CHAPTER 12. PRELIMINARY MANUFACTURER IMPACT ANALYSIS

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CHAPTER 12. PRELIMINARY MANUFACTURER IMPACT ANALYSIS

12.1 INTRODUCTION

The purpose of the manufacturer impact analysis (MIA) is to identify and quantify the likely impacts of energy conservation standards on manufacturers. In the notice of proposed rulemaking (NOPR) stage of the analysis, the U.S. Department of Energy (DOE) considers a wide range of quantitative and qualitative industry impacts that might occur due to an energy conservation standard. For example, a particular standard level could require changes in manufacturing practices, equipment, raw materials, etc. DOE fully analyzes these impacts during the NOPR stage.

DOE announced changes to the preliminary analysis MIA format through a report issued to Congress on January 31, 2006 (as required by section 141 of the Energy Policy Act of 2005 (EPACT 2005), titled Energy Conservation Standards Activities.[1] As a result, DOE collects, evaluates, and reports preliminary MIA information in the preliminary analysis (as opposed to waiting for the NOPR stage). Such preliminary information includes market data, market shares, industry consolidation, product mix, key issues, conversion costs, foreign competition, and cumulative regulatory burden information, if available. DOE solicits this information during the preliminary manufacturer interviews and reports the results in this chapter.

To the extent appropriate for this rulemaking, DOE applies the methodology described below to evaluate energy conservation standards for furnace fans.

12.2 METHODOLOGY

DOE conducts the MIA in three phases. In Phase I, DOE creates an industry profile to characterize the industry and conducts a preliminary MIA to identify important issues that require consideration. Section 12.3.1 of this chapter presents initial findings of the Phase I analysis. In Phase II, DOE prepares an industry cash flow model and a detailed interview questionnaire to guide subsequent discussions with manufacturers. In Phase III, DOE interviews manufacturers and assesses the impacts of energy conservation standards both quantitatively and qualitatively. DOE assesses industry and subgroup cash flow impacts and industry net present value using the Government Regulatory Impact Model (GRIM). For additional details on the GRIM, see section 12.2.2.1. DOE also assesses impacts on competition, manufacturing capacity, employment, and regulatory burden based on manufacturer interviews and discussions. The NOPR and technical support document present results of the Phase II and III analyses.

[1] U.S. Department of Energy. Energy Conservation Standards Activities. 2006. (Last accessed February 8, 2012.) http://www1.eere.energy.gov/buildings/appliance_standards/schedule_setting.html

12.2.1 Phase I: Industry Profile

In Phase I of the MIA, DOE collects pertinent qualitative and quantitative financial and market information. This includes data on wages, employment, industry costs, and capacity utilization rates for manufacturers of furnace fans. Sources of information include reports published by industry groups, trade journals, the U.S. Census Bureau, and Securities Exchange Commission (SEC) 10-K filings. In addition, DOE relies on information from its market and technology assessment, engineering analysis, life-cycle cost analysis, and consumer price analysis to characterize the furnace fan manufacturing industry.

12.2.2 Phase II: Industry Cash-Flow Analysis and Interview Guide

In Phase II, DOE performs a preliminary industry cash-flow analysis and prepares written guidelines for interviewing manufacturers.

12.2.2.1 Industry Cash-Flow Analysis

The GRIM is a financial model that analyzes the impacts of energy conservation standards. Energy conservation standards may affect investment, production costs, and revenue through changes in prices and, possibly, shipments. The GRIM uses several factors to determine a series of annual cash flows for the year that energy conservation standards become effective and for several years after implementation. These factors include annual expected revenues, costs of sales, selling and general administration costs, taxes, and capital expenditures. Inputs to the GRIM include financial information, manufacturing costs, shipment forecasts, and price forecasts developed in other analyses. The financial information is developed from publicly available data and confidentially submitted manufacturer information. DOE compares the results of the GRIM against baseline projections in which no energy conservation standards are in place. The financial impact of energy conservation standards is the difference between the two sets of discounted annual cash flows.

12.2.2.2 Interview Guide

DOE conducts interviews with manufacturers to gather information on the effects of energy conservation standards on revenues, costs, direct employment, capital assets, and industry competitiveness. Before the interviews, which occur in Phase III, DOE distributes an interview guide to help identify the impacts of energy conservation standards on individual manufacturers or subgroups of manufacturers. Interview guide topics include production costs, shipment projections, market share, product mix, conversion costs, markups and profitability, competition, manufacturing capacity, cumulative regulatory burden, and other relevant topics.

12.2.3 Phase III: Subgroup Analysis

Phase III activities take place after publication of the preliminary analysis. These activities include manufacturer interviews; revision of the industry cash-flow analysis; a manufacturer subgroup analysis; and an assessment of the impacts on industry competition, manufacturing capacity, direct employment, cumulative regulatory burden, as well as other qualitative impacts.

12.2.3.1 Manufacturer Interviews

DOE conducts detailed interviews with manufacturers to gain insight into the potential impacts of energy conservation standards on sales, direct employment, capital assets, and industry competitiveness. The interview process is critical to the MIA because it provides an opportunity for manufacturers to privately express their views on important issues. Interviews are scheduled well in advance to provide every opportunity for manufacturers to be available for comment. Although a written response to the questionnaire is acceptable, DOE prefers interactive interviews, which help clarify responses and provide the opportunity to identify additional issues not specifically addressed in the interview questionnaire. A non-disclosure agreement allows confidential or sensitive information to be considered in DOE's decision-making process. Confidential information will not be made available in the public record. At most, sensitive or confidential information may be aggregated and presented in industry-wide representations.

DOE supplements the information gathered in Phase I and the cash-flow analysis performed in Phase II with information gathered during manufacturer interviews.

12.2.3.2 Revised Industry Cash-Flow Analysis

As discussed, DOE requests information about profitability impacts, necessary plant changes, and other manufacturing impacts during the interview process. DOE revises its industry cash flow model based on the feedback it receives in comments and during interviews.

12.2.3.3 Manufacturer Subgroup Analysis

Using average cost assumptions to develop an industry cash flow estimate will not adequately assess differential impacts among manufacturer subgroups. Smaller manufacturers, niche players, and manufacturers exhibiting a cost structure that differs largely from the industry average could be more negatively affected. Ideally, DOE would consider the impact on every firm individually; however, it typically uses the results of the industry characterization to group manufacturers with similar characteristics. During the interviews, DOE discusses the potential subgroups that have been identified for the analysis. DOE asks manufacturers and other interested parties to suggest what subgroups or characteristics are most appropriate for the analysis.

12.2.3.4 Competitive Impact Assessment

Section 342(6)(B)(i)(V) of the Energy Policy Act of 1992 (EPACT 1992), modifying the Energy Policy and Conservation Act (EPCA), directs DOE to consider any lessening of competition likely to result from the imposition of standards. EPCA further directs the U.S. Attorney General to determine the impacts, if any, of any decrease in competition. DOE attempts to gather and report firm-specific financial information and impacts wherever possible. DOE bases the competitive impact assessment on manufacturer cost data and other information collected from interviews. When assessing competitive impacts, DOE's interviews generally focus on assessing asymmetrical cost increases, the potential increase in business risks from an increased proportion of fixed costs, and potential barriers to market entry (e.g., proprietary

technologies). The competitive analysis will also focus on assessing any differential impacts to smaller manufacturers.

12.2.3.5 Manufacturing Capacity Impact

One of the significant outcomes of energy conservation standards can be the obsolescence of existing manufacturing assets, including tooling and other investments. The manufacturer interview guide presents a series of questions to help identify impacts on manufacturing capacity, specifically capacity utilization and plant location decisions in the United States with and without energy conservation standards. The interview guide also addresses the ability of manufacturers to upgrade or remodel existing facilities to accommodate the new requirements; the nature and value of stranded assets, if any; and estimates for any one-time restructuring or other charges, where applicable.

12.2.3.6 Employment Impact

The impact of energy conservation standards on employment is an important consideration in the rulemaking process. To assess how domestic employment patterns might be affected, the interview process explores current employment trends in the furnace fan industry and solicits manufacturer views on changes in employment patterns that may result from increased standard levels. The employment impacts section of the interview guide focuses on current employment levels at production facilities, expected future employment levels with and without an energy conservation standard, differences in workforce skills, and employee retraining.

12.2.3.7 Cumulative Regulatory Burden

DOE seeks to mitigate the overlapping effects on manufacturers due to energy conservation standards and other regulatory actions. DOE analyzes and considers the impact on manufacturers of multiple, product-specific regulatory actions.

12.3 PRELIMINARY MANUFACTURER IMPACT ANALYSIS RESULTS

During the preliminary activities phase, DOE conducted a preliminary evaluation of the impact of potential energy conservation standards on the furnace fan industry.

The primary sources of information for this analysis are the U.S. Census, industry reports, and interviews with manufacturers of furnace fans, conducted during the summer of 2011. To maintain confidentiality, DOE only reports aggregated information here. DOE does not disclose company-specific information, nor does it identify the individual manufacturers that disclosed information.

12.3.1 Industry Overview

The following section summarizes publicly available industry data.

12.3.1.1 Industry Cost Structure

DOE is unaware of any publicly available industry-wide cost data specific to only manufacturers of residential furnace fans. DOE examined the North American Industry Classification System (NAICS) codes for small business sizes and determined that furnace fan manufacturing is classified as a subset under NAICS code 333415, Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing.[2] Therefore, DOE presents the data below as a broader industry proxy for the furnace fan industry, which, in combination with information gained in interviews, inform DOE's analysis of the industry cost structure.

DOE obtained the below data from the U.S. Census Bureau's Annual Survey of Manufacturers, Statistics for Industry Groups and Industries from 2002 to 2010[3].

Table 12.3-1 presents the industry employment levels and earnings from 2002 to 2010. The statistics illustrate approximately a 23.3% decrease in production workers and a 23.0% percent decrease in overall number of employees from 2002 to 2010.

Table 12.3-1 Employment and Earnings for the Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing

Industry Year	**Production Workers**	**All Employees**	**Annual Payroll** ***$1000s***
2002	80,400	108,252	3,815,129
2003	77,471	104,646	3,775,799
2004	73,559	99,669	3,707,969
2005	76,011	102,354	3,942,808
2006	74,909	98,097	4,019,813
2007	74,728	101,485	4,034,043
2008	70,787	96,610	4,020,656
2009	60,259	85,475	3,768,643
2010	61,668	83,361	3,778,633

Source: U.S. Census Bureau. *Annual Survey of Manufacturers*, 2002-2010.

Table 12.3-2 presents the costs of materials and industry payroll as a percentage of shipment value from 2002 to 2010. During that timeframe, the cost of materials as a percentage of shipment value has increased 6.5%, the cost of payroll for production workers as a percentage of shipment value has decreased 20.8%, and the cost of total payroll as a percentage of shipment value has decreased 15.2%.

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[2] U.S. Census Bureau. North American Industry Classification System (NAICS) code 333415. "Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing." 2007. (Last accessed February 9, 2012.) http://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=333415&search=2007%20NAICS%20Search

[3] U.S. Census Bureau. Annual Survey of Manufacturers, Statistics for Industry Groups and Industries. (Last accessed February 9, 2012.) www.census.gov/manufacturing/asm/index.html

Table 12.3-2 Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing Industry Material and Payroll Costs

Year	Cost of Materials *% of shipment value*	Cost of Payroll for Production Workers *% of shipment value*	Cost of Total Payroll *% of shipment value*
2002	49.36	9.83	15.85
2003	50.59	9.53	15.39
2004	51.81	8.99	14.57
2005	53.78	8.52	13.78
2006	53.17	8.87	13.80
2007	55.59	8.17	13.43
2008	54.83	8.13	13.50
2009	54.14	7.89	14.05
2010	52.59	7.79	13.44

Source: U.S. Census Bureau. *Annual Survey of Manufacturers*, 2002-2010.

12.3.1.2 Inventory Levels

Table 12.3-3 shows the year-end inventory for the Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing industry obtained from the U.S. Census Bureau, Annual Survey of Manufacturers, Statistics for Industry Groups and Industries from 2002 to 2010. Year-end inventory refers to the amount of inventory a manufacturer has on hand at year end, which includes work-in-progress and finished goods. Again, DOE presents these data as a broader measure of the furnace fan industry. The industry's end-of-year inventory increased from 2002 to 2007, and then decreased from 2007 to 2010.

Table 12.3-3 End-of-Year Inventory for the Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing Industry

Year	End-of-Year Inventory *$000s*	End-of-Year Inventory *% of shipment value*
2002	2,302,012	9.57
2003	2,376,827	9.69
2004	2,473,932	9.72
2005	2,687,441	9.39
2006	2,887,139	9.91
2007	3,036,616	10.11
2008	2,888,034	9.72
2009	2,636,972	9.83
2010	2,585,194	9.19

Source: U.S. Census Bureau. *Annual Survey of Manufacturers*, 2002-2010.

DOE obtained full production capacity utilization rates from the U.S. Census Bureau, Current Industrial Reports, Survey of Plant Capacity from 2002 to 2010.[4] Table 12.3-4 presents

[4] U.S. Census Bureau. Survey of Plant Capacity Utilization. (Last accessed February 9, 2012.) http://www.census.gov/manufacturing/capacity/index.html

production capacity utilization rates for NAICS code 3334. Full production capacity is defined as the maximum level of production an establishment could attain under normal operating conditions. In the Survey of Plant Capacity report, the full production utilization rate is a ratio of the actual level of operations to the full production level.

Table 12.3-4 Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing Industry Full Production Capacity Utilization Rates

Year	Ventilation, Heating, Air Conditioning, and Commercial Refrigeration Equipment Manufacturing %
2002	60
2003	62
2004	60
2005	66
2006	63
2007	58
2008	64
2009	57
2010	60

Source: U.S. Census Bureau. *Quarterly Survey of Plant Capacity Utilization: Fourth Quarters 2002 through 2010.*

12.3.2 Interview Topics and Preliminary Findings

The following section summarizes information gathered during interviews held during the summer of 2011 for the preliminary MIA.

12.3.2.1 Market Shares and Industry Consolidation

Energy conservation standards can alter the competitive dynamics of the marketplace, prompting companies to enter the market, exit the market, or merge with other companies. The preliminary MIA interview questions asked manufacturers to share their perspectives on industry consolidation both in the presence of current energy conservation standards, as well as in the case of future, potentially more stringent standard levels. The interview questions focused on gathering information that assessed:

- current and anticipated market share in the event of standards;
- disproportionate cost increases to some manufacturers;
- likelihood of industry consolidation;
- increased proportion of fixed costs potentially increasing business risks; and
- potential barriers to market entry (e.g., proprietary technologies).

The need to assess anti-competitive effects of potential amended energy conservation standards derives from the need to protect consumer interests. During the interviews, DOE also solicited information to determine whether amended energy conservation standards could result in disproportionate economic or performance penalties for particular consumer or user subgroups. Manufacturers were also asked if energy conservation standards could result in

products that would be more or less desirable to consumers due to changes in product functionality, utility, or other features.

Market Shares. DOE inquired about current market shares of manufacturers in the furnace fan industry and about how those shares might change after potential amendment of energy conservation standards. Manufacturers stated that, in the presence of amended standards, market shares would be more likely to change for smaller companies than for larger companies, which typically have access to more resources.

Industry Consolidation. The furnace fans industry has experienced some consolidation in recent years. However, manufacturers interviewed as part of the preliminary MIA indicated that consolidation has been driven more by economic conditions and the housing industry rather than by government regulations.

12.3.2.2 Production and Product Mix

DOE requested manufacturers' feedback on the possible impact of energy conservation standards on profitability. For instance, capital and product conversion outlays may be required to upgrade or redesign products before they have reached the end of their useful life, which could result in reduced cash flow and stranded investments. Higher energy conservation standards could also result in higher per-unit costs that could cause consumers to shift to less expensive products, if available.

Product Mix. DOE is interested in understanding if amended energy conservation standards might change a manufacturer's product mix and if this change would affect profits. For example, higher energy efficiency standards might limit a manufacturer's ability to differentiate products and market premium products that command higher profit margins. DOE will also investigate how amended energy conservation standards might affect a manufacturer's consumer mix and its distribution channels, and how in turn this might change profitability. During preliminary interviews, one manufacturer stated that setting a new energy conservation standard is unlikely to impact product mix because the standard would impact all product classes similarly. As explained in more detail in chapters 3 and 5 of this TSD, DOE expects that manufacturers can use similar technology pathways to achieve similar increases in efficiency at similar cost for units with similar capacities, regardless of product class. Therefore, a standard would not have differential cost or efficiency impacts for any given product class that could result in a shift in product mix.

However, product mix may be affected by the relationship between furnace fan minimum efficiency levels and SEER levels for uncovered blower-coils in air-conditioners. Manufacturers of HVAC products that use furnace fans that are covered in this rulemaking also manufacture HVAC products, such as CAC blower-coil units, that use circulation fans that are not covered in this rulemaking. The electrical consumption of circulation fans used in CAC blower-coil air handlers is regulated by DOE using the SEER metric in a separate rulemaking. The minimum efficiency level set by the furnace fan rulemaking could be more or less stringent on fan electrical consumption compared to the SEER standards. If so, the combined effect of the furnace fan and SEER standards would have differential impacts on covered products compared to uncovered products like CAC blower-coil air handlers. These differential impacts could result

in a shift in the product mix. Chapter 3 of this TSD provides a detailed discussion of the scope of coverage of this rulemaking.

Product Utility. Amended energy conservation standards might require changes in product functionality, utility, and other features that would make products less desirable to consumers. Manufacturers expressed concern that complying with new standards for a component such as furnace fans may reduce the efficiency of the overall finished product. One manufacturer recalled an ASHRAE publication on air mover systems in which the overall performance of a unit is more efficient when several less efficient movers are used, rather than one more efficient unit. The manufacturer did not provide detailed reference information for the study. Therefore, setting a standard for a component may reduce product utility by limiting synergies between components. Furthermore, due to the higher costs of more efficient fans, customers may switch to cheaper heating technologies that may not provide the same features or quality of heating and cooling provided by furnaces and air conditioners. For example, some customers may use space heating equipment to heat their homes instead of a central heating system, which does not provide comparable distribution of conditioned air. Product utility may also be affected by the use of certain technology options DOE has identified. For example, although PSC motors may be less efficient, they are generally more reliable and easier to maintain than ECMs. Also, Backward-curved impellers are more sensitive to installation configuration. Manufacturers may not be able to offer models using backward-curved impellers that can be installed in a multiple configurations (i.e. upflow, downflow, and horizontal) as is common with HVAC products that use forward-curved impellers.

12.3.2.3 Cumulative Regulatory Burden

While any one regulation may not impose a significant burden on manufacturers, the combined effects of several impending regulations may have serious consequences for some manufacturers, groups of manufacturers, or an entire industry. Assessing the impact of a single regulation may overlook this cumulative regulatory burden. For the cumulative regulatory burden analysis, DOE describes other significant equipment-specific regulations that could affect furnace fan manufacturers or their parent companies.

Based on its own research and discussions with manufacturers, DOE identified several regulations relevant to furnace fans, including:

- DOE Energy Efficiency Standards
- Canadian Standards
- UL Certification
- California Title 24
- ASHRAE Standards
- Energy Star

DOE Energy Efficiency Standards. DOE recently issued amended standards for residential furnaces and central air conditioners in June 2011. Since manufacturers of furnace fans are also manufacturers of furnaces and air conditioners, they would need to comply with DOE standards at both the component and system levels.

Canadian Standards. Many manufacturers are also affected by Canadian energy efficiency standards. The CSA C823 standard specifies requirements for measuring the air delivery and the electrical energy consumption of air handlers in residential space conditioning systems over a range of static pressures and speed control settings. Manufacturers who sell their products in the US and in Canada would need to comply with two different sets of standards for furnace fans.

California Title 24. Title 24, Part 6, of the California Code of Regulations includes building energy efficiency standards for residential and nonresidential buildings. The California Energy Commission (CEC) published new standards in 2008 that became effective January 1, 2010. These standards include W/CFM limits for fans used in central, residential HVAC systems. Manufacturers would need to comply with state standards, such as California Title 24, as well as the federal energy conservation standard.

Energy Star. ENERGY STAR originally set specifications for residential gas and oil furnaces in 1995. ENERGY STAR specifications for furnaces did not include provisions for the electrical consumption of the furnace fan until the most recent revisions, Versions 3.0 and 4.0. In versions 3.0 and 4.0, the furnace fan electrical consumption must account for less than 2% of the total energy consumption (electrical and fuel) of the furnace. Version 3.0 took effect on February 1, 2012 and Version 4.0 will take effect on February 1, 2013.

12.3.3 Overall Key Issues

Perhaps the most important aspect of the preliminary MIA is the opportunity it creates for DOE to identify key manufacturer issues early in the development of energy conservation standards. During preliminary interviews, manufacturers identified several major issues, which are detailed in the following sections.

12.3.3.1 Regulation of Components

During the preliminary manufacturer impact analysis interview process, manufacturers expressed concern that DOE is now regulating components and sub-assemblies. In doing so, system effects could be ignored. One manufacturer provided the example that, in commercial HVAC equipment, using several less efficient fans may result in a more efficient system overall than using a single more efficient fan, but this system effect is not considered when determining minimum efficiency levels for individual components. Furthermore, some manufacturers stated that adopting such a narrow scope would limit design ingenuity, especially if few options are available which would allow compliance with new standards. Manufacturers also commented that customers may have difficulty making purchasing decisions if too many ratings are included on energy guide labels. For instance, having both an AFUE rating and a fan efficiency rating (FER) rating on the labels may confuse customers.

12.3.3.2 Customer Impact

Manufacturers were also concerned about potential impacts on their customers. If new standards are set too high, consumers may have a very limited range of options for furnace fans. Furthermore, if ECM motors are used, customers may have to pay more in order to maintain a level of AFUE efficiency that would have been attainable at a lower price for furnaces that use PSC motors. Customers who do not want to increase costs may decide to purchase units with lower AFUE ratings to offset the increase in price due to use of an ECM motor. In addition to being more expensive, ECM motors may also require more maintenance. If the price of furnace fans increases due to the new standards, customers may be more likely to repair an old unit rather than purchase a new unit. In addition, as described in section 12.3.3.1, customer purchasing decisions may be complicated if more than one rating is included on furnace fan energy guide labels.

12.3.3.3 PSC Market

Manufacturers also commented on the possibility that the PSC market may be eliminated if new standards are set. The minimum efficiency levels that would be required by a new standard may be more difficult to meet with PSC motors, and therefore the market for PSC motors in the furnace fan industry may shrink or disappear. With approximately 70% of new construction currently using PSC blowers, the impact on both manufacturers and suppliers of the furnace fan industry would be significant. If the PSC market were eliminated, manufacturers stated that consumers may switch to cheaper, alternative heating technologies. For example, if PSC motors could not be used to meet new minimum efficiency levels and the use of more expensive ECM motors raised the price of furnaces, some consumers may decide to heat their homes with water heaters instead.