

## **CHAPTER 1. INTRODUCTION**

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## 1.1 PURPOSE OF THE DOCUMENT

This technical support document (TSD) is a stand-alone report that provides the technical analyses and results supporting the information presented in the final rule for residential water heaters, direct heating equipment, and pool heaters (collectively referred to as “residential heating products”). This final rule TSD reports on the activities and analyses conducted in support of the final rule.

## 1.2 SUMMARY OF NATIONAL BENEFITS

DOE estimates the standards adopted in the final rule will save approximately 2.81 quads (quadrillion or  $10^{15}$ ) British thermal units (Btu) of energy over a 30-year period: 2.58 quads for residential water heaters during 2015–2045, and 0.21 and 0.02 quads for DHE and pool heaters, respectively, during 2013–2043. The total of 2.81 quads is equivalent to all the energy consumed by nearly 15 million American households in a single year. By 2045, DOE expects the energy savings from today’s standards to eliminate the need for approximately three new 250 MW power plants.

These energy savings will result in cumulative greenhouse gas emission reductions of approximately 164 million tons (Mt) of carbon dioxide ( $\text{CO}_2$ ), or an amount equal to that produced by approximately 46 million cars every year. Additionally, the standards will help alleviate air pollution by resulting in cumulative emissions reductions of approximately 125 kilotons (kt) for nitrogen oxides ( $\text{NO}_x$ ) and 0.54 tons of for power plant mercury (Hg).

The estimated monetary value of the cumulative  $\text{CO}_2$  emissions reductions, based on a range of values from a recent interagency process, is \$560 to \$8,725 million. The estimated net present monetary value of the other emissions reductions (discounted to 2010 using a 7-percent discount rate and expressed in 2009\$) is \$12.2 to 125 million for  $\text{NO}_x$ . At a 3-percent discount rate, the estimated net present value of these emissions reductions is \$27.2 to 284 million for  $\text{NO}_x$ .

The national NPV of consumer benefit of today’s standards is \$1.98 billion using a 7-percent discount rate and \$10.11 billion using a 3-percent discount rate, cumulative from 2013 to 2043 for DHE and pool heaters, and from 2015 to 2045 for water heaters, in 2009\$. This is the estimated present value of future operating cost savings minus the estimated increased costs of purchasing and installing the three types of heating products, discounted to 2010.

The benefits and costs of today’s rule can also be expressed in terms of annualized values from 2013 to 2043 for DHE and pool heaters, and from 2015 to 2045 for water heaters. Estimates of annualized values for the three types of heating products are shown in **Error! Reference source not found., Error! Reference source not found., and Error! Reference source not found..** The annualized monetary benefits are the sum of the annualized national economic value of operating cost savings (energy, maintenance, and repair), expressed in 2009\$, plus the monetary value of the benefits of  $\text{CO}_2$  and  $\text{NO}_x$  emission reductions. For the value of  $\text{CO}_2$  emission reductions, DOE uses the global Social Cost of Carbon (SCC) calculated using the

average value derived using a 3-percent discount rate (equivalent to \$21.40 per metric ton of CO<sub>2</sub> emitted in 2010, in 2007\$). This value is a central value from a recent interagency process. The derivation of this value is discussed in Appendix 15-A of this TSD. The monetary benefits of cumulative emissions reductions are reported in 2009\$ so that they can be compared with the other costs and benefits in the same dollar units.

Although the above consideration of benefits provides a valuable perspective, please note the following:

(1) The national operating cost savings are domestic U.S. consumer monetary savings found in market transactions, while the value of CO<sub>2</sub> reductions is based on a global value. Also, note that the central value is only one of four SCC developed by the interagency workgroup. Other marginal SCC values for 2010 are \$4.70, \$35.10, and \$64.90 per metric ton (2007\$ for emissions in 2010), which reflect different discount rates and, for the highest value, the possibility of higher-than-expected impacts further out in the tails of the SCC distribution.

(2) The assessments of operating cost savings and CO<sub>2</sub> savings are performed with different computer models, leading to different time frames for analysis. The national operating cost savings is measured for the lifetime of heating products shipped in the period 2013–2043 (for DHE and pool heaters) or 2015–2045 (for water heaters). The value of CO<sub>2</sub>, on the other hand, reflects the present value of all future climate-related impacts (out to 2300) due to emitting a ton of carbon dioxide in each year of the forecast period.

Using a 7-percent discount rate and the central SCC value, the combined cost of the standards adopted in today's final rule for heating products is \$1,285 million per year in increased equipment and installation costs, while the annualized benefits are \$1,500 million per year in reduced equipment operating costs, \$169 million in CO<sub>2</sub> reductions, and \$7.7 million in reduced NO<sub>x</sub> emissions. At a 7-percent discount rate, the net benefit amounts to \$391 million per year. Using a 3-percent discount rate and the central SCC value, the cost of the standards adopted in today's rule is \$1,249 million per year in increased equipment and installation costs, while the benefits of today's standards are \$1,843 million per year in reduced operating costs, \$169 million in CO<sub>2</sub> reductions, and \$9.2 million in reduced NO<sub>x</sub> emissions. At a 3-percent discount rate, the net benefit amounts to \$771 million per year.

**Table 1.2.1 Annualized Benefits and Costs for Water Heaters at the Amended Standard Level**

Category	Primary Estimate (AEO Reference Case)	Low Estimate (Low Energy Price Case)	High Estimate (High Energy Price Case)	Units		
				Year Dollars	Disc. Rate	Period Covered (2015-2045)
Benefits						
Energy Annualized Monetized (millions\$/year)	1407.0	1275.5	1537.5	2009	7%	30
	1729.6	1556.1	1902.9	2009	3%	30
CO <sub>2</sub> Monetized Value (at \$4.7/Metric Ton, millions\$/year)*	43.5	43.5	43.5	2009	5%	30
CO <sub>2</sub> Monetized Value (at \$21.4/Metric Ton, millions\$/year)*	158.6	158.6	158.6	2009	3%	30
CO <sub>2</sub> Monetized Value (at \$35.1/Metric Ton, millions\$/year)*	245.7	245.7	245.7	2009	2.5%	30
CO <sub>2</sub> Monetized Value (at \$64.9/Metric Ton, millions\$/year)*	483.8	483.8	483.8	2009	3%	30
NO <sub>x</sub> Monetized Value (at \$2,437/Metric Ton, millions\$/year)	7.0	7.0	7.0	2009	7%	30
	8.5	8.5	8.5	2009	3%	30
Total Monetary Benefits (millions\$/year)**	1457.5-1897.8	1326-1766.3	1588-2028.3	2009	7% range	30
	1572.7	1441.1	1703.2	2009	7%	
	1896.7	1723.2	2070.0	2009	3%	
	1781.5 - 2221.8	1608 - 2048.3	1954.9 - 2395.2	2009	3% range	30
Costs						
Annualized Monetized (millions\$/year)	1250.3	1184.5	1321.6	2009	7%	30
	1216.6	1145.7	1295.6	2009	3%	30
Net Benefits/Costs						
Annualized Monetized, including CO <sub>2</sub> Benefits (million\$/year)**	207.2 - 647.5	141.5 - 581.8	266.4 - 706.7	2009	7% range	30
	322.4	256.6	381.5	2009	7%	30
	680.1	577.5	774.4	2009	3%	30
	565 - 1005.3	462.3 - 902.6	659.3 - 1099.6	2009	3% range	30

\* These values represent global values (in 2009\$) of the social cost of CO<sub>2</sub> emissions in 2010 under several scenarios. The values of \$4.7, \$21.4, and \$35.1 per ton are the averages of SCC distributions calculated using 5%, 3%, and 2.5% discount rates, respectively. The value of \$64.9 per ton represents the 95<sup>th</sup> percentile of the SCC distribution calculated using a 3% discount rate.

\*\* Total Monetary Benefits for both the 3% and 7% cases utilize the central estimate of social cost of CO<sub>2</sub> emissions calculated at a 3% discount rate (averaged across three IAMs), which is equal to \$21.4/ton in 2010 (in 2009\$). The rows labeled as “7% Range” and “3% Range” calculate consumer, Hg, and NO<sub>x</sub> cases with the labeled discount rate but add these values to the full range of CO<sub>2</sub> values with the \$4.7/ton value at the low end, and the \$64.9/ton value at the high end.

**Table 1.2.2 Annualized Benefits and Costs for Direct Heating Equipment at the Amended Standard Level**

Category	Primary Estimate (AEO Reference Case)	Low Estimate (Low Energy Price Case)	High Estimate (High Energy Price Case)	Units		
				Year Dollars	Disc. Rate	Period Covered (2013-2043)
Benefits						
Energy Annualized Monetized (millions\$/year)	82.2	78.8	84.6	2009	7%	30
	100.6	96.3	103.6	2009	3%	30
CO <sub>2</sub> Monetized Value (at \$4.7/Metric Ton, millions\$/year)*	2.5	2.5	2.5	2009	5%	30
CO <sub>2</sub> Monetized Value (at \$21.4/Metric Ton, millions\$/year)*	9.2	9.2	9.2	2009	3%	30
CO <sub>2</sub> Monetized Value (at \$35.1/Metric Ton, millions\$/year)*	14.3	14.3	14.3	2009	2.5%	30
CO <sub>2</sub> Monetized Value (at \$64.9/Metric Ton, millions\$/year)*	28.1	28.1	28.1	2009	3%	30
NO <sub>x</sub> Monetized Value (at \$2,437/Metric Ton, millions\$/year)	0.6	0.6	0.6	2009	7%	30
	0.6	0.6	0.6	2009	3%	30
Total Monetary Benefits (millions\$/year)**	85.2-110.8	81.8-107.4	87.7-113.2	2009	7% range	30
	91.9	88.5	94.4	2009	7%	
	110.4	106.2	113.4	2009	3%	
	103.7 - 129.3	99.5 - 125	106.7 - 132.3	2009	3% range	30
Costs						
Annualized Monetized (millions\$/year)	27.7	27.7	27.7	2009	7%	30
	26.0	26.0	26.0	2009	3%	30
Net Benefits/Costs						
Annualized Monetized, including CO <sub>2</sub> Benefits (million\$/year)**	57.6 - 83.1	54.1 - 79.7	60 - 85.6	2009	7% range	30
	64.3	60.8	66.7	2009	7%	30
	84.4	80.1	87.4	2009	3%	30
	77.7 - 103.2	73.4 - 99	80.7 - 106.3	2009	3% range	30

\* These values represent global values (in 2009\$) of the social cost of CO<sub>2</sub> emissions in 2010 under several scenarios. The values of \$4.7, \$21.4, and \$35.1 per ton are the averages of SCC distributions calculated using 5%, 3%, and 2.5% discount rates, respectively. The value of \$64.9 per ton represents the 95<sup>th</sup> percentile of the SCC distribution calculated using a 3% discount rate.

\*\* Total Monetary Benefits for both the 3% and 7% cases utilize the central estimate of social cost of CO<sub>2</sub> emissions calculated at a 3% discount rate (averaged across three IAMs), which is equal to \$21.4/ton in 2010 (in 2009\$). The rows labeled as “7% Range” and “3% Range” calculate consumer, Hg, and NO<sub>x</sub> cases with the labeled discount rate but add these values to the full range of CO<sub>2</sub> values with the \$4.7/ton value at the low end, and the \$64.9/ton value at the high end.

**Table 1.2.3 Annualized Benefits and Costs for Pool Heaters at the Amended Standard Level**

Category	Primary Estimate (AEO Reference Case)	Low Estimate (Low Energy Price Case)	High Estimate (High Energy Price Case)	Units		
				Year Dollars	Disc. Rate	Period Covered (2013-2043)
Benefits						
Energy Annualized Monetized (millions\$/year)	10.6	10.1	10.9	2009	7%	30
	12.5	12.0	12.9	2009	3%	30
CO <sub>2</sub> Monetized Value (at \$4.7/Metric Ton, millions\$/year)*	0.2	0.2	0.2	2009	5%	30
CO <sub>2</sub> Monetized Value (at \$21.4/Metric Ton, millions\$/year)*	0.8	0.8	0.8	2009	3%	30
CO <sub>2</sub> Monetized Value (at \$35.1/Metric Ton, millions\$/year)*	1.3	1.3	1.3	2009	2.5%	30
CO <sub>2</sub> Monetized Value (at \$64.9/Metric Ton, millions\$/year)*	2.4	2.4	2.4	2009	3%	30
NO <sub>x</sub> Monetized Value (at \$2,437/Metric Ton, millions\$/year)	0.1	0.1	0.1	2009	7%	30
	0.1	0.1	0.1	2009	3%	30
Total Monetary Benefits (millions\$/year)**	10.8-13	10.4-12.6	11.1-13.3	2009	7% range	30
	11.4	11.0	11.7	2009	7%	
	13.4	12.8	13.7	2009	3%	
	12.8 - 15	12.3 - 14.4	13.2 - 15.3	2009	3% range	30
Costs						
Annualized Monetized (millions\$/year)	6.9	6.9	6.9	2009	7%	30
	6.7	6.7	6.7	2009	3%	30
Net Benefits/Costs						
Annualized Monetized, including CO <sub>2</sub> Benefits (million\$/year)**	3.9 - 6.1	3.4 - 5.6	4.2 - 6.4	2009	7% range	30
	4.5	4.0	4.8	2009	7%	30
	6.7	6.2	7.1	2009	3%	30
	6.1 - 8.3	5.6 - 7.8	6.5 - 8.7	2009	3% range	30



\* These values represent global values (in 2009\$) of the social cost of CO<sub>2</sub> emissions in 2010 under several scenarios. The values of \$4.7, \$21.4, and \$35.1 per ton are the averages of SCC distributions calculated using 5%, 3%, and 2.5% discount rates, respectively. The value of \$64.9 per ton represents the 95<sup>th</sup> percentile of the SCC distribution calculated using a 3% discount rate.

\*\* Total Monetary Benefits for both the 3% and 7% cases utilize the central estimate of social cost of CO<sub>2</sub> emissions calculated at a 3% discount rate (averaged across three IAMs), which is equal to \$21.4/ton in 2010 (in 2009\$). The rows labeled as “7% Range” and “3% Range” calculate consumer, Hg, and NO<sub>x</sub> cases with the labeled discount rate but add these values to the full range of CO<sub>2</sub> values with the \$4.7/ton value at the low end, and the \$64.9/ton value at the high end.

### **1.3 OVERVIEW OF RESIDENTIAL ENERGY CONSERVATION STANDARDS FOR RESIDENTIAL HEATING PRODUCTS**

The Energy Policy and Conservation Act (EPCA) of 1975 (42 U.S.C. 6291–6309) established an energy conservation program for major household appliances. The National Energy Conservation Policy Act of 1978 (NECPA) amended EPCA to add Part C of Title III (42 U.S.C. 6311–6317), which established an energy conservation program for certain industrial equipment. The amendments to EPCA in the National Appliance Energy Conservation Act of 1987 (NAECA) established energy conservation standards for residential water heaters, direct heating equipment, and pool heaters, as well as requirements for determining whether these standards should be amended. (42 U.S.C. 6291–6309)

NAECA required the U.S. Department of Energy (DOE) to conduct two cycles of rulemakings to determine if more stringent standards are economically justified and technologically feasible for these products. (42 U.S.C. 6295 (e)) Specifically, NAECA directed the Secretary of Energy to publish a final rule determining whether the standards for residential water heaters, direct heating equipment, and pool heaters should be amended by January 1, 1992, and again by January 1, 2000. (42 U.S.C. 6295 (e)(4)) On February 7, 1989, and October 17, 1990, DOE issued a final rule codifying the standards prescribed by NAECA, and thereby established the first set of energy conservation standards for residential water heaters, direct water heating equipment, and pool heaters. 54 FR 6077 (February 7, 1989) and 55 FR 42163 (October 17, 1990).

Pursuant to 42 U.S.C. 6295(e)(4)(A), on January 17, 2001, DOE published in the *Federal Register* a final rule (the January 2001 final rule), effective on January 20, 2004, amending the energy conservation standards for residential water heaters. 66 FR 4474 (January 17, 2001).

DOE initially analyzed energy conservation standards for direct heating equipment as part of an eight-product standards rulemaking. When DOE analyzed direct heating equipment in these earlier proceedings, DOE only considered products categorized as vented home heating equipment. DOE issued a NOPR on March 4, 1994, proposing to amend the energy conservation standards for direct heating equipment as well as other consumer products. 59 FR 10464 (March 4, 1994). The Department of Interior and Related Agencies Appropriations Act for Fiscal Year 1996 (Pub. L. 104-134) provided a moratorium on proposing or issuing final rules for appliance standards rulemakings for the remainder of fiscal year 1996, thereby preventing DOE from

finalizing the 1994 proposed standards and leaving the existing NAECA energy efficiency levels in place. As with direct heating equipment, DOE initially analyzed standards for pool heaters as part of the eight-product standards rulemaking of 1994, 59 FR 10464 (March 4, 1994), but never finalized the proposed standards.

## **1.4 PROCESS FOR SETTING ENERGY CONSERVATION STANDARDS**

Under EPCA, when DOE studies new or amended standards, it must consider to the greatest extent practicable the following seven factors:

- (1) the economic impact of the standard on the manufacturers and consumers of the products subject to the standard;
- (2) the savings in operating costs throughout the estimated average life of the products in the type (or class) compared to any increases in the price, initial charges, or maintenance expense for the products that 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 products likely to result from the imposition of the standard;
- (5) the impact of any lessening of competition, as determined in writing by the Attorney General, that is likely to result from the imposition of the standard;
- (6) the need for national energy conservation; and
- (7) other factors the Secretary considers relevant. (42 U.S.C. 6295(o)(2)(B)(i))

Other statutory requirements are set forth in 42 U.S.C. 6295(o)(1)-(2)(A), (2)(B)(ii)-(iii), and (3)-(4).

DOE considers the participation of interested parties a very important part of the process for setting energy conservation standards. Through formal public notifications (*i.e.*, *Federal Register* notices), DOE encourages the participation of all interested parties during the comment period in each stage of a rulemaking. Beginning with the framework document and during subsequent comment periods, interactions among interested parties provide a balanced discussion of the information required for a standards rulemaking.

Before DOE determines whether to adopt a proposed energy conservation standard, it must first solicit comments on the proposed standard. (42 U.S.C 6313(a)(6)(B)(i)) Any new or amended standard must be designed to achieve significant additional conservation of energy and be technologically feasible and economically justified. (42 U.S.C. 6313(a)(6)(A)) To determine whether economic justification exists, DOE must review comments on the proposal and determine that the benefits of the proposed standard exceed its burdens to the greatest extent practicable, weighing the seven factors listed above. (42 U.S.C. 6295(o)(2)(B)(i))

After publication of the framework document, the energy conservation standards rulemaking process involves three additional, formal public notices, which DOE publishes in the *Federal Register*. The first of the rulemaking notices is a notice of public meeting (NOPM) and announcement of the availability of the preliminary TSD, which is designed to publicly vet the models and tools used in the preliminary rulemaking analyses and to facilitate public participation before the NOPR stage. The second notice is the NOPR, which presents a discussion of comments received in response to the preliminary analyses; analyses of the impacts of potential amended energy conservation standards on consumers, manufacturers, and the Nation; DOE's weighting of these impacts of amended energy conservation standards; and the proposed energy conservation standards for each product. The third notice is the final rule, which presents a discussion of the comments received in response to the NOPR; the revised analyses; DOE's weighting of these impacts; the amended energy conservation standards DOE is adopting for each product; and the effective dates of the amended energy conservation standards.

In November 2006, DOE published a notice of public meeting and availability of the framework document. 71 FR 67825 (November 24, 2006). The framework document, *Rulemaking Framework for Residential Water Heaters, Direct Heating Equipment, and Pool Heaters*, describes the procedural and analytical approaches DOE anticipated using to evaluate the establishment of amended energy conservation standards for these products. This document is available at [http://www1.eere.energy.gov/buildings/appliance\\_standards/residential/pdfs/heating\\_equipment\\_framework\\_092706.pdf](http://www1.eere.energy.gov/buildings/appliance_standards/residential/pdfs/heating_equipment_framework_092706.pdf).

DOE held a public meeting on January 16, 2007, to discuss procedural and analytical approaches to the rulemaking. In addition, DOE used the public meeting to facilitate involvement of interested parties in the rulemaking process. The analytical framework presented at the public meeting described the different analyses, the methods proposed for conducting them, and the relationships among the various analyses.

**Table 1.4.1 Analyses During Each Rulemaking Stage**

<b>Preliminary Analyses</b>	<b>NOPR</b>	<b>Final Rule</b>
Market and Technology Assessment	Revised Preliminary Analyses	Revised Analyses
Screening Analysis	Life-Cycle Cost Sub-Group Analysis	
Engineering Analysis	Manufacturer Impact Analysis	
Energy Use Determination	Utility Impact Analysis	
Markups for Equipment Price Determination	Environmental Assessment	
Life-Cycle Costs and Payback Period Analyses	Employment Impact Analysis	
Shipments Analysis	Regulatory Impact Analysis	
National Impact Analysis		
Preliminary Manufacturer Impact Analysis		

During the January 2007 public meeting, interested parties commented about numerous issues relating to each of the analyses listed in Table 1.1. Due to the extensive scope of material and issues raised at the meeting, some interested parties requested an extension of the comment period. DOE extended the comment period until February 13, 2007 in a notice published in the

*Federal Register* on January 30, 2007. 72 FR 4219. DOE attempted to address the issues raised at the public meeting and during the written comment period in the preliminary analyses; DOE summarized the comments and its responses in chapter 2 of the preliminary analysis TSD.

As part of the information gathering and sharing for the preliminary analyses, DOE organized and held interviews with manufacturers of the residential heating products considered in this rulemaking. DOE selected companies that represent production of all types of products, ranging from small to large manufacturers, and included the Air-Conditioning, Heating, and Refrigerating Institute (AHRI) member companies. DOE had four objectives for these interviews: (1) solicit manufacturer feedback on the draft engineering analysis (including methodology, product costs, manufacturing processes, and findings); (2) solicit feedback on topics related to the preliminary manufacturer impact analysis; (3) provide an opportunity early in the rulemaking process to express manufacturers' concerns to DOE; and (4) foster cooperation between manufacturers and DOE.

DOE incorporated the information gathered during the engineering interviews with manufacturers into the engineering analysis (chapter 5) and the manufacturer impact analysis (chapter 12).

For each product, DOE developed an LCC spreadsheet that calculates the LCC and PBP at various energy efficiency levels. DOE also developed a national impact analysis spreadsheet that calculates the national energy savings (NES) and national net present values (NPVs) at various energy efficiency levels. This spreadsheet includes a model that forecasts the impacts of amended energy conservation standards at various levels on product shipments. All of these spreadsheets are available on the DOE website ([www.eere.energy.gov/buildings/appliance\\_standards](http://www.eere.energy.gov/buildings/appliance_standards)) within the specific pages for each of product.

On January 13, 2009, DOE published the NOPM and availability of the preliminary TSD. 74 FR 1643-1646. The preliminary TSD provides technical analyses and results that support the information presented in the preliminary NOPM and the executive summary for residential heating products. The preliminary TSD also provides a detailed description of all of the analyses discussed in the paragraphs above. The preliminary TSD is available on DOE's website at [http://www1.eere.energy.gov/buildings/appliance\\_standards/residential/water\\_pool\\_heaters\\_prelim\\_tsd.html](http://www1.eere.energy.gov/buildings/appliance_standards/residential/water_pool_heaters_prelim_tsd.html).

Following publication of the NOPM and the preliminary TSD, DOE held a public meeting on February 9, 2009, to facilitate discussion about the preliminary analyses that were performed for the NOPM and described in the preliminary TSD. In addition to the public meeting, a written comment period was open until March 16, 2009, to allow interested parties to provide new comments or elaborate on any comments made at the public meeting.

After receiving these comments, DOE revised the preliminary analyses for the NOPR phase of this rulemaking based on the feedback from interested parties. DOE organized and held a second round of interviews with manufacturers to gather additional feedback on the analyses and as part of the manufacturer impact analysis that was conducted for the NOPR phase of the rulemaking.

In addition to revising the various preliminary analyses, DOE also performed an LCC sub-group analysis, manufacturer impact analysis, utility impact analysis, employment impact analysis, and regulatory impact analysis for the NOPR stage of this rulemaking.

On December 11, 2009, DOE published the NOPR. 74 FR 65852. In conjunction with the NOPR, DOE also published on its website the complete NOPR TSD. The NOPR TSD provides technical analyses and results that support the information and proposed standards that are presented in the NOPR for residential heating products. The TSD also provides a detailed description of all of the NOPR analyses discussed in the paragraphs above. The NOPR TSD is available on DOE's website at [http://www1.eere.energy.gov/buildings/appliance\\_standards/residential/water\\_pool\\_heaters\\_nopr\\_tsd.html](http://www1.eere.energy.gov/buildings/appliance_standards/residential/water_pool_heaters_nopr_tsd.html)

Following publication of the NOPR, DOE held a public meeting on January 7, 2010, to facilitate discussion about the NOPR analyses and proposed standard levels. In addition to the public meeting, a written comment period was open until February 9, 2010, to allow interested parties to provide new comments or elaborate on any comments made at the public meeting.

After receiving comments on the NOPR, DOE revised the NOPR analyses for the final rule, as appropriate, based on any new feedback or data from interested parties.

## **1.5 STRUCTURE OF THE DOCUMENT**

This final rule TSD outlines the analytical approaches used in the rulemaking. The final rule TSD consists of 16 chapters (including an environmental impact analysis and regulatory impact analysis) and 25 appendices.

Chapter 1	Introduction: Provides an overview of the appliance standards program, describes how the program applies to the residential heating products rulemaking, and outlines the structure of the document.
Chapter 2	Analytical Framework: Describes the procedural and analytical approaches used to evaluate the establishment of amended energy conservation standards for residential heating products.
Chapter 3	Market and Technology Assessment: Characterizes the residential heating products market and the technologies available for increasing product energy efficiency.
Chapter 4	Screening Analysis: Determines which technology options are viable for consideration in the engineering analysis.
Chapter 5	Engineering Analysis: Discusses the methods used for developing the relationship between increased manufacturer price and increased energy efficiency.

Chapter 6	Markups to Determine Product Price: Discusses the methods used for establishing markups to convert manufacturer prices to customer product prices.
Chapter 7	Energy Use Characterization: Discusses the process used for generating energy use estimates for a variety of building types, climate locations, and standard levels.
Chapter 8	Life-Cycle Cost and Payback Period Analyses: Discusses the economic effects of standards on individual customers and users of the products and compares the LCC and PBP of products with and without amended energy conservation standards.
Chapter 9	Shipments Analysis: Discusses the methods used for forecasting shipments with and without amended energy conservation standards.
Chapter 10	National Impact Analysis: Assesses the aggregate impacts at the national level of potential energy conservation standards for each of the considered products, as measured by the net present value (NPV) of total consumer economic impacts and the national energy savings (NES).
Chapter 11	Life-Cycle Cost Sub-Group Analysis: Outlines the effects of amended energy conservation standards on a sub-group of consumers of residential heating products and compares the LCC and PBP of products with and without amended energy conservation standards for these consumers.
Chapter 12	Manufacturer Impact Analysis: Discusses the effects of amended energy conservation standards on the finances and profitability of product manufacturers.
Chapter 13	Utility Impact Analysis: Outlines the effects of amended energy conservation standards on the installed generation capacity of electric, gas, and oil utilities.
Chapter 14	Employment Impact Analysis: Outlines the effects of amended energy conservation standards on national employment.
Chapter 15	Regulatory Impact Analysis for Residential Heating Products: Outlines the impact of non-regulatory alternatives to amended energy conservation standards.
Chapter 16	Environmental Impact Analysis for Residential Heating Products: Outlines the effects of amended energy conservation standards on three pollutants—sulfur dioxide (SO <sub>2</sub> ), nitrogen oxides (NO <sub>x</sub> ), and mercury (Hg)—as well as carbon emissions.

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