REGULATORY IMPACT ANALYSIS

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1. INTRODUCTION

The Department of Energy has determined that proposed water heater efficiency standards constitute an "economically significant regulatory action" under Executive Order 12866 "Regulatory Planning and Review" (58 FR 51735, October 4,1993). Therefore, the efficiency standards proposal requires a regulatory analysis. This document details several possible alternatives to the current proposal, and analyzes the costs and benefits of each.

2. METHODOLOGY

Each of the alternatives considered improve the overall efficiency of the water heater stock. In each case, the analysis makes particular assumptions about the market share of water heater designs with varying efficiency. The efficiency market share of the base case is described in detail in Section 11.3.1.1. Non-regulatory alternatives generally cause a shift of a small amount of market share towards more efficient water heater models. In addition, in the case of scenarios involving credits, rebates or subsidies, there may be a direct financial benefit to consumers.

A shift in market share to higher efficiency may increase the average retail price and installation cost of new water heaters. In some scenarios, these cost increases are partially mitigated by government rebates or credits. Operating costs will generally decrease due to a decline in energy consumption. These effects may cause a shift in market shares by fuel type,[a] an indirect effect on net benefit and energy savings. Once market shares and costs are determined, we treat each non-regulatory approach in the same way as we did the proposed standards.

In general, the effect on costs and market share are moderate in the non-regulatory scenarios compared with the proposed standards. Net present values of the scenarios described include all savings to consumers, but do not include government expenditures which would be needed to initiate them.

[a] The interaction between market share by efficiency, equipment, and operating costs and fuel type market shares is described in detail in Chapter 11 and not repeated here.

2.1 No New Regulatory Action

We have carefully evaluated the case in which no regulatory action is taken with regard to water heater efficiency. This constitutes the "base case" scenario referred to in the previous chapters. From our assessment of current market shares, equipment and operating costs, we forecast water heater shipments and subsequent efficiency of the stock, from 2004 through 2030 (see Chapter 11). We then calculate total source energy consumption for water heaters (see Chapter 12). From this analysis, we expect a total consumption of 124.5 quads of source energy over the forecast period. This defines the basis of comparison for all other scenarios, thus defining zero energy savings and a net present value of zero dollars.

2.2 Informational Action

The two informational action alternatives are consumer product labeling and DOE public education and information programs (about both current and alternate water heater technologies). In both these cases, we assume that the programs will influence a relatively small fraction of consumers to purchase more efficient water heaters, thereby improving the overall efficiency of water heater stock.

2.2.1 Consumer Product Labeling

The first of these two scenarios implements a program of product labeling designed to inform consumers about the operating cost savings associated with buying a more efficient water heater. We assume that 50% of consumers will be impacted by the program, that is, they will consider the efficiency information presented. Of these, we expect that 10% are likely to change their purchase decision based on the available information. This results in a total market shift of 5%. To forecast the effects of this program, we start with the current efficiency market share estimate. We then move 5% of each significant market share to the next most efficient level. For example, if the lowest available efficiency level currently holds 20% of market share we shift 20%*5%=1% to the second least efficient level, and so on.

The result of this scenario is an overall source energy savings of 0.08 quads relative to the base case. The net present value of this program is forecast to be -$3 million, that is, consumer energy cost savings do not justify increased equipment costs in this case.

2.2.2 Public Education

A similar approach is to consider an Energy Star® program for heat pump water heaters. This approach affects electric water heaters only. We assume that, under this program, heat pump water heater sales reach 150,000 per year in 2008. In order to model this scenario, we assume that a shift in market share corresponding to 150,000 units occurs in 2009 and that this new market share configuration continues through 2030. The number of heat pump water heaters expected to be shipped in 2009 corresponds to roughly 3% of the total number of forecast shipments in that year.

Therefore we subtract 3% from the market share of the next most efficient design option, and add it to the heat pump market share.

We expect 0.5 quads of source energy savings from the Energy Star® program, with a net present value of $400 million.

2.3 Prescriptive Standards

One alternative to regulating minimum water heater efficiency performance is the requirement that newly manufactured water heaters utilize a particular efficiency-related design technology. For water heaters, DOE assumes that prescriptive standards are somewhat below the performance standards because a prescriptive standard reduces a manufacturer's flexibility to find a more cost-effective solution.

We assume that the prescriptive standard would require the inclusion of heat traps in the design of water heaters of all fuel types. Water heaters with heat traps are more efficient than the current standard, but fall below Trial Standard Level 1 for electric, natural gas, and LPG models. Our estimate of the current baseline market shares estimates that heat trap water heaters currently possess the same market share as baseline units without heat traps. The effect of the prescriptive standard is to remove all of the market share of baseline units, and add it to that of the heat trap design. The result of this market shift is a slight increase in retail price, no increase in installation cost, and a slight decrease in operating cost. Over the period from 2004 to 2030, we expect that prescriptive standards would save 0.7 quads of source energy, with a resulting net present value of $1.0 billion.

2.4 Financial Incentives

We consider several scenarios in which some form of financial incentive is provided to consumers in order to encourage the purchase of high-efficiency water heaters. There are three types of incentives: tax credits, rebates and subsidies. Tax credits can be granted to consumers who purchase high-efficiency water heaters. Alternatively, the government can issue tax credits to manufacturers in order to offset costs associated with producing high-efficiency designs. We also consider the scenario in which the government provides consumers with a cash rebate at the time of purchase. The effects of rebates are similar to those of tax credits. Finally, we consider the case of subsidies designed to remove market barriers which affect primarily low-income and senior-only households. The analysis models financial incentive programs assuming that they begin in 2004 and continue for six years, after which time the program ends, and the market returns to the base case.

Financial incentive programs involve some market shift to a well-defined target efficiency. Table RIA.1 summarizes the design options corresponding to the assumed target efficiencies of these possible programs.

Table RIA.1 Energy-Efficient Design Options Qualifying for Financial Incentive Programs

Fuel	Efficiency Factor*	Trial Standard Level	Design Option	Incremental Manufacturer Cost $
Electric	0.91	4	3" Insulation	78
Natural Gas, LPG	0.60	2	78% RE+2.5" Insulation	37
Oil	0.61	4	Increased HX Area	161

* EF at typical rated volumes: 50 gallons for electric, 40 gallons for natural gas and LPG, 32 gallons for oil.

2.4.1 Tax Credits to Consumers

DOE assumes tax credits equal to 50% of the difference between retail price of baseline and high-efficiency models. The value to the consumer of this credit is discounted slightly based on the assumption that the consumer receives it about six months after purchase of the water heater.[a] We assume that, as a direct effect of tax credits, 5% of total market share will be shifted from baseline to targeted high-efficiency models. Although the program remains in effect for only six years, it will produce energy savings throughout the period from 2003 to 2030, because high-efficiency units bought under the program remain in the stock for many years. The total source energy savings expected from this program is 0.1 quads, with a net present value of $200 million.

2.4.2 Tax Credits to Manufacturers

We consider a manufacturer tax credit equal to 20% of all tooling and machinery costs associated with designing and producing high-efficiency units. Manufacturer incremental costs are summarized in Table RIA.1 above. We assume that this mitigation of costs will be passed directly on to consumers, and that the resulting price break will cause a small (1%) shift in market share from baseline to high-efficiency units. The source savings of this scenario is 0.039 quads, with a net present value of $30 million.

2.4.3 Consumer Rebates

There are two possible scenarios considered which involve consumer rebates. Like the tax credit scenarios, each lasts for 6 years. The first of these targets the same high-efficiency models as the tax credit scenarios. We assume a rebate of 35% of the retail price difference between

[a] The average of consumer discount rates used in the Life-Cycle Cost analysis is 6.06%. The equivalent interest rate compounded semiannually is 2.99%. This results in a discount factor of 0.97 for a payment received 6 months after purchase.

baseline and high-efficiency models. As in the case of tax credits to consumers, this incentive is expected to shift 5% of total market share from baseline to high-efficiency models. Such a rebate results in a source energy savings of 0.1 quads and a net present value of $200 million.

We also consider a rebate scenario involving electric heat pump water heaters. In this case, only shipments due to new construction are considered, since heat pump units may require more closet space and more air space from which to remove heat[a]. DOE estimates installed costs of heat pump water heaters ($875) and market penetration levels (300,000 units per year) based on ADL data on drop-in heat pump water heaters. We forecast that base case electric water heater shipments total 29.3 million from 2004 to 2009, or 4.9 million per year on average. A market penetration of 300,000 annual heat pump water shipments amounts to 6% of this total. Therefore we model the heat pump rebate scenario by as a market shift of 6% which lasts for the six years the program is in effect. This results in a source energy savings of 0.5 quads and a net present value of $800 million.

2.4.4 Low Income and Seniors Subsidy

The final financial incentive we consider is a subsidy targeted at low-income and senior-only households. One of the market barriers to higher efficiency water heaters is the expense of upgrading venting systems for gas-fired units. Another market barrier for electric and gas-fired water heaters is the expense of enlarging small closets or relocating water heaters with thicker insulation when they will not fit into an existing space. These expenses can be a particular burden on low-income and seniors-only households. The subsidy program provides $100 towards the purchase and installation of a high-efficiency water heater. According to the RECS survey,[1] 28% of current households qualify as low-income or senior-only. We assume that half of these, or 14% of all households will take advantage of the program by buying one of the high-efficiency water heaters listed in Table RIA.1. Consequently a 14% market shift results which continues for the 6 years that the program is in place. Total source energy savings associated with this alternative is 0.4 quads. Net present value is $500 million.

2.5 Voluntary Efficiency Targets

The voluntary efficiency target scenario considers the possibility that manufactures will include energy efficient design in all new water heaters, in the absence of any regulatory intervention. In this scenario, we assume that new water heaters would be of a design equivalent to Trial Standard Level 1 of the current proposal. While the proposed standards are scheduled to go into effect in 2004, voluntary efficiency targets are assumed to take effect at some later date. The analysis considers the possibility that the delay in adoption of more efficient design is either 5 or 10 years.

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[a] These concerns were part of the reason DOE eliminated heat pumps from consideration in this rulemaking, as explained in Chapter 4.

The effect of voluntary efficiency targets is simply modeled by assuming that all of the market share held by design options which are less efficient that Trial Standard Level 1 is transferred to the Trial Standard Level 1 option. This market shift is assumed to take place abruptly in either 2009 or 2014. The results of this scenario is a source savings of 2.8 quads and a net present value of $900 million in the case of a 5-year delay, or a source savings of 2.1 quads and a net present value of $500 million in the case of a 10-year delay.

2.6 Mass Government Purchases

The final non-regulatory scenario that we consider is the purchase of high-efficiency electric and gas-fired water heaters by Federal, State and local governments. We modeled this policy by assuming that government agencies—i.e., U.S. Department of Housing and Urban Development (HUD)— purchase high-efficiency water heaters for 5% of low-income rented housing. This number of households are estimated to generate 82,500 water heater shipments per year. We assume that the policy continues through 2030, and that fuel type market shares remain at current levels for low-income households, as provided by RECS. The resulting high-efficiency shipments are then converted into a market share shift based on baseline shipment forecasts. This scenario results in a source energy savings of 0.06 quads, with a net present value of $10 million.

3. RESULTS

Total source savings and net present value of each of the non-regulatory alternatives is given in Table RIA.2. For comparison to proposed efficiency standards, Trial Standard Level 3 is included at the bottom of the table. Government expenditures related to the scenarios are not included in net present value.

Table RIA.2 Regulatory Alternative Results

Scenario	Source Energy Savings (Quads)	NPV (billion 1998$)
Baseline	0.0	0.0
Consumer Product Labeling	0.08	-0.003
Public Education	0.5	0.4
Prescriptive Standards	0.7	1.0
Consumer Tax Credits	0.1	0.2
Manufacturer Tax Credits	0.03	0.03
Consumer Rebates High-Efficiency	0.1	0.2
Consumer Rebates Heat Pump	0.5	0.8
Low Income and Seniors Subsidy	0.4	0.5
Voluntary Efficiency Target (5-year delay)	2.8	0.9
Voluntary Efficiency Target (10-year delay)	2.1	0.5
Mass Government Purchases	0.06	0.01
Proposed Trial Standard Level 3	4.6	2.0

REFERENCE

1. U.S. Department of Energy - Energy Information Administration, *Residential Energy Consumption Survey: Household Energy Consumption and Expenditures 1997,*1999. <http://www.eia.doe.gov/emeu/recs/recs97/publicusefiles.html>