 percent, over the forecast period.

The technologies that are necessary to meet this standard are presently available. The Department finds the level to be economically justified. The consumer payback of this standard level is 3.5 years, which compares favorably with the 12-year product life. This standard has the lowest life-cycle cost and is expected to result in a reduction in life-cycle cost of approximately $24. Additionally, the standard is expected to have only a slight reduction in the prototypical manufacturer's return on equity of negative 1.9 percent. Since this standard does not involve substantial redesign or retooling, the Department expects that it will not have negative impacts on smaller competitors.

V. Environmental, Regulatory Impact, Takings Assessment, Federalism, and Regulatory Flexibility Reviews

The Department has reviewed today's proposed action in accordance with the Department's obligations under:

- The National Environmental Policy Act (42 U.S.C. 4321 et seq.), the Council on Environmental Quality regulations implementing the provisions of the National Environmental Policy Act (40 CFR parts 1500–1508), and the

[46] See footnote 37.

Department's regulations for compliance with the National Environmental Policy Act (10 CFR part 1021);

- Executive Order 12866 (58 FR 51735, October 4, 1993) which pertains to agency review of the impact of Federal regulations;
- Executive Order 12630 (53 FR 8859, March 18, 1988) which pertains to agency consideration of Federal actions that interfere with constitutionally protected property rights;
- Executive Order 12612 (52 FR 41685, October 30, 1987) which pertains to agency consideration of Federal actions that would have a substantial direct effect on States, on the relationship between the Federal Government and the States, and on the distribution of power and responsibilities among the various levels of government; and
- The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) which requires, in part, that an agency prepare an initial regulatory flexibility analysis for any proposed rule unless it determines that the rule will not have a "significant economic impact on a substantial number of small entities." In the event that such an analysis is not required for a particular rule, the agency must publish a certification and explanation of that determination in the **Federal Register.**

a. Environmental Review

The Department prepared an Environmental Assessment (DOE/EA–0819) on the proposed standards pursuant to the National Environmental Policy Act, 42 U.S.C. 4321 *et seq.*, and the implementing regulations of the Council on Environmental Quality (40 CFR parts 1500–1508). The Environmental Assessment addresses the possible incremental environmental effects attributable to the application of the proposed standards to the design of the eight types of covered products: Room air conditioners, water heaters, direct heating equipment, mobile home furnaces, kitchen ranges and ovens, pool heaters, fluorescent lamp ballasts, and television sets.

A Finding of No Significant Impact was issued December 1992 and is being published elsewhere in today's **Federal Register.** Publishing the finding has been delayed along with the proposed rulemaking due to difficulties in resolving issues and coordinating with a related rulemaking. The Finding of No Significant Impact concludes that the proposed standards would result in no significant environmental impacts and that an environmental impact statement is not required.

The Environmental Assessment is published within the Technical Support Document and is available at the DOE Freedom of Information Reading Room at the address provided at the beginning of this notice.

b. Regulatory Impact Review

Executive Order 12866 (58 FR 51735, October 4, 1993) directs that, in proposing a significant regulatory action,[47] an agency perform a regulatory analysis. Such an analysis presents major alternatives to the regulation that could achieve substantially the same regulatory goal at lower cost, as well as a description of the costs and benefits (including potential net benefits) of the proposed rule.

The Department has determined that this proposed rule is a "significant regulatory action." Accordingly, the draft regulatory action has been prepared and submitted to the Office of Management and Budget. The Office of Management and Budget has reviewed the draft regulatory action under Executive Order 12866.

The regulatory review of the draft regulatory action is summarized below. This summary focuses on the major alternatives considered in arriving at the proposed approach to improving the energy efficiency of consumer products. The reader is referred to the complete draft "Regulatory Impact Analysis," which is contained in the Technical Support Document, 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.

It should be noted at the outset that none of the alternatives that were examined for these eight products saved as much energy as the proposed rule. Also, most of the alternatives would require that enabling legislation be enacted, since authority to carry out those alternatives does not presently exist.

Alternatives for Achieving Consumer Product Energy Conservation

Six major alternatives were identified by DOE as representing feasible 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

- Voluntary Energy Efficiency Targets
- The Proposed Approach (Performance Standards)

Each alternative has been evaluated in terms of its ability to achieve significant energy savings at reasonable costs, and has been compared to the effectiveness of the proposed rule.

If no new regulatory action were taken, then no new standards would be implemented for these eight products. This is essentially the "base case" for each appliance. In this case, between the years 1996 and 2030 there would be expected energy use of 443.6 quads of primary energy, with no energy savings and a zero net present value.

Several alternatives to the base case can be grouped under the heading of informational action. They include consumer product labeling and the Department's public education and information program. Both of these alternatives are mandated by the Act. One base case alternative would be to estimate the energy conservation potential of enhancing these programs. To model this possibility, the Department assumed that market discount rates would be lowered by 5 percent for purchasers of these eight products. This resulted in energy savings equal to 1.7 quads, with expected consumption equal to 441.8 quads. The net present value is estimated to be $2.7 billion.

Another method of setting standards would entail requiring that certain design options be used on each product, i.e., prescriptive standards. For these eight products, prescriptive standards are assumed to be implemented as standards at one level below the performance standards. The lower standards level entails slightly smaller expenditures for tooling and purchased parts. Consequently, the economic impacts that are expected before the implementation date should be slightly smaller for prescriptive standards. This

[47] "Significant regulatory action" means any regulatory action that is likely to result in a rule that may: (1) Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities; (2) Create a serious inconsistency or otherwise intefere with an action taken or planned by another agency; (3) Materially alter the budgetary impact of entitlement, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or (4) Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in this Executive order.

resulted in energy consumption, between 1996 and 2030, of 389.2 quads, and savings of 54.3 quads. The net present value, in 1990 dollars, was $92.3 billion.

Various financial incentive alternatives were tested. These included tax credits and rebates to consumers, as well as tax credits to manufacturers. The tax credits to consumers were assumed to be 15 percent of the increased expense for higher energy efficiency features of these appliances, while the rebates were assumed to be 15 percent of the increase in equipment prices. The tax credits to consumers showed a change from the base case, saving 3.7 quads with a net present value of $6.0 billion. Consumer rebates showed more sizable changes; they would save 4.5 quads with a net present value of $8.1 billion.

Another financial incentive that was considered was tax credits to manufacturers for the production of energy-efficient models of these eight appliances. In this scenario, an investment tax credit of 20 percent was assumed. The tax credits to manufacturers had almost no effect; the energy consumption estimates are 442.8 quads with savings equal to 0.7 quad, and a net present value equal to $0.8 billion.

The impact of this scenario is so small because the investment tax credit was applicable only to the tooling and machinery costs of the firms. The firms' fixed costs and most of the design improvements that would likely be adopted to manufacture more efficient versions of these products would involve purchased parts. Expenses for purchased parts would not be eligible for an investment tax credit.

Two scenarios of voluntary energy efficiency targets were examined. In the first one, the proposed energy conservation standards were assumed to be voluntarily adopted by all the relevant manufacturers in 5 years. In the second scenario, the proposed standards were assumed to be adopted in 10 years. In these scenarios, the 5-year delay would result in energy consumption by these appliances of 388.0 quads, energy savings of 55.2 quads, and a net present value of $97.1 billion; the 10-year delay would result in 398.4 quads of energy being consumed, 44.8 quads being saved, and a net present value of $76.6 billion.

These scenarios assume that there would be universal voluntary adoption of the energy conservation standards by these appliance manufacturers, an assumption for which there is no reasonable assurance.

Lastly, all of these alternatives must be gauged against the performance standards that are being proposed in this notice. Such performance standards would result in energy consumption of the eight appliances to total an estimated 379.4 quads of primary energy over the 1996–2030 time period. Savings would be 64.1 quads, and the net present value would be an expected $108.7 billion.

As noted at the beginning of this section, none of the alternatives that were considered for these products would save as much energy as the proposed rule.

c. "Takings" Assessment Review

Executive Order 12630 (53 FR 8859, March 18, 1988) directs that, in proposing a regulation, an agency conduct a "takings" review. Such a review is intended to assist agencies in avoiding unnecessary takings and help such agencies account for those takings that are necessitated by statutory mandate.

For purposes of the Order:

"Policies that have takings implications" refers to Federal regulations, proposed Federal regulations, proposed Federal legislation, comments on proposed Federal legislation, or other Federal policy statements that, if implemented or enacted, could effect a taking, such as rules and regulations that propose or implement licensing, permitting, or other condition requirements or limitations on private property use, or that require dedications or exactions from owners of private property.[48]

There are three parts of the appliance standards program that conceivably could be viewed as having "takings implications." These are testing and certification requirements, the impacts of standard levels, and possible DOE testing of products for validation.

With regard to the first part, namely, testing and certification, the Department believes that such a requirement, implementing a long-established statutory mandate in a manner calculated to minimize adverse economic impacts, does not constitute a "taking" of private property.

Similarly, the Department's possible validation testing does not constitute a "taking" within limitations described above.

Lastly, the impact of standards could be viewed by some as a "taking." Nevertheless, the Department believes that while an energy conservation standard may limit some manufacturers in the range of appliance efficiencies they can produce, such narrowing of the energy efficiency range does not constitute a "taking" in the sense described above.

In short, in none of the three parts of the appliance standards program does the Department believe that the provisions of Executive Order 12630 pertain.

d. Federalism Review

Executive Order 12612 (52 FR 41685, October 30, 1987) requires that regulations or rules be reviewed for any substantial direct effects on States, on the relationship between the Federal Government and the States, or on the distribution of power and responsibilities among various levels of government. If there are sufficient substantial direct effects, then Executive Order 12612 requires preparation of a federalism assessment to be used in all decisions involved in promulgating and implementing a regulation or a rule.

The Department finds that today's proposed rule, if finalized, will not have a substantial direct effect on State governments. State regulations that may have existed on these eight products were preempted by the Federal standards established in the National Appliance Energy Conservation Act. States could petition the Department for exemption from such preemption, and none has done so. Today's Final Rule has no added effect on States. Thus, based on the foregoing, the Department finds that the preparation of a Federalism assessment for this rulemaking is not warranted.

The Act provides for subsequent State petitions for exemption from preemption, which necessarily means that the determination as to whether a State law prevails must be made on a case-by-case basis using criteria set forth in the Act. When DOE receives such a petition, it will be appropriate to consider preparing a federalism assessment consistent with the criteria in the Act.

e. Regulatory Flexibility Review

The Regulatory Flexibility Act of 1980 (Pub. L. 96–354) requires an assessment of the impact of regulations on small businesses. Small businesses are defined as those firms within an industry that are privately owned and less dominant in the market.

In this rulemaking, eight different products and, hence, industries are being addressed. Regulatory flexibility issues will be discussed for the industries for which standards are being prescribed.

First, the energy conservation standard on those room air conditioner

[48] Executive Order 12630, March 15, 1988, Sec. 2.

manufacturers who could be considered small businesses will be discussed.

The room air conditioner industry is characterized by three firms with large market shares (accounting for nearly 75 percent of sales) and numerous firms sharing the remaining one-quarter of the market.

There are significant differences among the major firms. For this industry, the Department has learned that average cost has an inverse relationship to firm size. Thus, the industry has economies of scale, and large firms (to the extent that their facilities are up-to-date) have lower average costs than small firms. This fact, coupled with increasing competitiveness of the national market, probably accounts for the continuing consolidation that has been occurring for several decades. The fact that the consolidation has been producing larger firms strongly corroborates the finding that large firms have a cost advantage.

A principal implication of consolidation is that the smaller of the firms will be, on average, in more danger of failing or being bought out than will the large firms. Because of the greater precariousness of smaller firms, any decrease in average profitability is more likely to mean the difference between success and failure for a smaller firm.

From the point of view of competitiveness, a decrease in average profitability could speed up the process of consolidation, producing a less competitive industry, while an increase in average profitability could help maintain the current levels of competition. Either effect might well be temporary, because, in the long run, the number of firms should be determined by the industry's cost structure and by the way a single firm's elasticity of demand relates to the number of competing firms.

While some small firms have more energy efficient models than larger firms, and while some have more models of average efficiency, the impact of higher efficiency standards on small firms is likely to be mixed. If standards are technologically difficult to meet, however, they may hurt selected smaller firms the most, because smaller firms have less sophisticated research and development capabilities.

Secondly, the impact of the energy conservation standards on water heater manufacturers needs to be addressed.

Water heater manufacturing firms can be divided into two groups: those that compete on large sales volume products and those that compete in small, specialized markets. Small firms are generally forced to specialize in small market niches that offer some protection from the cost advantage that large firms hold when they can produce in volume. This effect can even be observed among the major producers, in the tendency of the smaller major producers to produce somewhat more specialized products.

Just like the room air conditioner industry, water heater manufacturing is characterized by economies of scale in production, and large firms generally tend to have average costs that are lower than those of small firms.

Although larger firms have a cost advantage because of economies of scale, the very small firms in the water heater manufacturing industry have found market niches in which to survive profitably. There are at least two small firms which manufacture standard electric resistance water heaters. In addition, there are also two small firms that manufacture heat pump water heaters. Therefore, if a very stringent efficiency standard for water heaters is mandated, one could expect that given the small margins in the industry, some small firms may have to leave the market. On the other hand, the small firms that specialize in higher efficiency models (such as heat pump water heaters) may experience a boom.

The small firms that sell niche products such as heat pump water heaters usually find that these markets have higher margins. As a result, it is possible that small firms would have an easier time passing through increased variable costs that result from standards, and thus may be more positively affected than large firms by standards. However, this prediction should be tempered by the observation that if standards are technologically difficult to meet, they may hurt selected smaller firms the most since, as noted above, smaller firms typically have less sophisticated research and development capabilities.

Thirdly, the direct heating equipment industry must be considered. This industry, too, is characterized by economies of scale in production, with larger firms having average costs that are lower than those of smaller firms. Here, too, there has been continuing consolidation over the past several decades.

The same points raised above about the implications of consolidation and competitiveness among water heater firms pertain to manufacturers of direct heating equipment as well.

Next, the mobile home furnace industry will be addressed. In this industry, two firms supply all the gas-fired mobile home furnaces. Since discussions with industry sources revealed that the market shares of the two firms are approximately 50 percent each, the Department believes that neither is a small firm on which standards could have a significant adverse impact.

The characterization of the kitchen ranges and oven industry (including microwave ovens) is similar to those industries previously discussed. This industry, too, displays economies of scale in production and increasing consolidation as the larger firms have been acquiring smaller ones for the past few decades.

Since many, if not most, of the energy conservation standards can be achieved without significant retooling of plant and equipment, it is probable that such standards will not have significant adverse impacts on the small firms.

The pool heater industry, too, is characterized by economies of scale in production, with the consequent price advantage that large firms have over smaller ones. This industry, though, is already highly concentrated, and apparently never had a large number of firms. Most of the firms manufacture gas-fired pool heaters as an adjunct to other larger lines of business, e.g., boilers, pool and swimming equipment, etc. It appears that there are no real niche markets. Nevertheless, since the proposed standards are generally not considered to be technologically difficult to meet, and since the forecasts are that all standard levels are profitable, the Department does not expect significant adverse impacts on small firms.

Another industry that shares the characterization of larger firms having cost advantages over smaller ones, i.e., that displays economies of scale, is the fluorescent lamp ballast industry. Here, too, there has been continuing consolidation over time, and presently, three firms produce 90 percent of the market.

Many (if not most) of the standard levels considered do not require significant retooling of plant and equipment. In fact, much of the industry is currently retooling in anticipation of future growth, which is due in part to demand motivated by demand-side management programs of electric utility companies. These factors, combined with the estimates that profitability will be higher at all standard levels, imply that there will probably not be significant adverse impacts on small firms.

Lastly, the impact of energy conservation standards on the television set industry is discussed. This industry also has undergone significant consolidation over the past few decades. Presently, as with most of the other

industries discussed above, the larger firms have cost advantages over the smaller ones.

Zenith is the only domestic television set manufacturer located in the U.S., and it has 13 percent of the market. Therefore, there really cannot be any adverse small firm impacts since, domestically, there is only one firm, and it is not small.

In view of the foregoing, the Department has determined and hereby certifies pursuant to section 605(b) of the Regulatory Flexibility Act that today's action will not have a "significant economic impact on a substantial number of small entities."

In conclusion, for each of these eight industries, the Department finds that the standard levels proposed in today's Proposed 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.

VI. Public Comment Procedures

a. Participation in Rulemaking

The Department encourages the maximum level of public participation possible in this rulemaking. Individual consumers, representatives of consumer groups, manufacturers, associations, States or other governmental entities, utilities, retailers, distributors, manufacturers, and others are urged to submit written statements on the proposal. The Department also encourages interested persons to participate in the public hearing to be held in Washington, DC, at the time and place indicated at the beginning of this notice.

The DOE has established a comment period of 75 days following publication of this notice for persons to comment on this proposal. All public comments received and the transcript of the public hearing will be available for review in the DOE Freedom of Information Reading Room.

b. Written Comment Procedures

Interested persons are invited to participate in this proceeding by submitting written data, views or arguments with respect to the subjects set forth in this notice. Instructions for submitting written comments are set forth at the beginning of this notice and below.

Comments (with 10 copies) should be labeled both on the envelope and on the documents, "Eight Products Rulemaking (Docket No. EE–RM–90–201)," and must be received by the date specified at the beginning of this notice. 10 copies are requested to be submitted. Additionally, the Department would appreciate an electronic copy of the comments to the extent possible. The Department is currently using WordPerfect™ 5.1. All comments received by the date specified at the beginning of this notice and other relevant information will be considered by DOE before final action is taken on the proposed regulation.

All written comments received on the proposed rule will be available for public inspection at the DOE Freedom of Information Reading Room, as provided at the beginning of this notice.

Pursuant to the provisions of 10 CFR 1004.11, any person submitting information or data that is believed to be confidential and exempt by law from public disclosure should submit one complete copy of the document and 10 copies, if possible, from which the information believed to be confidential has been deleted. The Department will make its own determination with regard to the confidential status of the information or data and treat it according to its determination.

Factors of interest to DOE, when evaluating requests to treat information as confidential, include: (1) A description of the item; (2) an indication as to whether and why such items of information have been treated by the submitting party as confidential, and whether and why such items are customarily treated as confidential within the industry; (3) whether the information is generally known or available from other sources; (4) whether the information has previously been available to others without obligation concerning its confidentiality; (5) an explanation of the competitive injury to the submitting person that would result from public disclosure; (6) an indication as to when such information might lose its confidential character due to the passage of time; and (7) whether disclosure of the information would be in the public interest.

c. Public Hearing

1. Procedure for Submitting Requests to Speak

The time and place of the public hearing are indicated at the beginning of this notice. The Department invites any person who has an interest in these proceedings, or who is a representative of a group or class of persons having an interest, to make a written request for an opportunity to make an oral presentation at the public hearing. Such requests should be labeled both on the letter and the envelope, "Eight Products Rulemaking (Docket No. EE–RM–90–201)," and should be sent to the address, and must be received by the time specified, at the beginning of this notice. Requests may be hand-delivered, or telephoned in to such address between the hours of 8:30 a.m. and 4:30 p.m., Monday through Friday, except Federal holidays.

The person making the request should briefly describe the interest concerned and, if appropriate, state why he or she is a proper representative of the group or class of persons that has such an interest, and give a telephone number where he or she may be contacted. Each person selected to be heard will be so notified by DOE as to the approximate time they will be speaking.

Each person selected to be heard is requested to submit an advance copy of his or her statement prior to the hearing as indicated at the beginning of this notice. In the event any persons wishing to testify cannot meet this requirement, that person may make alternative arrangements in advance by so indicating in the letter requesting to make an oral presentation.

2. Conduct of Hearing

The Department reserves the right to select the persons to be heard at the hearing, to schedule the respective presentations, and to establish the procedures governing the conduct of the hearing. The length of each presentation is limited to 15 minutes.

A DOE official will be designated to preside at the hearing. The hearing will not be a judicial or an evidentiary-type hearing, but will be conducted in accordance with 5 U.S.C. 533 and section 336 of the Act. At the conclusion of all initial oral statements at each day of the hearing, each person who has made an oral statement will be given the opportunity to make a rebuttal statement, subject to time limitations. The rebuttal statement will be given in the order in which the initial statements were made. The official conducting the hearing will accept additional comments or questions from those attending, as time permits. Any interested person may submit, to the presiding official, written questions to be asked of any person making a statement at the hearing. The presiding official will determine whether the question is relevant, and whether time limitations permit it to be presented for answer.

Further questioning of speakers will be permitted by DOE. The presiding official will afford any interested person an opportunity to question other interested persons who made oral presentations, and employees of the United States who have made written or oral presentations with respect to

disputed issues of material fact relating to the proposed rule. This opportunity will be afforded after any rebuttal statements, to the extent that the presiding official determines that such questioning is likely to result in a more timely and effective resolution of such issues. If the time provided is insufficient, DOE will consider affording an additional opportunity for questioning at a mutually convenient time. Persons interested in making use of this opportunity must submit their request to the presiding official no later than shortly after the completion of any rebuttal statements and be prepared to state specific justification, including why the issue is one of disputed fact and how the proposed questions would expedite their resolution.

Any further procedural rules regarding proper conduct of the hearing will be announced by the presiding official.

A transcript of the hearing will be made, and the entire record of this rulemaking, including the transcript, will be retained by DOE and made available for inspection at the DOE Freedom of Information Reading Room as provided at the beginning of this notice. Any person may purchase a copy of the transcript from the transcribing reporter.

d Issues Requested for Comment

As discussed above in today's notice, DOE has identified a number of issues where comments are requested. These issues include, but are not limited to, the following:

- The baseline units and the base cases;
- Consideration of incremental impacts of various standard levels;
- Market share elasticities;
- Usage elasticities, i.e., rebound effect;
- Appropriate discount rates, including those for residential and commercial consumer analyses (life-cycle cost and Lawrence Berkeley Laboratory-Residential Energy Model) and the use of a social discount rate (Lawrence Berkeley Laboratory-Residential Energy Model);
- Energy price forecasts;
- The characterization of prototypical firms for the manufacturer impact analysis (Lawrence Berkeley Laboratory-Manufacturer Impact Model);
- Efficiency forecasts for these products;
- Any lessening of product utility resulting from the addition of the design options identified;
- The effects on forecasts due to the use of national average energy prices and usage rates;
- The effects of standards on manufacturers' incentives to develop innovative products and product features;
- Any uncertainties in modeling, especially with regard to product usage, e.g., changes in usage rates as shown by survey data or changes in usage of features;
- Location of water heaters with respect to conditioned space;
- Lifetimes of appliances;
- Maintenance costs and failure rates of appliances and components;
- The possible expansion of DOE's economic analysis to include the variable effects of standards on identifiable sub-groups of consumers, and/or the incremental effects of standards relative to lower or higher standard levels; and
- Possible modifications or alternatives to LBL's Manufacturer Impact Model.

Many of these issues are not unique to this proposed rule and some, such as discount rates and modifications of the Lawrence Berkeley Laboratory Manufacturer Impact Model, have been raised in previous DOE public notice under the appliance conservation standards program or by public comments on these notices. Those issues and the possible expansion of DOE's economic analysis in several areas were raised in DOE's Advance Notice of Proposed Rulemaking Regarding Energy Conservation Standards for Three Types of Consumer Products, published on September 8, 1993 (58 FR 47326). DOE hopes that its conclusions in these areas for this rulemaking will serve as the basis for the development and promulgation of future appliance conservation standards, unless comments in future rulemakings make a persuasive case to the contrary.

List of Subjects in 10 CFR Part 430

Administrative practice and procedure, Energy conservation, Household appliances.

Issued in Washington, DC, December 15, 1993.

Christine A. Ervin,

Assistant Secretary, Energy Efficiency and Renewable Energy.

For the reasons set forth in the preamble part 430 of chapter II of title 10, Code of Federal Regulations, is proposed to be 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.

2. Section 430.32 is amended by revising paragraphs (b), (d), (e), and (i) through (m) to read as follows:

§ 430.32 Energy conservation standards and effective dates.

* * * * *

(b) *Room air conditioners.*

Product class	Energy efficiency ratio, effective as of	
	January 1, 1990	[3 years after publication of Final Rule]
1. Without reverse cycle and with louvered sides less than 6,000 Btu	8.0	11.1
2. Without reverse cycle and with louvered sides 6,000 to 7,999 Btu	8.5	10.3
3. Without reverse cycle and with louvered sides 8,000 to 13,999 Btu	9.0	11.0
4. Without reverse cycle and with louvered sides 14,000 to 19,999 Btu	8.8	11.1
5. Without reverse cycle and with louvered sides 20,000 and more Btu	8.2	9.6
6. Without reverse cycle and without louvered sides less than 6,000 Btu	8.0	10.7
7. Without reverse cycle and without louvered sides 6,000 to 7,999 Btu	8.5	9.9
8. Without reverse cycle and without louvered sides 8,000 to 13,999 Btu	8.5	10.7
9. Without reverse cycle and without louvered sides 14,000 to 19,999 Btu	8.5	10.8
10. Without reverse cycle and without louvered sides 20,000 and more Btu	8.2	9.3
11. With reverse cycle, and with louvered sides	8.5	10.8
12. With reverse cycle, without louvered sides	8.0	10.4

* * * * *

(d) *Water heaters.*

Product class	Energy factor, effective as of		
	January 1, 1990	April 15, 1991	[3 years after publication of Final Rule]
1. Gas	0.62—(.0019×Rated Storage Volume in gallons).	0.62—(.0019×Rated Storage Volume in gallons).	0.64—(.0017×Measured Storage Volume in gallons).
2. Gas Instantaneous	N/A	0.62—(.0019×Rated Storage Volume in gallons).	0.75.
3. Oil	0.59—(.0019×Rated Storage Volume in gallons).	0.59—(.0019×Rated Storage Volume in gallons).	0.73—(.0017×Measured Storage Volume in gallons).
4. Electric	0.95—(.00132×Rated Storage Volume in gallons).	0.93—(.00132×Rated Storage Volume in gallons).	1.96—(.00117×Measured Storage Volume in gallons).

Note: Rated Storage Volume equals the water storage capacity of a water heater, in gallons, as specified by the manufacturer Measured Storage Volume equals the water storage capacity of a water heater, in gallons, as measured in paragraph 6.1.1 of the test procedure.

(e) *Furnaces.*

Product class	Annual fuel utilization efficiency, effective as of January 1, 1992	Annual efficiency, effective as of [3 years after publication of Final Rule]
1. Furnaces (excluding classes noted below)	78	.....
2. Gas-Fired mobile home furnaces	[1]75	74.3
3. Oil-Fired mobil home furnaces	[1]75	74.7
4. Small furnaces (other than furnaces designed solely for installation in mobile homes), input rate less than 45,000 Btu/hour	78	.....
5. Boilers (excluding gas steam)	80	.....
6. Gas steam boilers	75	.....

[1] Effective as of September 1, 1990.

* * * * *

(i) *Direct heating equipment.*

Product class	Annual fuel utilization efficiency, effective as of January 1, 1990	Annual efficiency, effective as of 3 years after publication of Final Rule]
1. Gas wall fan type up to 42,000 Btu/hour	73	72.2
2. Gas wall fan type over 42,000 Btu/hour	74	73.4
3. Gas wall gravity type up to 10,000 Btu/hour	59	67.7
4. Gas wall gravity type over 10,000 Btu/hour up to 12,000 Btu/hour	60	67.7
5. Gas wall gravity type over 12,000 Btu/hour up to 15,000 Btu/hour	61	67.9
6. Gas wall gravity type over 15,000 Btu/hour up to 19,000 Btu/hour	62	68.2
7. Gas wall gravity type over 19,000 Btu/hour up to 27,000 Btu/hour	63	73.6
8. Gas wall gravity type over 27,000 Btu/hour up to 46,000 Btu/hour	64	73.9
9. Gas wall gravity type over 46,000 Btu/hour	65	74.2
10. Gas floor type up to 37,000 Btu/hour	56	70.7
11. Gas floor type over 37,000 Btu/hour	57	70.0
12. Gas room type up to 18,000 Btu/hour	57	64.4
13. Gas room type over 18,000 Btu/hour up to 20,000 Btu/hour	58	69.9
14. Gas room type over 20,000 Btu/hour up to 27,000 Btu/hour	63	67.1
15. Gas room type over 27,000 Btu/hour up 46,000 Btu/hour	64	71.2
16. Gas room type over 46,000 Btu/hour	65	71.5

(j) *Kitchen ranges and ovens.*

Gas kitchen ranges and ovens with an electrical supply cord shall not be equipped with a constant burning pilot light. The standard is effective on January 1, 1990. The annual energy use of a kitchen range and oven shall be the sum of the annual energy use of any of the following components incorporated into the kitchen range and oven, and shall not exceed the allowable sum of energy usages for those components listed below.

Kitchen range and oven component	Annual energy use, effective as of [3 years after publication of Final Rule]
1. Electric ovens, self-cleaning	267 kWh
2. Electric ovens, non-self-cleaning	218 kWh
3. Gas ovens, self-cleaning	1.64 MMBtu
4. Gas ovens, non-self-cleaning	1.14 MMBtu
5. Microwave ovens	233 kWh
6. Electric cooktop, coil element	260 kWh
7. Electric cooktop, smooth element	294 kWh
8. Gas cooktop	1.71 MMBtu

(k) *Pool heaters.*

Product class	Thermal efficiency (percent), effective as of January 1, 1990	Annual efficiency (percent), effective as of [3 years after publication of Final Rule]
Pool heaters	78	82.2

(l) *Television sets.*

Product class	Annual energy use—kWh/yr, effective as of [3 years after publication of Final Rule]
1. Color—Screen size of 13.0 to 33 inches	20.5 + 6.1D

Note: D equals the screen size, in inches, as specified by the manufacturer.

(m) *Fluorescent lamp ballasts.* (1) Except as provided in paragraphs (m)(2) and (m)(3) of this section, each fluorescent lamp ballast designed—

(i) To operate at nominal input voltages of 120 or 277 volts;

(ii) To operate with an input current frequency of 60 Hertz; and

(iii) For use in connection with F32, F40, F96, or F96HO lamps; shall have a power factor of 0.90 or greater and shall have a ballast efficacy factor not less than the following:

Product class	Ballast input voltage	Efficacy factor, effective as of January 1, 1990	Efficacy factor, effective as of [3 years after publication of Final Rule]
1. One F40 lamp	120	[1] 1.805	[1] 2.50
	277	[1] 1.805	[1] 2.50
2. Two F40 lamps	120	[1] 1.060	[1] 1.28
	277	[1] 1.050	[1] 1.28
3. Two F96 lamps	120	[1] 0.570	[1] 0.72
	277	[1] 0.570	[1] 0.72
4. Two F96HO lamps	120	[1] 0.390	[1] 0.50
	277	[1] 0.390	[1] 0.50
5. Three F40 lamps	120	[2]	[1] 0.87
	277	.....	[1] 0.87
6. Four F40 lamps	120	[2]	[1] 0.67
	277	.....	[1] 0.67
7. One F32T8 lamp	120	[2]	3.17
	277	.....	3.17
8. Two F32T8 lamps	120	[2]	1.58
	277	.....	1.58
9. Three F32T8 lamps	120	[2]	1.06
	277	.....	1.06
10. Four F32T8 lamps	120	[2]	0.76
	277	.....	0.76

[1] Applies to T12 lamps only.
[2] Not applicable.

(2) The standards that are effective January 1, 1990, as described in paragraph (m)(1) of this section, do not apply to:

(i) A ballast which is designed for dimming or for use in ambient temperatures of 0°F or less, or

(ii) A ballast which has a power factor of less than 0.09 and is designed for use only in residential building applications.

(3) The standards described in paragraph (m)(1) of this section, effective [3 years after publication of Final Rule], do not apply to:

(i) A ballast which is designed for use in ambient temperatures of 0°F or less, or

(ii) A ballast which has a power factor or less than 0.90 and is designed for use only in residential building applications.

[FR Doc. 94–4586 Filed 3–3–94; 8:45 am]

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Friday
March 4, 1994

Part III

Department of the Treasury

Fiscal Service

31 CFR Part 315, et al.
Offering and Governing Regulations for United States Savings Bonds; Final Rule

DEPARTMENT OF THE TREASURY

Fiscal Service

31 CFR Parts 315, 316, 317, 321, 330, 332, 342, 351, 352, and 353

Offering and Governing Regulations for United States Savings Bonds, Series E, EE, and H, HH, and Savings Notes; Issuing and Paying Agents; and Payment Under Special Endorsement

AGENCY: Bureau of the Public Debt, Fiscal Service, Department of the Treasury.

ACTION: Final rule.

SUMMARY: This Final Rule amends the offering circulars for United States savings bonds and savings notes; the regulations governing savings bonds and notes; and the regulations governing activities of financial institutions and organizations serving as savings bond issuing and paying agents, to reflect the designation of five Federal Reserve Offices as savings bond processing sites. The changes are made to improve the efficiency of the processing of savings bond transactions. The regulations are further amended to reflect the fact that EZ CLEAR has become the only means by which savings bond paying agents may transmit and receive settlement for redeemed savings bonds and notes.

EFFECTIVE DATE: March 4, 1994.

FOR FURTHER INFORMATION CONTACT: Calvin Ninomiya, Chief Counsel, Bureau of the Public Debt, Washington, DC 20239–0001, (202) 219–3320.

SUPPLEMENTARY INFORMATION: As fiscal agents of the United States, Federal Reserve Banks and Branches perform a number of activities in support of the savings bond program, including issuing, redeeming, and reissuing savings bonds and notes. In recent years, both the Bureau of the Public Debt and Federal Reserve Offices have recognized that there would be benefits associated with consolidating certain savings bond activities. Since 1986, several activities have been consolidated, *e.g.*, issuing savings bonds for payroll savings plans based upon a master file data base, and maintaining savings bonds for employee thrift plans in book-entry accounts.

The Bureau and the Federal Reserve recognized that further consolidation would reduce operating costs, improve program management, and provide opportunities for more efficient use of technology, without any reduction in the level of service to bondowners and financial institutions serving as savings bond agents. Therefore, a Savings Bond Processing Study Team, composed of staff from both Public Debt and Reserve Offices, was formed to determine the optimum number of Reserve Office sites at which savings bond processing should be performed. The Team's recommendations formed the basis of the Bureau's decision to approve the changes in sites where consolidated savings bond processing would be performed. A listing of the consolidated processing sites is added to each of the following sections: 31 CFR 315.1, 316.12, 330.8, 332.12, 342.9, 352.13, and 353.1, the offering circulars and governing regulations for savings bonds and notes, and 31 CFR 317.9 and 321.25, the regulations governing the issue and redemption of savings bonds. Federal Reserve Offices, other than those newly listed, may continue to provide some savings bond services, but their activities will be phased out over the period prior to March 1, 1996.

Also, the regulations in 31 CFR part 317, also referred to as Department of the Treasury Circular, Public Debt Series No. 4–67, are being further amended to indicate that issuing agents are subject to the provisions of the Privacy Act of 1974, as amended (5 U.S.C. 552a).

Finally, the regulations in 31 CFR part 321, also referred to as Department of the Treasury Circular No. 750, Fourth Revision, are being further amended to reflect the fact that submission of redeemed savings securities via EZ CLEAR has become the only means of transmitting and receiving settlement for such paid securities. The EZ CLEAR method of paid bond processing permits savings bond paying agents to transmit and receive settlement for redeemed securities in the same manner as for checks and other cash items. The reduction in separate processing has increased efficiency and reduced costs for the savings bond program.

Procedural Requirements

This Final Rule does not meet the criteria for a "significant regulatory action" pursuant to Executive Order No. 12866. The regulatory review procedures, therefore, do not apply.

Because this Final Rule relates to public contracts and procedures for United States securities, the notice, public comment, and delayed effective date provisions of the Administrative Procedure Act are inapplicable, pursuant to 5 U.S.C. 553(a)(2). As no notice of proposed rulemaking is required, the provisions of the Regulatory Flexibility Act (5 U.S.C. 601, *et seq.*) do not apply.

There are no collections of information required by this Final Rule, and, therefore, the Paperwork Reduction Act does not apply.

List of Subjects in 31 CFR Parts 315, 316, 317, 321, 330, 332, 342, 351, 352 and 353

Bonds, Federal Reserve System, Government Securities.

Dated: February 22, 1994.

Gerald Murphy,

Fiscal Assistant Secretary.

31 CFR chapter II, parts 315, 316, 317, 321, 330, 332, 342, 351, 352, and 353, are hereby amended as follows:

PART 315—REGULATIONS GOVERNING U.S. SAVINGS BONDS, SERIES A, B, C, D, E, F, G, H, J, AND K, AND U.S. SAVINGS NOTES

1. The authority citation for part 315 continues to read as follows:

Authority: 31 U.S.C. 3105, 5 U.S.C. 301.

2. Section 315.1 is amended as follows:

A. Paragraph (a) is amended by adding "in the list below" after "Federal Reserve Banks and Branches".

B. Paragraph (b) is revised to read as follows:

§ 315.1 Official agencies.

* * * * *

(b) Communications concerning transactions and requests for forms should be addressed to:

(1) A Federal Reserve Bank or Branch in the list below; the Bureau of the Public Debt, 200 Third Street, Parkersburg, WV 26101; or the Bureau of the Public Debt, Washington, DC 20226.

(2)(i) The following Federal Reserve Offices have been designated to provide savings bond services:

Servicing office	Reserve districts served	Geographic area served
Federal Reserve Bank, Buffalo Branch, P.O. Box 961, Buffalo, NY 14240.	New York, Boston	CT, MA, ME, NH, NJ (northern half), NY (City & State), RI, Vt, Puerto Rico and Virgin Islands.
Federal Reserve Bank, Pittsburgh Branch, P.O. Box 867, Pittsburgh, PA 15230.	Cleveland, Philadelphia	DE, KY (eastern half), NJ (southern half), OH, PA, WV (northern panhandle).

Servicing office	Reserve districts served	Geographic area served
Federal Reserve Bank of Richmond, P.O. Box 27622, Richmond, VA 23261.	Richmond, Atlanta	AL, DC, FL, LA (southern half), MD, MS (southern half), NC, SC, TN (eastern half), VA, WV (except northern panhandle).
Federal Reserve Bank of Minneapolis, 250 Marquette Avenue, Minneapolis, MN 55480.	Minneapolis, Chicago	IA, IL (northern half), IN (northern half), MN, MT, ND, SD, WI.
Federal Reserve Bank of Kansas City, 925 Grand Avenue, Kansas City, MO 64198.	Dallas, San Francisco, Kansas City, St. Louis.	AK, AR, AZ, CA, CO, HI, ID, IL (southern half), IN (southern half), KS, KY (western half), LA (northern half), MO, MS (northern half), NE, NM, NV, OK, OR, TN (western half), TX, WA, WY, UT and GU.

(ii) Until March 1, 1996, other Federal Reserve Offices may continue to provide some savings bond services, but such services will be phased out over the period prior to that date.

§ 315.31 [Amended]

3. In § 315.31, paragraph (d) is amended by adding "designated" before "Federal Reserve Bank".

§ 315.35 [Amended]

4. In § 315.35, paragraph (e) is amended by adding "designated" before "Federal Reserve Bank".

§ 315.39 [Amended]

5. In § 315.39, paragraph (b) is amended by adding "designated" before "Federal Reserve Bank or Branch" in the two places the phrase appears.

§ 315.40 [Amended]

6. In § 315.40, paragraph (a) is amended by adding "a designated" before "Federal Reserve Bank".

§ 315.41 [Amended]

7. Section 315.41 is amended by adding "designated" before "Federal Reserve Bank or Branch".

§ 315.56 [Amended]

8. In § 315.56, paragraph (a) is amended by adding "designated" before "Federal Reserve Bank".

PART 316—OFFERING OF UNITED STATES SAVINGS BONDS, SERIES E

1. The authority citation for part 316 continues to read as follows:

Authority: 31 U.S.C. 3105, 5 U.S.C. 301.

§ 316.3 [Amended]

2. Section 316.3, footnote No. 2, is amended by adding "designated" before "Federal Reserve Bank".

§ 316.6 [Amended]

3. In § 316.6, paragraph (c) is amended by adding "designated" before "Federal Reserve Banks".

§ 316.10 [Amended]

4. In § 316.10, paragraph (b) is amended by adding "referred to in § 316.12" immediately following "a Federal Reserve Bank or Branch".

5. Section 316.12 is revised to read as follows:

§ 316.12 Fiscal agents.

(a) Federal Reserve Banks and Branches referred to below, as fiscal agents of the United States, are authorized to perform such services as may be requested of them by the Secretary of the Treasury in connection with the redemption and payment of Series E bonds.

(b)(1) The following Federal Reserve Offices have been designated to provide savings bond services:

Servicing office	Reserve districts served	Geographic area served
Federal Reserve Bank, Buffalo Branch, P.O. Box 961, Buffalo, NY 14240.	New York, Boston	CT, MA, ME, NH, NJ (northern half), NY (City & State), RI, VT, Puerto Rico and Virgin Islands.
Federal Reserve Bank, Pittsburgh Branch, P.O. Box 867, Pittsburgh, PA 15230.	Cleveland, Philadelphia	DE, KY (eastern half), NJ (southern half), OH, PA, WV (northern panhandle).
Federal Reserve Bank of Richmond, P.O. Box 27622, Richmond, VA 23261.	Richmond, Atlanta	AL, DC, FL, LA (southern half), MD, MS (southern half), NC, SC, TN (eastern half), VA, WV (except northern panhandle).
Federal Reserve Bank of Minneapolis, 250 Marquette Avenue, Minneapolis, MN 55480.	Minneapolis, Chicago	IA, IL (northern half), IN (northern half), MN, MT, ND, SD, WI.
Federal Reserve Bank of Kansas City, 925 Grand Avenue, Kansas City, MO 64198.	Dallas, San Francisco, Kansas City, St. Louis.	AK, AR, AZ, CA, CO, HI, ID, IL (southern half), IN (southern half), KS, KY (western half), LA (northern half), MO, MS (northern half), NE, NM, NV, OK, OR, TN (western half), TX, WA, WY, UT and GU.

(2) Until March 1, 1996, other Federal Reserve Offices may continue to provide some savings bond services, such services will be phased out over the period prior to that date.

PART 317—REGULATIONS GOVERNING AGENCIES FOR ISSUE OF UNITED STATES SAVINGS BONDS

1. The authority citation for part 317 continues to read as follows:

Authority: 31 U.S.C. 3105, 2 U.S.C. 901, 5 U.S.C. 301.

2. Section 317.1 is amended as follows:

A. Paragraph (b) is revised to read as follows:

§ 317.1 Definitions

* * * * *

(b) *Federal Reserve Bank* refers to the Federal Reserve Bank or Branch providing savings bond services to the district in which the issuing agent or the applicant organization is located. See § 317.9 (a).

* * * * *

B. Paragraph (c), first sentence, is amended by adding "designated" before "Federal Reserve Bank".

3. Section 317.3 is amended as follows:

A. Paragraph (a) is revised to read as follows:

§ 317.3 Procedure for qualifying and serving as issuing agent

(a) *Execution of application agreement.* The applicant-organization shall obtain from, duly execute, and file with, a designated Federal Reserve Bank, an application-agreement form.

(1) The terms of each application agreement shall include the provisions prescribed by section 202 of Executive Order No. 11246, entitled "Equal

Employment Opportunity" (3 CFR, subchapter B, 42 U.S.C. 2000e note).

(2) The provisions of the Privacy Act of 1974, as amended (5 U.S.C. 552a), and regulations issued pursuant thereto (31 CFR part 1, subpart C).

* * * * *

B. Paragraphs (b), and (c) are amended by adding "designated" before "Federal Reserve Bank" in each paragraph.

§ 317.5 [Amended]

4. In § 317.5, paragraphs (a) and (b) are amended by adding "designated" before "Federal Reserve Bank" in each paragraph.

§ 317.6 [Amended]

5. In § 317.6, paragraphs (a) and (b) are amended by adding "designated" before "Federal Reserve Bank" in all places that it appears.

§ 317.7 [Amended]

6. Section 317.7 is amended by removing the word "a", before "Federal Reserve Bank" and replacing it with the words "the designated".

§ 317.8 [Amended]

7. Section 317.8 is amended by adding "designated" before "Federal Reserve Banks", in the first sentence.

8. The appendix to § 317.8 is amended as follows:

A. Subpart A, paragraph 2 (e) and paragraph 5 are amended by adding "designated" before "Federal Reserve Bank".

B. Subpart B, paragraph 1, is amended by adding "designated" before "Federal Reserve Bank".

C. Subpart B, paragraph 2 is amended by adding "designated" before "Federal Reserve Bank", at the end of the sentence.

D. Subpart B, paragraph 3, the introductory paragraph and paragraphs (a) and (b), are amended by adding "designated" before "Federal Reserve Bank" in where it appears.

E. Subpart D, paragraph 1, is amended by adding "designated" before "Federal Reserve Bank" at the end of the paragraph.

F. Subpart D, paragraph 2(b) is amended by adding "the designated" before "Federal Reserve Bank" in the title.

9. Section 317.9 is amended as follows:

A. Paragraph (b) is redesignated as paragraph (c) and the word "designated" is added before "Federal Reserve Banks", in the heading and in the introductory text.

B. Paragraph (a) is revised and a new paragraph (b) is added to read as follows:

§ 317.9 Role of Federal Reserve Banks.

(a) *Role as fiscal agents.* In their capacity as fiscal agents of the United States, the Federal Reserve Banks referred to below are authorized to perform such duties, including the issuance of instructions and forms, as may be necessary to fulfill the purposes and requirements of these regulations.

(b)(1) The following Federal Reserve Offices have been designated to provide savings bond services:

Servicing office	Reserve districts served	Geographic area served
Federal Reserve Bank, Buffalo Branch, P.O. Box 961, Buffalo, NY 14240.	New York, Boston	CT, MA, ME, NH, NJ (northern half), NY (City & State), RI, VT, Puerto Rico and Virgin Islands.
Federal Reserve Bank, Pittsburgh Branch, P.O. Box 867, Pittsburgh, PA 15230.	Cleveland, Philadelphia	DE, KY (eastern half), NJ (southern half), OH, PA, WV (northern panhandle).
Federal Reserve Bank of Richmond, P.O. Box 27622, Richmond, VA 23261.	Richmond, Atlanta	AL, DC, FL, LA (southern half), MD, MS (southern half), NC, SC, TN (eastern half), VA, WV, (except northern panhandle).
Federal Reserve Bank of Minneapolis, 250 Marquette Avenue, Minneapolis, MN 55480.	Minneapolis, Chicago	IA, IL (northern half), IN (northern half), MN, MT, ND, SD, WI.
Federal Reserve Bank of Kansas City, 925 Grand Avenue, Kansas City, MO 64198.	Dallas, San Francisco, Kansas City, St. Louis.	AK, AR, AZ, CA, CO, HI, ID, IL (southern half), IN (southern half), KS, KY (western half), LA (northern half), MO, MS (northern half), NE, NM, NV, OK, OR, TN (western half), TX, WA, WY, UT and GU.

(2) Until March 1, 1996, other Federal Reserve Offices may continue to provide some savings bond services, but such services will be phased out over the period prior to that date.

* * * * *

PART 321—PAYMENTS BY BANKS AND OTHER FINANCIAL INSTITUTIONS OF UNITED STATES SAVINGS BONDS AND UNITED STATES SAVINGS NOTES (FREEDOM SHARES)

1. The authority citation for part 321 continues to read as follows:

Authority: 31 U.S.C. 3105, 2 U.S.C. 901, 5 U.S.C. 301.

2. Section 321.1 is amended as follows:

A. Paragraph (f) is removed, and paragraphs (d) and (e) are redesignated paragraphs (e) and (f) respectively.

B. A new paragraph (d) is added and redesignated paragraph (f) is revised to read as follows:

§ 321.1 Definitions.

* * * * *

(d) *Central Site* refers to the Federal Reserve Bank of Cleveland, Pittsburgh Branch, EZ CLEAR Department.

* * * * *

(f) *Federal Reserve Bank or Branch* refers to the Federal Reserve Bank to which the agent is instructed to transmit redeemed securities; or to which the agent is instructed to forward securities for payment or other transactions, and includes parent Banks, Branches and Regional Check Processing Centers, as appropriate.

* * * * *

3. Section 321.2(b) is revised to read as follows:

§ 321.2 Eligible organizations.

* * * * *

(b)(1) An organization that desires to redeem securities must first qualify as a paying agent. An organization that has qualified and is serving as a paying agent must:

(i) MICR-encode data on securities accepted for payment,

(ii) Submit them directly to the Check Department of the appropriate Federal Reserve Bank or Branch or the Regional Check Processing Center, and

(iii) Receive payment of fees by ACH, or arrange to obtain one or more of these services from another financial institution.

(2) All presenting institutions, as defined in § 321.1, must qualify as savings bond paying agents and enroll in EZ CLEAR.

4. Section 321.3 is amended as follows:

A. Paragraph (a), introductory paragraph, is amended by removing "with, a Federal Reserve Bank an application-agreement form" and replacing it with "an application-

agreement with the appropriate Federal Reserve Office referred to in § 321.25".

B. The concluding text of paragraph (a) is amended by removing "of New York" and replacing it with "Branch in Buffalo, New York" and by removing "of San Francisco" and replacing it with "Kansas City".

C. Paragraph (b) is amended by adding "referred to in § 321.25" after "Federal Reserve Bank", removing "its district," and replacing it with "the Reserve Bank's geographical area, as shown in § 321.25,".

D. Paragraph (c) is amended by adding "referred to in § 321.25" after "a Federal Reserve Bank".

E. Paragraph (d) is revised to read as follows:

§ 321.3 Procedure for qualifying and serving as paying agent.

* * * * *

(d) *Adverse action.* An organization will be notified by the appropriate Federal Reserve Bank referred to in § 321.25, in writing, if its application-agreement to act as paying agent is not approved.

§ 321.5 [Amended]

5. Section 321.5 is amended as follows:

A. Paragraph (a) is amended by adding "referred to in § 321.25" after "a Federal Reserve Bank".

B. Paragraph (b) is amended by adding "referred to in § 321.25" after "Federal Reserve Bank".

6. In § 321.8, paragraph (d) is revised to read as follows:

§ 321.8 Redemption-exchange of Series E and EE savings bonds and savings notes.

* * * * *

(d) *Completion of transaction.* An agent shall transmit for settlement via EZ CLEAR securities redeemed on exchange and, at the same time, forward the exchange application (PD F 3253) and any additional cash needed to complete the transaction, to the Fiscal Agency Department of the servicing Federal Reserve Bank referred to in § 321.25. Securities redeemed on exchange may be commingled with cash redemptions in mixed or separately sorted cash letters."

* * * * *

7. In § 321.11, paragraph (f) is revised to read as follows:

§ 321.11 Payment.

* * * * *

(f) *Certification of request.* An agent is not required to complete the certification to the requests for payment on securities it redeems. When an agent transmits redeemed securities for settlement, as indicated in § 321.14 of this part, such agent shall be understood by such submission to have represented and certified that the identity of the presenter, and his or her entitlement to request payment, have been established in accordance with this part and the appendix hereto.

§ 321.13 [Amended]

8. Section 321.13 is amended as follows:

A. The first sentence is amended by adding "appropriate" after "and four-digit code number assigned by the".

B. The second sentence is amended by removing the word "a" before Federal Reserve Bank, at the end of the sentence and replacing it with "an appropriate".

9. Section 321.14 is revised to read as follows:

§ 321.14 Transmittal to and settlement by Federal Reserve Bank.

In accordance with Federal Reserve Bank instructions, a paying agent shall transmit with an EZ CLEAR cash letter securities redeemed for cash and on redemption-exchange, either directly or through a correspondent institution, to the Check Department of the appropriate Bank or Branch, or to a Regional Check Processing Center (RCPC). Upon receipt of the securities, the Bank, Branch, or RCPC will arrange for immediate settlement with the presenting institution. Such settlement shall be made by a credit to the presenting institution's Reserve or other clearing account in the total amount paid, as reflected on the cash letter, and shall be subject to adjustment via a charge or credit to that account if any discrepancy is subsequently discovered.

§ 321.20 [Amended]

10. Section 321.20 is amended by adding "referred to in § 321.25" after "any Federal Reserve Bank".

§ 321.22 [Amended]

11. Section 321.22, first sentence, is amended by adding "referred to in § 321.25" after "a Federal Reserve Bank".

§ 321.23 [Amended]

12. In § 321.23, Paragraph (a) is amended as follows:

A. The phrase "referred to in § 321.25" is added at the end of the introductory paragraph after "available from a Federal Reserve Bank".

B. Paragraph (a)(1) is removed and paragraphs (a)(2) and (a)(3) are redesignated as (a)(1) and (a)(2), respectively.

13. Section 321.25 is revised to read as follows:

§ 321.25 Role of Federal Reserve Banks.

(a) The Federal Reserve Banks referred to below, as fiscal agents of the United States, shall perform such services in connection with this part as may be requested by the Secretary of the Treasury, or his designee. The Banks are authorized and directed to perform such duties, including the issuance of instructions and forms, as may be necessary to fulfill the purposes and requirements of these regulations.

(b)(1) The following Federal Reserve Offices have been designated to provide savings bond services:

Servicing office	Reserve districts served	Geographic area served
Federal Reserve Bank, Buffalo Branch, P.O. Box 961, Buffalo, NY 14240.	New York, Boston	CT, MA, ME, NH, NJ (northern half), NY (City & State), RI, VT, Puerto Rico and Virgin Islands.
Federal Reserve Bank, Pittsburgh Branch, P.O. Box 867, Pittsburgh, PA 15230.	Cleveland, Philadelphia	DE, KY (eastern half), NJ (southern half), OH, PA, WV (northern panhandle).
Federal Reserve Bank of Richmond, P.O. Box 27622, Richmond, VA 23261.	Richmond, Atlanta	AL, DC, FL, LA (southern half), MD, MS (southern half), NC, SC, TN (eastern half), VA, WV (except northern panhandle).
Federal Reserve Bank of Minneapolis, 250 Marquette Avenue, Minneapolis, MN 55480.	Minneapolis, Chicago	IA, IL (northern half), IN (northern half), MN, MT, ND, SD, WI.
Federal Reserve Bank of Kansas City, 925 Grand Avenue, Kansas City, MO 64198.	Dallas, San Francisco, Kansas City, St. Louis.	AK, AR, AZ, CA, CO, HI, ID, IL (southern half), IN (southern half), KS, KY (western half), LA (northern half), MO, MS (northern half), NE, NM, NV, OK, OR, TN (western half), TX, WA, WY, UT and GU.

(2) Until March 1, 1996, other Federal Reserve Offices may continue to provide some savings bond services, but such services will be phased out over the period prior to that date.

Appendix to Part 321 [Amended]

14. The appendix to part 321 is amended as follows:

A. Paragraph Number 4 is revised to read as follows:

* * * * *

4. *Paying agent code numbers.* [§§ 321.3(b) and 321.13] The appropriate Federal Reserve Bank will assign a four-digit code number to each agent it qualifies. A separate number will be assigned to each branch authorized to redeem and submit redeemed securities for its own account to a Federal Reserve Bank or Branch or to a Regional Check Processing Center. At the paying agent's request, only one four-digit code will be assigned for use by all of its branches. The presenting institution's ABA number will be used in the adjustment of discrepancies and in the computation and payment of fees for securities transmitted in separately sorted cash letters.

* * * * *

B. Paragraph 5 is amended by removing "the Federal Reserve Bank", and replacing it with "the appropriate Federal Reserve Bank referred to in § 321.25".

C. Paragraph 9(a), first sentence, is amended by adding "referred to in § 321.25" after "a Federal Reserve Bank".

D. Paragraphs 13(a), 13(b), 14(a), 14(b), 14(d), 18, 23(a), 23(d), 23(e) and 27 are amended by removing "Federal Reserve Bank" and replacing it with "the appropriate Federal Reserve Bank referred to in § 321.25", wherever found.

E. Paragraph 14(e) is revised to read as follows:

* * * * *

14. * * *

(e) *MICR-encoding of payment information.* [§ 321.13] An agent shall MICR-encode the redemption value in the "Amount" field on the face of each security or arrange to have this service performed by another financial institution. If the agent transmits securities in mixed cash letters, it must also MICR-encode the routing/transit number assigned to the Bureau of the Public Debt's savings bond activity in the "R/T" field on the face of all pre-October 1957 paper securities and those punch card securities on which it does not already appear. The Bureau's routing/transit number is 000090007. Care should be taken in repairing MICR-encoded items so as not to obliterate any data in surrounding MICR fields or elsewhere on the face of the security.

* * * * *

F. Paragraph 15 is revised to read as follows:

* * * * *

15. *Transmittal of securities to Federal Reserve Bank.* [§ 321.14] An agent shall transmit and receive settlement for redeemed securities via EZ CLEAR, i.e., the Check Department of a Federal Reserve Bank or Branch, or the Regional Check Processing Center. Redeemed securities may be transmitted in separately sorted or mixed cash letters to the Check Department of a Federal Reserve Bank or Branch, or to a Regional Check Processing Center, either directly, or via a parent office or correspondent institution. An agent shall transmit redeemed securities under cover of the appropriate transmittal document. Securities redeemed in exchange for Series HH bonds must be transmitted for settlement via EZ CLEAR at the same time as the exchange application (PD F 3253) and any additional cash needed to complete the transaction are forwarded to the Fiscal Agency Department of the servicing Federal Reserve Bank referred to in § 321.25. Securities redeemed on exchange may be commingled with cash redemptions in mixed or separately sorted cash letters."

* * * * *

G. Paragraph 16 is revised to read as follows:

* * * * *

16. *Transmittal of securities to Federal Reserve Bank via fiscal agency system.* [§ 321.14] The Fiscal Agency Department of a Federal Reserve Bank or Branch will not accept for settlement securities an agent has redeemed."

* * * * *

H. Paragraph 17(e)(2) is revised and new paragraphs (e)(3),(4) and (5) are added to read as follows:

17. *Transmittal of securities to Federal Reserve Bank via EZ CLEAR. [§ 321.14]*

(e) * * *

(2) *Audit and adjustment* [§ 321.14] The Bureau of the Public Debt will audit all redemption data received from the Central Site as promptly as possible. Each presenting institution will, in due course, be notified by the Bank of any adjustments required. The Bank will adjust via a charge or credit to the presenting institution's Reserve or clearing account any amounts previously credited to that account.

(3) *Requests for Adjustments.* Depositors who discover errors in their EZ CLEAR cash letters subsequent to deposit should allow sixty (60) calendar days from the date of their EZ CLEAR cash letter before requesting adjustments for the cash letter. This will allow sufficient time for the Treasury to classify the savings bonds, forward adjustments to the Central Site and for the Central Site to research and function adjustments to the depositor.

(4) *Separately Sorting Depositors* should submit adjustment requests directly to the Central Site Adjustments Department in correspondence. However, all requests for adjustments due to incorrect cash letter crediting should be directed to the servicing Federal Reserve Bank.

(5) *Mixed Depositors* should submit adjustment requests to their servicing Federal Reserve Bank.

* * * * *

I. Paragraph 18 is revised to read as follows:

* * * * *

18. *Record of securities paid.* [§§ 321.14 and 321.24] A record of the serial number and the amount paid for each redeemed security must be retained by the agent for one year so that settlement can be made if the security is lost in transit, and so that the agent can process any subsequent adjustment as described in paragraph 17(e)(2) above. For that purpose, agents are authorized to microfilm the face and back of each security they redeem. Such film records shall be kept confidential and prints therefrom may be made only with the permission of the Bureau of the Public Debt or an appropriate Federal Reserve Bank.

* * * * *

J. Paragraph 24 is amended as follows:

A. Paragraph (a) is removed.

B. The title and designation "(b) EZ CLEAR transmittals. [§ 321.23]" are removed from current paragraph (b); the beginning of the sentence is amended by removing "by the Federal Reserve Bank" after "Fees will be paid"; and, the second sentence is amended by adding "Federal Reserve" after "No fees will be paid for securities received by the".

K. Paragraph 25 is revised to read as follows:

* * * * *

25. *Claims on account of lost securities* [§ 321.24] If a security redeemed by an agent is lost, stolen, or destroyed while in the custody of the agent, or in transit prior to settlement or audit, relief will be considered, provided the security can be identified by serial number. [See paragraph 18 of this appendix regarding the maintenance of records of redeemed securities]. The presenting institution should resubmit a photocopy of the security to obtain settlement in accordance with established procedures. Questions concerning the established procedures should be referred to the servicing Federal Reserve Bank.

* * * * *

PART 330—REGULATIONS GOVERNING PAYMENT UNDER SPECIAL ENDORSEMENT OF UNITED STATES SAVINGS BONDS AND UNITED STATES SAVINGS NOTES (FREEDOM SHARES)

1. The authority citation for part 330 is revised to read as follows:

Authority: 31 U.S.C. 3105 and 5 U.S.C. 301.

2. Section 330.1 is amended as follows:

A. Paragraph (a) is revised to read as follows:

§ 330.1 Definition of terms.

* * * * *

(a) *Federal Reserve Bank or Bank* refers to the Federal Reserve Bank

providing savings bond services to the district in which a paying agent is located. See § 330.9.

* * * * *

B. Paragraph (c) is amended by removing "account directly to a Federal Reserve Bank" and replacing it with "are themselves directly accountable for such redemptions".

C. Paragraph (i) is amended by adding "designated" before "Federal Reserve Bank".

§ 330.2 [Amended]

3. In § 330.2, paragraphs (a) and (c) are amended by adding "designated" before "Federal Reserve Bank", each time it appears.

§ 330.3 [Amended]

4. In § 330.3, paragraphs (a) and (b) are amended by adding "designated" before "Federal Reserve Bank", each time it appears.

§ 330.4 [Amended]

5. Section 330.4 is amended by adding "designated" before "Federal Reserve Bank", in the introductory paragraph.

§ 330.6 [Amended]

6. In § 330.6, paragraph (c) is amended by adding "designated" before "Federal Reserve Bank".

7. Section 330.7 is amended by revising the last two sentences to read as follows:

§ 330.7 Payment or redemption-exchange by agent.

* * * * *

Securities so paid should be combined with other securities paid under that Circular and presented for settlement through EZ CLEAR. Securities redeemed by an agent in an exchange must be presented for settlement through EZ CLEAR separately from, but at the same times as, an exchange subscription and any remittance are forwarded to the Fiscal Agency Department of the appropriate Federal Reserve Bank.

§ 330.8 [Amended]

8. Section 330.8 is amended by adding "designated" before "Federal Reserve Bank", at the end of the first sentence.

9. Section 330.9 is revised to read as follows:

§ 330.9 Fiscal agents.

(a) The Federal Reserve Banks referred to below, as fiscal agents of the United States, are authorized to perform such services as may be requested by the Secretary of the Treasury, or his or her delegate, in connection with this part.

(b)(1) The following Federal Reserve Offices have been designated to provide savings bond services:

Servicing office	Reserve districts served	Geographic area served
Federal Reserve Bank, Buffalo Branch, P.O. Box 961, Buffalo, NY 14240.	New York, Boston	CT, MA, ME, NH, NJ (northern half), NY (City & State), RI, VT, Puerto Rico and Virgin Islands.
Federal Reserve Bank, Pittsburgh Branch, P.O. Box 867, Pittsburgh, PA 15230.	Cleveland, Philadelphia	DE, KY (eastern half), NJ (southern half), OH, PA, WV (northern panhandle).
Federal Reserve Bank of Richmond, P.O. Box 27622, Richmond, VA 23261.	Richmond, Atlanta	AL, DC, FL, LA (southern half), MD, MS (southern half), NC, SC, TN (eastern half), VA, WV (except northern panhandle).
Federal Reserve Bank of Minneapolis, 250 Marquette Avenue, Minneapolis, MN 55480.	Minneapolis, Chicago	IA, IL (northern half), IN (northern half), MN, MT, ND, SD, WI.
Federal Reserve Bank of Kansas City, 925 Grand Avenue, Kansas City, MO 64198.	Dallas, San Francisco, Kansas City, St. Louis.	AK, AR, AZ, CA, CO, HI, ID, IL (southern half), IN (southern half), KS, KY (western half), LA (northern half), MO, MS (northern half), NE, NM, NV, OK, OR, TN (western half), TX, WA, WY, UT and GU.

(2) Until March 1, 1996, other Federal Reserve Offices may continue to provide some savings bond services, but such services will be phased out over the period prior to that date.

PART 332—OFFERING OF UNITED STATES SAVINGS BONDS, SERIES H

1. The authority citation for part 332 continues to read as follows:

Authority: 31 U.S.C. 3105, 5 U.S.C. 301.

§ 332.10 [Amended]

2. Section 332.10 is amended by adding "referred to in § 332.12" immediately after "a Federal Reserve Bank or Branch".

3. Section 332.12 is revised to read as follows:

§ 332.12 Fiscal agents.

(a) Federal Reserve Banks and Branches referred to below, as fiscal agents of the United States, are authorized to perform such services as may be requested of them by the Secretary of the Treasury, or his or her delegate, in connection with the reissue, redemption and payment of Series H bonds.

(b)(1) The following Federal Reserve Offices have been designated to provide savings bond services:

Servicing office	Reserve districts served	Geographic area served
Federal Reserve Bank, Buffalo Branch, P.O. Box 961, Buffalo, NY 14240.	New York, Boston	CT, MA, ME, NH, NJ (northern half), NY (City & State), RI, VT, Puerto Rico and Virgin Islands.
Federal Reserve Bank, Pittsburgh Branch, P.O. Box 867, Pittsburgh, PA 15230.	Cleveland, Philadelphia	DE, KY, (eastern half), NJ (southern half), OH, PA, WV (northern panhandle).
Federal Reserve Bank of Richmond, P.O. Box 27622, Richmond, VA 23261.	Richmond, Atlanta	AL, DC, FL, LA (southern half), MD, MS (southern half), NC, SC, TN (eastern half), VA, WV (except northern panhandle).
Federal Reserve Bank of Minneapolis, 250 Marquette Avenue, Minneapolis, MN 55480.	Minneapolis, Chicago	IA, IL (northern half), IN (northern half), MN, MT, ND, SD, WI.
Federal Reserve Bank of Kansas City, 925 Grand Avenue, Kansas City, MO 64198.	Dallas, San Francisco, Kansas City, St. Louis.	AK, AR, AZ, CA, CO, HI, ID, IL (southern half), IN (southern half), KS, KY (western half), LA (northern half), MO, MS (northern half), NE, NM, NV, OK, OR, TN (western half), TX, WA, WY, UT and GU.

(2) Until March 1, 1996, other Federal Reserve Offices may continue to provide some savings bond services, but such services will be phased out over the period prior to that date.

PART 342—OFFERING OF UNITED STATES SAVINGS NOTES

1. The authority citation for part 342 continues to read as follows:

Authority: 31 U.S.C. 3105, 5 U.S.C. 301.

§ 342.7 [Amended]

2. In § 342.7, paragraph (a) is amended by adding the phrase "referred to in § 342.9", immediately following "any Federal Reserve Bank or Branch".

3. Section 342.9 is revised to read as follows:

§ 342.9 Fiscal agents.

(a) Federal Reserve Banks and Branches referred to below, as fiscal agents of the United States, are authorized to perform such services as may be requested of them by the Secretary of the Treasury, or his or her delegate, in connection with the issue, redemption and payment of savings notes.

(b)(1) The following Federal Reserve Offices have been designated to provide savings bond services:

Servicing office	Reserve districts served	Geographic area served
Federal Reserve Bank, Buffalo Branch, P.O. Box 961, Buffalo, NY 14240.	New York, Boston	CT, MA, ME, NH, NJ (northern half), NY (City & State), RI, VT, Puerto Rico and Virgin Islands.
Federal Reserve Bank, Pittsburgh Branch, P.O. Box 867, Pittsburgh, PA 15230.	Cleveland, Philadelphia	DE, KY (eastern half), NJ (southern half), OH, PA, WV (northern panhandle).
Federal Reserve Bank of Richmond, P.O. Box 27622, Richmond, VA 23261.	Richmond, Atlanta	AL, DC, FL, LA (southern half), MD, MS (southern half), NC, SC, TN (eastern half), VA, WV (except northern panhandle).
Federal Reserve Bank of Minneapolis, 250 Marquette Avenue, Minneapolis, MN 55480.	Minneapolis, Chicago	IA, IL (northern half), IN (northern half), MN, MT, ND, SD, WI.
Federal Reserve Bank of Kansas City, 925 Grand Avenue, Kansas City, MO 64198.	Dallas, San Francisco, Kansas City, St. Louis.	AK, AR, AZ, CA, CO, HI, ID, IL (southern half), IN (southern half), KS, KY (western half), LA (northern half), MO, MS (northern half), NE, NM, NV, OK, OR, TN (western half), TX, WA, WY, UT and GU.

(2) Until March 1, 1996, other Federal Reserve Offices may continue to provide some savings bond services, but such services will be phased out over the period prior to that date.

PART 351—OFFERING OF UNITED STATES SAVINGS BONDS, SERIES EE

1. The authority citation for part 351 continues to read as follows:

Authority: 31 U.S.C. 3105, 5 U.S.C. 301.

§ 351.5 [Amended]

2. In § 351.5, paragraph (b)(1) is amended by adding "(see § 351.12)" after "Federal Reserve Banks".

§ 351.7 [Amended]

3. Section 351.7, paragraph (b) is amended by adding the phrase "referred to in § 351.12", immediately following "A Federal Reserve Bank or Branch".

4. Section 351.12 is revised to read as follows:

§ 351.12 Fiscal agents.

(a) Federal Reserve Banks and Branches referred to below, as fiscal agents of the United States, are authorized to perform such services as may be requested of them by the Secretary of the Treasury, or his or her delegate, in connection with the issue, servicing and redemption of Series EE bonds.

(b)(1) The following Federal Reserve Offices have been designated to provide savings bond services:

Servicing office	Reserve districts served	Geographic area served
Federal Reserve Bank, Buffalo Branch, P.O. Box 961, Buffalo, NY 14240.	New York, Boston	CT, MA, ME, NH, NJ (northern half), NY (City & State), RI, VT, Puerto Rico and Virgin Islands.
Federal Reserve Bank, Pittsburgh Branch, P.O. Box 867, Pittsburgh, PA 15230.	Cleveland, Philadelphia	DE, KY, (eastern half), NJ (southern half), OH, PA, WV (northern panhandle).
Federal Reserve Bank of Richmond, P.O. Box 27622, Richmond, VA 23261.	Richmond, Atlanta	AL, DC, FL, LA (southern half), MD, MS (southern half), NC, SC, TN (eastern half), VA, WV (except northern panhandle).
Federal Reserve Bank of Minneapolis, 250 Marquette Avenue, Minneapolis, MN 55480.	Minneapolis, Chicago	IA, IL (northern half), IN (northern half), MN, MT, ND, SD, WI.
Federal Reserve Bank of Kansas City, 925 Grand Avenue, Kansas City, MO 64198.	Dallas, San Francisco, Kansas City, St. Louis.	AK, AR, AZ, CA, CO, HI, ID, IL (southern half), IN (southern half), KS, KY (western half), LA (northern half), MO, MS (northern half), NE, NM, NV, OK, OR, TN (western half), TX, WA, WY, UT and GU.

(2) Until March 1, 1996, other Federal Reserve Offices may continue to provide some savings bond services, but such services will be phased out over the period prior to that date.

PART 352—OFFERING OF UNITED STATES SAVINGS BONDS, SERIES HH

1. The authority citation for part 352 continues to read as follows:

Authority: 31 U.S.C. 3105, 5 U.S.C. 301.

§ 352.2 [Amended]

2. In § 352.2, paragraph (h) is amended by adding "designated" before "Federal Reserve Banks".

§ 352.5 [Amended]

3. Section 352.5 is amended by adding "(see § 352.13)" after "Federal Reserve Banks".

§ 352.7 [Amended]

4. Section 352.7 is amended as follows:

A. Paragraph (b) is amended by adding "referred to in § 351.13" immediately following "a Federal Reserve Bank".

B. Paragraph (c) is amended by adding "referred to in § 351.13" immediately following "a Federal Reserve Bank".

5. Section 352.13 is revised to read as follows:

§ 352.13 Fiscal Agents.

(a) Federal Reserve Banks and Branches, referred to below, as fiscal agents of the United States, are authorized to perform such services as may be requested of them by the Secretary of the Treasury, or his or her delegate, in connection with the issue, servicing, and redemption of Series HH bonds.

(b)(1) The following Federal Reserve Offices have been designated to provide savings bond services:

Servicing office	Reserve districts served	Geographic area served
Federal Reserve Bank, Buffalo Branch, P.O. Box 961, Buffalo, NY 14240.	New York, Boston	CT, MA, ME, NH, NJ (northern half), NY (City & State), RI, VT, Puerto Rico and Virgin Islands.
Federal Reserve Bank, Pittsburgh Branch, P.O. Box 867, Pittsburgh, PA 15230.	Cleveland, Philadelphia	DE, KY (eastern half), NJ (southern half), OH, PA, WV (northern panhandle).
Federal Reserve Bank of Richmond, P.O. Box 27622, Richmond, VA 23261.	Richmond, Atlanta	AL, DC, FL, LA (southern half), MD, MS (southern half), NC, SC, TN (eastern half), VA, WV (except northern panhandle).
Federal Reserve Bank of Minneapolis, 250 Marquette Avenue, Minneapolis, MN 55480.	Minneapolis, Chicago	IA, IL (northern half), IN (northern half), MN, MT, ND, SD, WI.
Federal Reserve Bank of Kansas City, 925 Grand Avenue, Kansas City, MO 64198.	Dallas, San Francisco, Kansas City, St. Louis.	AK, AR, AZ, CA, CO, HI, ID, IL (southern half), IN (southern half), KS, KY (western half), LA (northern half), MO, MS (northern half), NE, NM, NV, OK, OR, TN (western half), TX, WA, WY, UT and GU.

(2) Until March 1, 1996, other Federal Reserve Offices may continue to provide some savings bond services, but such services will be phased out over the period prior to that date.

PART 353—REGULATIONS GOVERNING U.S. SAVINGS BONDS, SERIES EE & HH

1. The authority citation for part 353 continues to read as follows:

Authority: 31 U.S.C. 3105, 5 U.S.C. 301.

2. Section 353.1 is amended as follows:

A. Paragraph (a) is amended by adding "in the list in paragraph (b) of this section" after "Federal Reserve Banks and Branches".

B. Paragraph (b) is revised to read as follows:

§ 353.1 Official agencies.

* * * * *

(b) Communications concerning transactions and requests for forms should be addressed to:

(1) A Federal Reserve Bank or Branch in the list below; the Bureau of the Public Debt, 200 Third Street, Parkersburg, WV 26101; or the Bureau of the Public Debt, Washington, DC 20226.

(2)(i) The following Federal Reserve Offices have been designated to provide savings bond services:

Servicing office	Reserve districts served	Geographic area served
Federal Reserve Bank, Buffalo Branch, P.O. Box 961, Buffalo, NY 14240.	New York, Boston	CT, MA, ME, NH, NJ (northern half), NY (City & State), RI, VT, Puerto Rico and Virgin Islands.
Federal Reserve Bank, Pittsburgh Branch, P.O. Box 867, Pittsburgh, PA 15230.	Cleveland, Philadelphia	DE, KY (eastern half), NJ (southern half), OH, PA, WV (northern panhandle).
Federal Reserve Bank of Richmond, P.O. Box 27622, Richmond, VA 23261.	Richmond, Atlanta	AL, DC, FL, LA (southern half), MD, MS (southern half), NC, SC, TN (eastern half), VA, WV (except northern panhandle).
Federal Reserve Bank of Minneapolis, 250 Marquette Avenue, Minneapolis, MN 55480.	Minneapolis, Chicago	IA, IL (northern half), IN (northern half), MN, MT, ND, SD, WI.
Federal Reserve Bank of Kansas City, 925 Grand Avenue, Kansas City, MO 64198.	Dallas, San Francisco, Kansas City, St. Louis.	AK, AR, AZ, CA, CO, HI, ID, IL (southern half), IN (southern half), KS, KY (western half), LA (northern half), MO, NE, NM, NV, OK, OR, TN (western half), TX, WA, WY, UT and GU.

(ii) Until March 1, 1996, other Federal Reserve Offices may continue to provide some savings bond services, but such services will be phased out over the period prior to that date.

* * * * *

§ 353.13 [Amended]

3. In § 353.13, paragraph (d), the introductory paragraph, is amended by adding "designated" before "Federal Reserve Bank", and removing "of the district" and replacing it with "or Branch".

§ 353.31 [Amended]

4. In § 353.31, paragraph (d) is amended by adding "designated" before "Federal Reserve Bank".

§ 353.35 [Amended]

5. In § 353.35, paragraph (c) is amended by adding "designated" before "Federal Reserve Bank or Branch".

§ 353.39 [Amended]

6. In § 353.39, paragraph (b) is amended by adding "designated" before "Federal Reserve Bank or Branch" in the two places the phrase appears.

§ 353.40 [Amended]

7. In § 353.40, paragraph (a) is amended by adding "a designated" before "Federal Reserve Bank".

§ 353.41 [Amended]

8. Section 353.41 is amended by adding "designated" before "Federal Reserve Bank or Branch".

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