Energy Conservation Standards Rulemaking Framework Document for Small Electric Motors

U.S. Department of Energy
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LIST OF ACRONYMS

AEO	Annual Energy Outlook
ANOPR	advance notice of proposed rulemaking
BT	Building Technologies Program
CAIR	Clean Air Interstate Rule
CFR	Code of Federal Regulations
CSCR	capacitor-start, capacitor-run
CSIR	capacitor-start, induction-run
CSL	candidate standard level
DOE	U.S. Department of Energy
DOJ	U.S. Department of Justice
EERE	Office of Energy Efficiency and Renewable Energy
EIA	Energy Information Administration
EPCA	Energy Policy and Conservation Act
FR	Federal Register
GRIM	Government Regulatory Impact Model
Hz	hertz
IEEE	Institute of Electrical and Electronics Engineers, Inc.
IMBUILD	Impact of Building Energy Efficiency Programs (spreadsheet model)
IMPLAN	Impact Analysis for Planning (national input-output model)
LCC	life-cycle cost
NEMA	National Electrical Manufacturers Association
NEMS	National Energy Modeling System
NES	national energy savings
NOPR	notice of proposed rulemaking
NO_x	nitrogen oxides
NPV	net present value
OMB	Office of Management and Budget
PSC	permanent-split capacitor
R&D	research and development
RPM	revolutions per minute
SG&A	selling, general, and administrative costs
SO_2	sulfur dioxide
TSD	technical support document
TSL	trial standard level
U.S.C.	United States Code

Rulemaking Framework Document for Small Electric Motors

1 INTRODUCTION

The U.S. Department of Energy (DOE) Appliances and Commercial Equipment Standards Program, within the Office of Energy Efficiency and Renewable Energy (EERE)'s Building Technologies Program (BT), develops and promulgates test procedures and energy conservation standards for consumer appliances and commercial equipment. A DOE report submitted to Congress on January 31, 2006, identifies the rulemakings DOE has scheduled for completion by June 2011 and explains many of the techniques DOE will be applying during the rulemaking process to meet this schedule.

The purpose of this document is to describe the procedural and analytical approaches DOE anticipates using to evaluate energy conservation standards for small electric motors (see section 1.1 below for a discussion of the statutory authority for this rulemaking). This document is intended to inform stakeholders of the process DOE will follow for the standards rulemaking for these motors and to encourage and facilitate stakeholder input during the rulemaking. This document is merely the starting point for developing standards and is not a definitive statement with respect to any issue to be determined in the rulemaking.

Section 1 provides an overview of the rulemaking process. Sections 2 through 16 discuss analyses DOE intends to conduct to fulfill the statutory requirements and guidance for this standards rulemaking. As an initial matter, it should be noted that the category "small electric motors" includes several distinct types of motors. DOE will conduct separate analyses for each small electric motor type to determine whether amended energy conservation standards are technologically feasible, economically justified, and would result in significant conservation of energy. In other words, for each of the small electric motor types examined in this rulemaking, DOE will perform a separate set of analyses, including an engineering analysis, a life-cycle cost (LCC) and payback period analysis, a national impact analysis, and a manufacturer impact analysis.

DOE will maintain information regarding this rulemaking on its website at: http://www.eere.energy.gov/buildings/appliance_standards/.

While DOE invites stakeholder comment on all aspects of the material presented in this document, several specific issues on which DOE seeks comment are set out in comment boxes like this one. DOE uses these comment boxes to highlight issues and ask specific questions on the approaches DOE is proposing to follow to conduct the analyses required for the standards rulemaking.

1.1 The Appliances and Commercial Equipment Standards Program

The Energy Policy and Conservation Act (EPCA) of 1975, Pub. L. 94-163, (42 U.S.C. 6291–6309) established an energy conservation program for major household appliances. The National Energy Conservation Policy Act of 1978, Pub. L. 95-619, 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 Energy Policy Act of 1992 (EPACT), Pub. L. 102-486, also amended EPCA, and included amendments that expanded Title III to include certain types of commercial equipment, including small electric motors. Specifically, it amended section 346 of EPCA (42 U.S.C. 6317) to provide that the Secretary of Energy (the Secretary) prescribe testing requirements and energy conservation standards for those small electric motors for which the Secretary determines that standards "would be technologically feasible and economically justified, and would result in significant energy savings." (42 U.S.C. 6317(b)(1))

On July 10, 2006, the Secretary made a positive determination with respect to testing requirements and energy conservation standards for small electric motors. 71 FR 38799. As a result of DOE's determination analysis, the Secretary determined "preliminarily" that standards for small electric motors would be "technologically feasible and economically justified, and would result in significant energy savings." Id at 38807. DOE will determine whether and at what level to promulgate energy conservation standards for small electric motors based on in-depth consideration, with public participation, of the technical feasibility, economic justification, and energy savings of potential standards levels in the context for prescribing new or amended standards established by EPCA section 325(o),(p) (42 U.S.C. 6295(o),(p)). This document describes how DOE proposes to conduct the in-depth analysis for this rulemaking process.

1.2 Overview of Definition and Sub-categories of Covered Small Electric Motors

Section 340(13)(F) of EPCA (42 U.S.C. 6311(13)(F)) provides the following definition for small electric motor: "The term 'small electric motor' means a NEMA [National Electrical Manufacturers Association] general purpose alternating current single-speed induction motor, built in a two-digit frame number series in accordance with NEMA Standards Publication MG1-1987." In NEMA Standards Publication MG1-1987, which is entitled "Motors and Generators," the two-digit frame series encompasses NEMA frame sizes 42, 48, and 56, and motors with horsepower ratings ranging from 1/4 to 3 horsepower. These motors operate at 60 hertz (Hz) and have either a single-phase or a polyphase electrical design.

Section 346(b)(3) of EPCA (42 U.S.C. 6317(b)(3)) specifies that a standard prescribed for small electric motors shall not apply to any small electric motor that is a component of a covered product under section 322(a) of EPCA (42 U.S.C. 6292(a)) or of covered equipment under section 340 (42 U.S.C. 6311). Such products and equipment include residential air conditioners and heat pumps, furnaces, refrigerators and freezers, clothes washers and dryers, commercial packaged air-conditioning and heating equipment, and commercial refrigeration equipment. Accordingly, this rulemaking does not address small electric motors incorporated in residential and commercial products specifically excluded by statute.

Item 1 *DOE welcomes comment on additional covered products that contain small motors or other factors that would affect the scope of the small electric motors rulemaking.*

As background, the following two subsections provide some detail on the single-phase and polyphase small electric motors covered under this rulemaking.

1.2.1 Single-phase Small Electric Motors

Single-phase small electric motors are commonly found in products and appliances including pumps, fans, and power tools. NEMA classifies single-phase electric motors according to motor size, using a two-digit frame size classification system. Small motors range in capacity from 1/4 horsepower to one horsepower and are available in two-, four-, or six-pole configurations, with the four-pole configuration being the most common. The basic principal of operation of a single-phase, squirrel-cage, induction motor utilizes a rotating magnetic field produced through equal and opposite rotor torque components. While the electromagnetic torque acting on the rotor of a polyphase motor is relatively smooth and free from pulsating disturbances, this is not the case in the single-phase motor. For single-phase motors, the torque may pulsate from zero to a maximum value at twice the power-line frequency—*e.g.*, 120 Hz. In most applications, torque pulsations are of little consequence, as the inertia of the small electric motor and the driven load act to smooth out the pulsations.

The basic construction of the single-phase induction motor includes a fixed housing on the outside (called a "stator") and a rotating armature on the inside (called a "rotor"). Both the stator and the rotor generate opposing magnetic fields, which forces the rotor to spin, enabling the motor to perform work. In order to generate the magnetic fields, the stator and rotor are each constructed of wire wrapped around a stack of electromagnetic-grade steel laminations. As alternating current is applied to the windings, the magnetic fields change direction, causing a push-pull force on the rotor relative to the stator, causing the rotor to spin.[1] The stator laminations contain a series of slots for the wire windings which are commonly either aluminum or copper wire. Two sets of windings are provided, at a 90-degree phase difference. The "main" or "run" winding operates directly from line current, and it stays energized as long as the motor is running.

Single-phase motors are categorized according to the way the "start and run," "secondary," or "auxiliary" winding is used for starting the motor and then running it at normal speed. Widely-used single-phase motor categories include: (1) split-phase motors; (2) capacitor-start, induction-run (CSIR) motors; (3) permanent-split capacitor (PSC) motors; and (4) capacitor-start, capacitor-run (CSCR) motors. Split-phase and CSIR small motors both use the secondary winding for starting only, although the capacitor-start version provides higher starting torque. The secondary winding uses a much smaller diameter wire energized for a limited time without overheating and automatically disconnects after startup by a centrifugal switch. In PSC and CSCR small motors, the secondary winding continues operating when the motor is running. The capacitor in series with this winding shifts the phase of the input voltage approximately 90 degrees, so the two windings together create a rotating magnetic field. The benefits achieved by PSC and CSCR small motors are the suppression of torque pulsations and the improved use of

[1] The "squirrel-cage" rotor has a series of aluminum bars cast lengthwise into the rotor laminations. These bars are connected with rings located at each end of the stack. Absent the laminated steel core, the assembly of bars and end rings have the appearance of a squirrel cage, hence the industry nomenclature for this type of construction.

both the windings and the iron in the motor. These benefits increase the efficiency and the power factor of the small motor, but at an added cost associated with the capacitor.

1.2.2 Polyphase Small Electric Motors

Polyphase motors in a two-digit NEMA frame size range from 1/4 horsepower to three horsepower, although the majority are one horsepower or less. Such motors are available in two-pole, four-pole, or six-pole configurations, with the four-pole configuration being the most common. The typical polyphase induction motor employs a wound stator and a squirrel-cage rotor. Opposing and attracting magnetic forces acting between the stator and rotor of the motor cause the rotor to spin and produce torque. The stator consists of a hollow cylindrical core formed by a stack of thin steel laminations. Insulated copper windings are assembled into slots formed around the inner circumference of the stator steel laminations. The stator winding carries current through one slot and then back though a companion slot located approximately one pole pitch distant from the first. For a two-pole motor, the pole pitch is half the circle, while for four- or six-pole machines it is one quarter or one-sixth of the circle, respectively.

The rotor unit consists of a laminated steel core mounted on a steel shaft. Like the stator, the rotor core also has windings set into slots, but these are wrapped around its outer circumference (to be closer to the windings of the stator). Moreover, in the squirrel-cage rotor configuration, the rotor windings consist of solid conductor bars that are interconnected at either end with solid-conductor end rings.

When the stator windings are energized by a polyphase electrical source, a radially-directed magnetic flux is established in the “air gap” between the rotor and the stator. This flux rotates at a speed determined by the electrical frequency and number of poles given by the stator-winding configuration. For example, with 60-Hz excitation and a two-pole (or one-pole-pair) winding, the flux rotates at a so-called “synchronous” speed of 60 revolutions per second or 3,600 revolutions per minute (rpm). When the driven equipment, such as a pump, fan blade, or compressor cylinder, exerts torque on the motor, a difference arises between the synchronous speed and the actual speed of the motor, which is termed “slip.” Thus, the fully loaded speed is slightly less than the synchronous motor speed. The flux produced by the energized stator windings envelops the rotor cage bars and, due to its motion, induces current to flow in these conductors. The interaction of the alternating stator flux and the rotor bar currents develops the motor’s drive torque.

Important characteristics of the polyphase squirrel-cage induction motor are simplicity, ruggedness, and inherently high starting torque (without the start-assisting devices required for single-phase motors).

1.3 Overview of the Rulemaking Process

As discussed in Section 1.1 above, DOE is required to develop both test procedures and energy conservation standards for small electric motors. Test procedures are used by manufacturers to evaluate compliance with standards.

1.3.1 Test Procedures

In parallel with the rulemaking on energy conservation standards, DOE is undertaking a test procedure rulemaking for small electric motors. Currently, DOE does not have a test procedure for small electric motors, but DOE is developing one in a separate rulemaking proceeding concurrent with this one so that manufacturers can test for compliance.

Test procedures may incorporate by reference portions of test procedures and definitional information from relevant sources, such as those developed by the Institute of Electrical and Electronics Engineers, Inc. (IEEE), NEMA, CSA International, and the International Electrotechnical Commission. Particular test procedures of interest for polyphase motors include Method B of the IEEE Standard 112, "IEEE Standard Test Procedure for Polyphase Induction Motors and Generators," and Method 1 of Canadian Standards Association (CSA) Standard C390, "Energy Efficiency Test Methods for Three-Phase Induction Motors." For single-phase motors, IEEE Standard 114, "IEEE Standard Test Procedure for Single-Phase Induction Motors," is an existing test procedure that may be a starting point for the test procedure rulemaking.

Item 2 *DOE welcomes comment on any additional test procedures that should be considered or comments about the test procedures listed.*

1.3.2 Rulemaking Process and Stakeholder Participation

When DOE evaluates new or amended standards for "covered products" under EPCA, it must ensure that prior to promulgation, any such standard results in significant energy savings and achieves the maximum improvement in energy efficiency (or water efficiency) that is technologically feasible and economically justified. In determining whether a standard is economically justified, DOE considers to the greatest extent practicable, 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 products in the type (or class) compared to any increase in the price, or in the initial charges for, or maintenance expenses of the covered products which are likely to result from the imposition of the standard;
(3) The total projected amount of energy (or as applicable, water) savings likely to result directly from the imposition of the standard;
(4) Any lessening of the utility or the performance of the covered products likely to result from the imposition of the standard;
(5) The impact of any lessening of competition, as determined in writing by the Attorney General, that is likely to result from the imposition of the standard;
(6) The need for national energy and water conservation; and
(7) Other factors the Secretary considers relevant.
(42 U.S.C. 6295(o)(2)(B)(i))

Additional statutory requirements for prescribing new or amended standards are set forth in 42 U.S.C. 6295(o)(1)–(2)(A), (2)(B)(ii)-(iii), and (3)–(5).

The process for developing efficiency standards involves analysis, public notice, and consultation with interested parties. Such parties (collectively referred to as "stakeholders") generally include manufacturers, consumers, energy conservation and environmental advocates, State and Federal agencies, and any other groups or individuals with an interest in energy conservation standards and test procedures. DOE considers stakeholder participation to be a very important part of the rulemaking process. Accordingly, DOE actively encourages the participation and interaction of all stakeholders during the comment period provided at each stage of the rulemaking. The broad array of stakeholders who routinely provide comments promotes a balanced discussion of critical information required to conduct the standards rulemaking, beginning with public comment on the Framework Document.

In conducting the test procedure rulemakings and the energy (and water) conservation standards rulemakings, DOE involves stakeholders through a variety of means, including formal public notifications (*i.e.*, *Federal Register* notices) and public meetings. As discussed in further detail below, the standards rulemaking process involves three major public notices, which are published in the *Federal Register*:

- Advance notice of proposed rulemaking (ANOPR, see section 1.4). The ANOPR is designed to publicly vet the models and tools that DOE will use in the rulemaking, and to facilitate public participation before the proposed rule stage. Candidate standard levels, which span the range of efficiencies from baseline products to the most efficient technology, are the basis for demonstrating the functionality of the models and tools.

- Notice of proposed rulemaking (NOPR, see section 1.5). The NOPR presents: a discussion of comments received in response to the ANOPR; the analysis of the impacts of standards on consumers, manufacturers, and the nation; DOE's weighting of the impacts; and the proposed standard levels for public comment.

- Final rule (see section 1.6). The final rule presents a discussion of comments received in response to the NOPR, the revised analysis of the impacts of standards, DOE's weighting of the impacts, and the standard levels DOE is adopting. The final rule also establishes the effective date of the standards.

1.4 Advance Notice of Proposed Rulemaking

As part of its initial rulemaking activity, DOE typically conducts a Screening Analysis in which equipment technology options are identified and subjected to a preliminary determination of whether DOE will retain that option for detailed analysis or eliminate it from further consideration. This process includes a market and technology assessment (see section 3) and a screening analysis (see section 4). DOE applies four screening criteria in the Screening Analysis to determine which technology options to eliminate from further consideration. These four criteria are: (1) technological feasibility; (2) practicability to manufacture, install, and service; (3) adverse impacts on product or equipment utility or availability; and (4) adverse impacts on

health or safety. Technologies that pass through the screening analysis are referred to as "design options" in the engineering analysis.

These activities include consultations with stakeholders and independent technical experts who can assist with identifying the key issues and design options that DOE will consider in the rulemaking. DOE intends this Framework Document, the public meeting following its publication, and the opportunity for comment on this Framework Document to initiate dialogue with stakeholders, and to provide an opportunity for comment and input into the structure and analytical approach proposed for this energy conservation standards rulemaking.

During the ANOPR stage of the rulemaking, in addition to the market and technology assessment and screening analysis discussed above, DOE also conducts other principal analyses, including: (1) the engineering analysis (see section 5); (2) the consumer life-cycle cost (LCC) and payback period analysis (see section 8); (3) the national impact analysis, which considers national energy savings (NES) and consumer net present value (NPV) (see section 10); and (4) a preliminary manufacturer impact analysis (see section 12). DOE will present the results of these analyses in the ANOPR *Federal Register* notice.

Discussion of various candidate standard levels (efficiency levels) in the ANOPR will facilitate stakeholder review of the spreadsheet models that underpin the analyses. DOE will use stakeholder comments to refine the models for the next stage of the rulemaking analyses, where DOE will propose specific efficiency levels for adoption. In the ANOPR, DOE generally selects efficiency levels or design options for consideration that span the full range of technologically achievable efficiencies. Relative to a baseline market (see section 3.4 for a discussion of the baseline market), the range of levels DOE analyzes typically includes:

- The highest energy efficiency level or lowest energy consumption level that is technologically feasible (the "max tech" level);
- The level with the lowest LCC; and
- Levels that incorporate noteworthy technologies or fill in large gaps between other efficiency levels considered.

DOE will make the spreadsheet tools and results from the ANOPR analyses available on its website for review and will consider comments on them after the publication of the ANOPR.[2] When it publishes the ANOPR, DOE also will make available a technical support document (TSD) containing the details of all the analyses performed to date. Following publication of the ANOPR, DOE will provide a 75-day public comment period and hold one public meeting. At this point, DOE will encourage stakeholders, to the extent possible, to develop joint recommendations for standard levels.

[2] All materials associated with the Small Motors determination analysis, test procedure and energy conservation standard are available on DOE's website:
http://www.eere.energy.gov/buildings/appliance_standards/commercial/small_electric_motors.html

1.5 Notice of Proposed Rulemaking

In developing the NOPR, DOE will first review and consider all the comments it received after the publication of the ANOPR. This process may result in revisions or refinements to the ANOPR analyses, including the engineering and LCC analyses. DOE also will conduct additional economic and environmental impact analyses at this stage of the rulemaking. These analyses generally include a consumer LCC subgroup analysis (see section 11), a complete manufacturer impact analysis (see section 12), a utility impact analysis (see section 13), an employment impact analysis (see section 14), an environmental assessment (see section 15), and a regulatory impact analysis (see section 16).

The NOPR analytical process ends with the selection of proposed standard levels (if any) that DOE will publish in the NOPR. DOE selects these proposed standard levels from the trial standard levels (TSLs) analyzed during the NOPR phase of the rulemaking. The NOPR *Federal Register* notice will document the evaluation and selection of the proposed standard levels, along with a discussion of other TSLs considered but not selected (and the reasons for not selecting them).

The selection process for proposed efficiency standards generally runs as follows. For each equipment class, DOE will identify the max-tech efficiency level. If DOE proposes a level lower than that, it will sequentially explain the reasons for eliminating higher levels, beginning with the highest level considered. DOE will present the analytical results in the NOPR, with the details of the analysis provided in an accompanying TSD.

DOE considers many factors in selecting proposed standards, as described above in section 1.3.2. These factors and criteria are contained in EPCA and take into consideration the benefits, costs, and impacts of energy conservation standards. To assist in weighing these various factors, DOE encourages stakeholders to develop joint recommendations for standard levels. DOE will carefully consider such recommendations in its decision process.

When DOE publishes the NOPR, it will provide the Department of Justice (DOJ) with copies of the NOPR and TSD, in order to solicit feedback on the impact of the proposed standard levels on competition in the motors industry. DOJ will review these standard levels in light of any lessening of competition that is likely to result from the imposition of standards. (See 42 U.S.C. 6295(o)(2)(B)(i)(V) and (B)(ii)) Publication of the NOPR will be followed by a 75-day public comment period that includes one public meeting.

1.6 Final Rule

After the publication of the NOPR, DOE will consider public comments it receives on the proposal and accompanying analyses. On the basis of the public comments, DOE will review the engineering and economic impact analyses and proposed standards and consider modifications where necessary. Before the final rule is issued, DOE also will consider DOJ comments on the NOPR relating to the impacts of the proposed standard levels on competition, to determine whether changes to these standard levels are needed.

The standards rulemaking will conclude with the publication of the final rule. DOE will select the final standard level based on the complete record of the standards rulemaking. The final rule will promulgate the final standard level and the effective date and explain the basis for their selection. The final rule will be accompanied by a final TSD.

2 OVERVIEW OF ANALYSES FOR RULEMAKING

The purpose of the analyses conducted in support of the standards rulemaking is to ensure that DOE selects energy conservation standards that achieve the maximum improvement in energy efficiency that is technologically feasible and economically justified, and will result in significant energy savings. Economic justification includes the consideration of economic impacts on domestic manufacturers and consumers, national benefits including environmental impacts, issues of consumer utility, and impacts from any lessening of competition. DOE expects the selection of such standards to achieve the maximum energy savings that are economically justified without imposing excessive financial burden on any particular party.

This section offers an overview of the DOE analytical methodology for standard setting and discusses the major components of the analyses DOE will conduct. DOE will ensure a consistent approach to its analyses throughout the rulemaking by considering each analysis as a part of the overall standards-setting framework.

Figure 1 summarizes the analytical components of the standards-setting process. The "analyses" are presented in the center column. Each analysis has a set of "key inputs," which are data and information required for the analysis. "Approaches" are the methods that DOE will use to obtain key inputs, which may vary depending on the information in question. For example, some key inputs exist in public databases; DOE will collect other information from stakeholders or experts with special knowledge, and DOE will develop yet other information independently in support of this rulemaking. The results of each analysis are "key outputs," which feed directly into the rulemaking. Arrows indicate the flow of information between the various analyses.

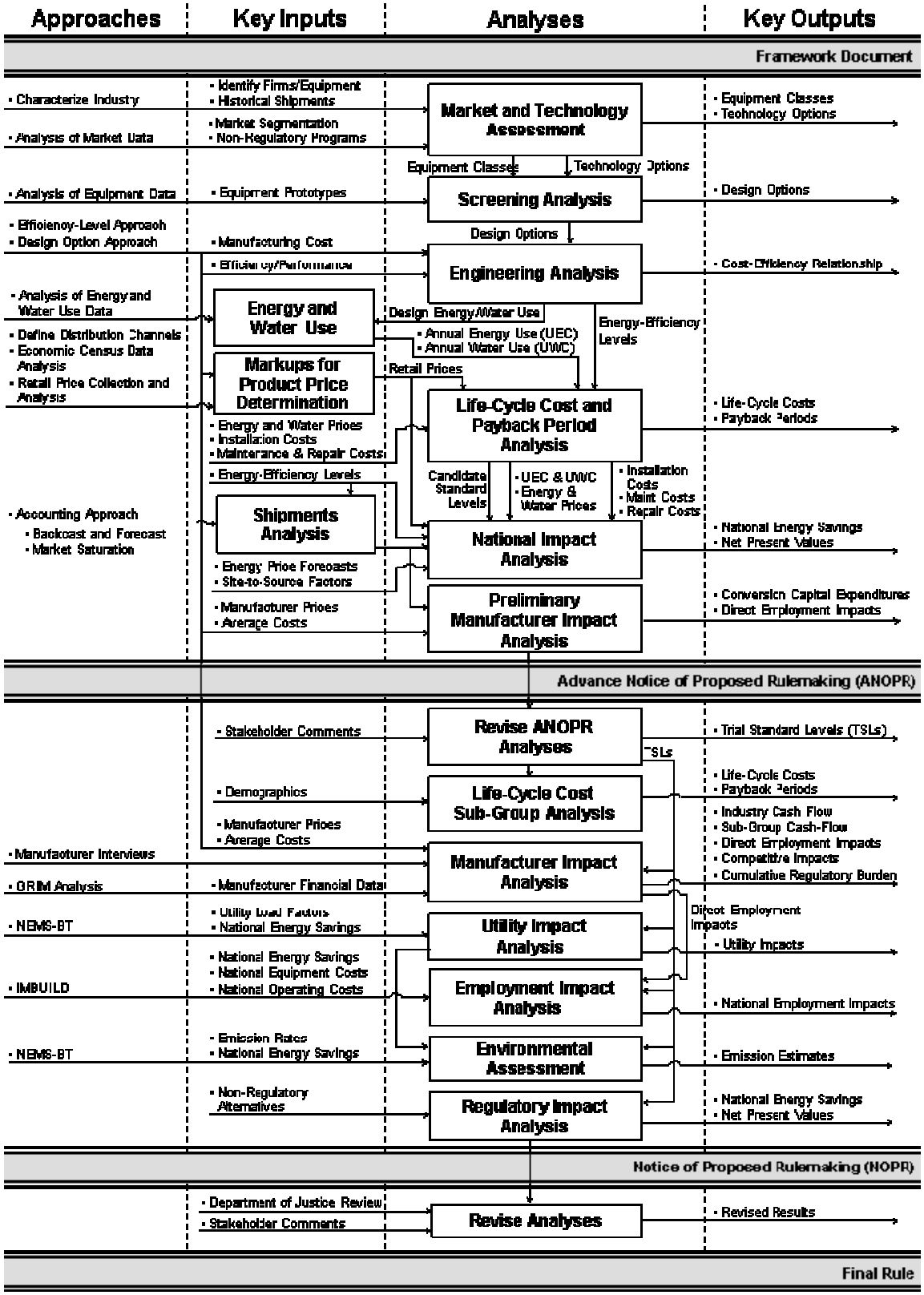

Figure 1 Flow Diagram of Analyses Conducted for an Energy Conservation Standard Rulemaking

3 MARKET AND TECHNOLOGY ASSESSMENT

The market and technology assessment will provide information about the manufacturers of small, single-phase, capacitor-start electric motors (both induction-run and capacitor-run) and small, polyphase electric motors, and specifics about the performance attributes of these motors. DOE will use this assessment throughout the rulemaking. However, the assessment is particularly important at the outset for developing equipment classes and for identifying technology options that improve the efficiency of small electric motors.

3.1 Market Assessment

DOE will qualitatively and quantitatively characterize the structure of the markets for small, single-phase, capacitor-start electric motors (both induction-run and capacitor-run) and small, polyphase electric motors. In the market assessment, DOE will characterize the manufacturers, estimate market shares and trends, and address regulatory and non-regulatory initiatives intended to improve the efficiency or reduce the energy consumption of covered motors.

This market assessment will establish the context for this rulemaking, and it will serve as a resource to guide the analyses that follow. For example, DOE may use historical shipments and prices as an indicator of future shipments and prices. Similarly, DOE plans to use market structure data for the manufacturer impact analysis.

DOE recognizes that there may be limited public information on national shipments, manufacturing costs, channels of distribution, and manufacturers' market shares of small electric motors. These types of data would be extremely valuable for conducting analyses to determine if energy conservation standards are economically justified and will result in significant energy savings. Therefore, DOE encourages stakeholders to submit any available data that pertains to these areas of interest and that would improve DOE's understanding of the small electric motors market. This data may be provided under a confidentiality agreement with DOE's contractor responsible for this part of the rulemaking analysis, Navigant Consulting, Inc. As in other rulemakings, Navigant Consulting regularly works with confidential data from manufacturers and other organizations, preparing aggregated results for DOE's analysis that do not divulge sensitive raw data, but that enable other stakeholders to review and comment on the aggregated dataset. Alternatively, stakeholders may submit confidential data to DOE, indicating in writing which data should remain confidential. In order to prevent public disclosure of the data due to actions taken by a third party, stakeholders providing confidential information to DOE must submit that data according to 10 CFR 1004.11.

Item 3 *DOE welcomes input on shipments, manufacturing costs, distribution channels, and estimates of market shares for the small electric motors covered in this rulemaking. For DOE to be able to use the data to conduct energy savings calculations, a degree of disaggregation (e.g., equipment class, frame size, and horsepower) is desirable.*

DOE is developing a database of commonly available equipment based on the most recent manufacturer catalogues from motor manufacturers. This model database enables DOE to understand what is available in the market and to compare available equipment to statutory definitions. DOE will use the resulting knowledge about equipment availability to evaluate how the market may respond to various standard levels (*e.g.*, consumers substituting motors that are not subject to regulation), as well as performance attributes of the various commercially-available motor technologies.

3.2 Equipment Classes

When necessary, DOE divides covered equipment into classes by: (a) the type of energy used; (b) the capacity of the equipment; or (c) any other performance-related feature that justifies different standard levels, such as features affecting consumer utility. (42 U.S.C. 6295(q)) For the determination analysis on small electric motors, DOE separately analyzed the following products as separate classes: (i) single-phase, capacitor-start, induction-run motors; (ii) single-phase, capacitor-start, capacitor-run motors; and (iii) polyphase motors. The division was based on the different sizes and starting torques (and therefore different consumer utilities) of these small electric motors. DOE seeks comment on the appropriateness of using such divisions for this rulemaking, as well as any further (*i.e.*, finer) divisions of covered equipment under each of these three classes.

Item 4 *DOE welcomes comment on equipment classes for single-phase, capacitor-start, induction-run electric motors.*

Item 5 *DOE welcomes comment on equipment classes for single-phase, capacitor-start, capacitor-run electric motors.*

Item 6 *DOE welcomes comment on equipment classes for polyphase electric motors.*

3.3 Technology Assessment

The technology assessment centers on understanding how energy is used by the product or equipment, and potential changes that would reduce energy consumption. These measures that improve the energy efficiency of the equipment are called "technology options," and they are based on existing technologies, as well as prototype designs and concepts. In consultation with stakeholders, DOE will develop a list of technology options to consider in this rulemaking. Initially, this list will include all those options that are technologically feasible, including a max-tech design. In the screening analysis, DOE will eliminate from consideration any technology options that fail to meet one of the four screening criteria: (1) technological feasibility; (2) practicability to manufacture, install, and service; (3) adverse impacts on product or equipment utility or availability; and (4) adverse impacts on health or safety (see section 4 for a more complete discussion).[3]

[3] Technology options that pass all the screening criteria are called "design options," and, as such, they are analyzed in the engineering analysis (see section 5).

DOE is studying technology options that could be employed to improve the efficiency of the small electric motors covered in this rulemaking. To this end, DOE is reviewing manufacturer catalogues, recent trade publications, technical journals, and DOE also intends to consult with technical experts who have worked on small motor designs and applications. Presently, DOE is aware of a limited set of design options that could improve the efficiency of these motors. These design options are discussed below.

The following summarizes small motor operation, the mechanisms of energy loss in those products, and some initial technology options DOE has identified that would be expected to improve energy efficiency. The application of a motor to do work creates losses that are both contained within the motor itself and induced in the power distribution system supplying electricity to the motor. Losses within the motor are referred to as 'internal energy losses.' These losses are caused by electrical conductivity losses (both Eddy currents and hysteresis losses[4]), mechanical losses (*i.e.*, frictional and air-resistance losses), and stray losses. All of these energy losses result in the generation of heat in the motor. Losses are strongly dependent on motor design and the quality of the materials used and construction of motor components. The conventional methods for reducing losses include increasing the amount of active material (*e.g.*, the cross-sectional area of wire conductors), substituting a higher grade of electrical steel for the magnetic components, improving the mechanical components and design (*e.g.*, winding, bearings, and fan), and improving the quality control of components and assembly. These methods may increase either the motor cost or size if no other changes in the motor are made.

In addition to the internal losses discussed above, small motors with low power factors can induce extra energy losses in the power distribution system that supplies electricity to the motor. The lower a motor's power factor, the greater the current per watt required to operate the motor. These increased currents cause additional losses in the power distribution system because of conductive losses (also called I^2R losses).

The precise impacts on small electric motor cost and efficiency will depend on how the designer makes tradeoffs between added performance from improved materials or design, and maintenance of the motor performance. The I^2R (the expression of heat loss in watts where I is measured current and R is resistance) of the rotor is one of the main sources of energy loss in the rotor. Technology options employed that may reduce the I^2R loss in the rotor may increase electrical conductivity losses in the stator. DOE is aware that there are certain technology options that have design trade-offs, and can increase losses in some areas while reducing losses in other areas.

[4] Hysteresis losses are caused by the magnetic lag or reluctance of the core molecules to reorient themselves with the 60 Hz alternating magnetic field applied by the primary winding. Eddy current losses are actual currents induced in the core by the magnetic field, in the same manner that the field induces current in the secondary winding. However, these currents cannot leave the core and simply circulate within each lamination, eventually becoming heat. In both instances, hysteresis and eddy current losses create heat in the core material.

Item 7 *DOE welcomes comment on the preliminary design options identified in this section. DOE welcomes comment on whether there are other technology options that it should also consider.*

3.4 Baseline Models

Once DOE establishes equipment classes, it will select baseline models as reference points against which it can measure changes resulting from potential energy conservation standards. The baseline model represents the characteristics of common or typical equipment sold in a given equipment class. Given that no existing energy efficiency standards apply to small electric motors, DOE will select baseline models that are typical of what is sold in the market today. Accordingly, DOE has determined that a baseline model should encompass motor features and performance characteristics such as frame size and type, motor speed (in rpm), and enclosure type. DOE will not define all the detailed characteristics of the proposed baseline models until it receives comments from stakeholders and can conduct further analysis.

At a subsequent stage in its analysis, DOE will use the baseline models to conduct the engineering analysis and the LCC and payback period analyses. To determine energy savings and changes in manufacturer selling price, DOE will compare each of the more efficient motors (*i.e.*, motors that incorporate design options to improve efficiency) with the baseline model.

Item 8 *DOE welcomes comment on which baseline models should be selected from the representative equipment classes and why.*

Item 9 *DOE welcomes comment on the scaling of findings from the representative equipment classes to other equipment classes that it does not analyze.*

4 SCREENING ANALYSIS

The purpose of the screening analysis is to screen out technology options that DOE will not consider in the rulemaking for small electric motors. Following the process set forth below, DOE will screen out technology design options based upon the four criteria below.

As an initial matter, DOE will develop a list of design options (developed through its own research and in consultation with interested parties) for consideration in the engineering analysis (see section 5). The identified candidate design options or best available technologies will encompass all those technologies that may be technologically feasible. Thereafter, DOE will review each such design option or best available technology in light of the following four

criteria, as provided in sections 4(a)(4) and 5(b) of the Process Rule[5] and tailored to the current rulemaking:

1. *Technological feasibility.* If DOE determines that a design option is not incorporated in commercially available motors or in working prototypes, then it will not give further consideration to that design option.

2. *Practicability to manufacture, install, and service.* If DOE determines that mass production or reliable installation and servicing of a design option could not be achieved on the scale necessary to serve the relevant market by the time of the effective date of the standard, then it will not give further consideration to that design option.

3. *Adverse impacts on product or equipment utility or availability.* If DOE determines a design option to have significant adverse impact on the utility of the motor to significant subgroups of consumers, or result in the unavailability of any covered motor type with performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially the same as motors generally available in the United States at the time, it will not give further consideration to that design option.

4. *Adverse impacts on health or safety.* If DOE determines that a design option will have significant adverse impacts on health or safety, it will not give further consideration to that design option.

DOE will fully document its reasons for eliminating any design options during the screening analysis, and will publish this documentation for stakeholder review and comment as part of the ANOPR.

Item 10 *DOE welcomes comment on how the above four screening criteria might apply to a technology design option(s) that a stakeholder recommends to DOE.*

5 ENGINEERING ANALYSIS

After conducting the screening analysis described above, DOE will perform an engineering analysis based on the remaining design options that improve motor efficiency. This section provides an overview of the engineering analysis (section 5.1), discusses DOE's proposed approach (section 5.2), and addresses manufacturer prices (section 5.3), proprietary designs (section 5.4), and regulatory burdens that might affect the engineering analysis (section 5.5).

[5] 10 CFR Part 430, Subpart C, Appendix A.

5.1 Engineering Analysis Overview

The purpose of the engineering analysis is to determine the relationship between the manufacturer's selling price and efficiency for small electric motors. In determining the price-efficiency relationship, DOE will estimate the increase in the manufacturer selling price associated with technological and design changes that increase the efficiency of small motors relative to the baseline models. DOE will develop cost estimates for the engineering analysis (which it will also use in section 12, the manufacturer impact analysis) from detailed data on the incremental costs of changes in material, labor, and overhead. To start, DOE will develop separate engineering analyses for each of the baseline models identified in section 3.4. DOE intends to use commercially-available motor design software to develop its own cost-efficiency relationships for the small motors analyzed.

DOE seeks input on the methods and approaches used by manufacturers to improve the efficiency of small motors. In addition, DOE intends to identify the model with the highest efficiency that is technologically feasible within each equipment class (*i.e.*, the "max-tech" model). DOE's engineering analysis will document the design changes and costs associated with improving motor efficiency from the baseline through the max-tech model. This will include considering improved electrical steel for the stator and rotor, improved electrical conductors, and so on. As each of these design options are added, the manufacturer's cost generally increases and the motor's efficiency (and performance) improves.

Item 11 *For each equipment class, DOE welcomes stakeholder comment on methods and approaches employed to improve the efficiency of the motors, including the max tech model. Detailed information on the motor performance and the incremental manufacturing costs (e.g., material costs,[6] labor costs,[7] overhead costs[8] (excluding depreciation), building conversion capital expenditures, tooling/equipment conversion capital expenditures associated with more efficient designs, R&D expenses, and marketing expenses) would be useful.*

[6] Direct material costs are the costs of raw materials such as steel, copper, and insulation, and also include scrap metal that can be traced to final or end equipment. Direct material costs do not include indirect material costs which are attributed to supplies that may be used in the production process, but are not assigned to final pieces of equipment (*e.g.*, lubricating oil for production machinery).

[7] Labor costs are the earnings of workers who assemble parts into a finished good or operate machines in the production process. Direct labor includes the fringe benefits of direct laborers such as group health care, as well as overtime pay. Direct labor does not include indirect labor, which is defined as the earnings of employees who do not work directly in assembling a piece of equipment—such as supervisors, janitors, stockroom personnel, inspectors, and forklift operators.

[8] Factory overhead excludes depreciation, but includes indirect labor, downtime, set-up costs, indirect material, expendable tools, maintenance, property taxes, insurance on assets, and utility costs. Factory overhead does not include selling, general, and administrative costs (SG&A), R&D, interest, or profit (which DOE accounts for separately).

5.2 Engineering Analysis Approach

For the engineering analysis, DOE will examine incremental increases in the manufacturer selling price associated with increases in equipment efficiency. For the ANOPR, DOE intends to develop a database of small electric motor software designs that offer a range of efficiencies. DOE will conduct design runs to examine various parameters that increase the efficiency of the motor. The software would provide design and performance specifications for motor designs, and generate a detailed bill of materials, from which DOE can calculate a final manufacturers selling price. An important input to this software includes prices for materials such as the electrical steel, copper windings, and aluminum rotor bar/end rings. A materials price analysis will be based on a five-year average of typical costs when these materials are purchased in volume. DOE will seek materials pricing information from current, publicly-available data. DOE may supplement this software analysis through: (1) a review of data collected from manufacturers on prices, efficiencies, and other features of various models of small electric motors, and (2) interviews with manufacturers about the techniques and associated costs used to improve efficiency. In addition, DOE will use the cost data generated by the engineering analysis in the manufacturer impact analysis (see section 12). If possible, DOE will then aggregate the cost numbers by weighting each individual data point by company-level sales volumes for each equipment class.

To be useful in the manufacturer impact analysis, manufacturer cost information should reflect the variability in baseline models, design strategies, and cost structures that exist among manufacturers. If necessary, DOE will qualify any aggregated cost-efficiency data. Information obtained through follow-up with manufacturers will assist this effort. These confidential interviews will provide a deeper understanding of the various combinations of technologies used to increase small motor efficiency, as well as their associated manufacturing costs.

DOE will estimate the contribution of the depreciation of conversion capital expenditures to the incremental overhead. During the interviews with manufacturers, DOE will gather information about the capital expenditures needed to increase the efficiency of the baseline models to various efficiency levels (*i.e.*, conversion expenditures by efficiency). DOE will also gather information about the depreciation method(s) used to expense the conversion expenditures.

The approach proposed above will enable DOE to characterize the cost-efficiency relationship for motors across the entire efficiency range. As explained above, DOE will maintain the confidentiality of proprietary data, while allowing the public to examine the cost and design assumptions that underlie the cost-efficiency estimates.

Item 12 *DOE welcomes comment from stakeholders on current prices for materials used in the construction of small electric motors.*

Item 13 *DOE welcomes comment on the above-described approach to determining the relationship between manufacturer selling price and motor efficiency.*

Item 14 *DOE welcomes comment from stakeholders on which software tool is the best one to use for its engineering analysis and why.*

5.3 Manufacturer Prices

DOE plans to apply markups to convert manufacturer production costs to manufacturer selling prices. DOE intends to estimate manufacturer markups from publicly-available financial information (*e.g.*, Securities and Exchange Commission 10-K reports).

Item 15 *DOE welcomes comment on the markup approach proposed for developing estimates of manufacturer selling prices.*

5.4 Proprietary Designs

DOE will consider in its engineering and economic analyses all design options that are commercially available or present in a working prototype, including proprietary designs. DOE will consider a proprietary design in the subsequent analyses only if it is not a unique path to a given motor efficiency level. If the proprietary design is the only approach available to achieve a given efficiency level, then DOE will reject the efficiency level (that can only be achieved by a proprietary design) from further analysis. Furthermore, DOE is sensitive to manufacturer concerns regarding proprietary designs and will take appropriate steps to maintain the confidentiality of any proprietary data that manufacturers submit. This information will provide input to the competitive impacts assessment and other economic analyses.

Item 16 *DOE welcomes comment on whether there are proprietary designs it should consider for any of the motor types under consideration in this rulemaking and, if so, how DOE should acquire the cost data necessary for evaluating these designs.*

5.5 Outside Regulatory Changes Affecting the Engineering Analysis

In conducting an engineering analysis, DOE takes into consideration the effects of regulatory changes outside DOE's statutory energy conservation standards rulemaking process that can impact the manufacturers of the covered equipment. As previously mentioned, section 346(b)(3) of EPCA (42 U.S.C. 6317(b)(3)) specifies that a standard prescribed for small electric motors shall not apply to any small electric motor that is a component of a covered product under section 322(a) of EPCA (42 U.S.C. 6292(a)) or of covered equipment under section 340 (42 U.S.C. 6311). Any additional regulation on products containing small electric motors may alter DOE's scope of coverage in this rulemaking (*e.g.*, regulation stemming from new legislation). Some regulatory changes can also affect the efficiency or energy consumption of the small motors covered under this rulemaking. DOE will attempt to identify all such outside engineering issues that could impact the engineering analysis. The consideration of these issues is closely

related to the cumulative regulatory burden assessment that DOE will carry out as part of the manufacturer impact analysis.

Item 17 *DOE welcomes comment on whether there are outside issues that DOE should consider in its analysis of small electric motors.*

Item 18 *DOE welcomes comment on whether there are small electric motor designs that are used for general purposes as well as for regulated appliances.*

6 ENERGY USE AND END-USE LOAD CHARACTERIZATION

The purpose of the energy-use and end-use load characterization is to identify how products and equipment are used by consumers, and thereby determine the energy savings potential of energy efficiency improvements. For small electric motors, the end-use load is the mechanical work that is performed by the equipment which varies over time and with different applications. The energy use of the motor equals the end-use load plus any energy losses associated with motor operation. For the motors in this rulemaking, this analysis will focus on how end-users install and operate these motors and how motor operation and its associated losses varies over time with different applications.

DOE intends this analysis, which is an input to the LCC and national impact analyses, to capture and represent the typical energy consumption in the field. This usage profile will enable DOE to conduct a calculation to determine the LCC and the payback period of more efficient motor technologies relative to the baseline motor.

Motor loading is the fraction of motor capacity that is utilized on average. This factor is important for determining which types of motor designs will deliver a specified efficiency. Thus, as part of the energy use and end-use load characterization, DOE intends to develop a model of motor loads, to determine average and peak load levels for the various types of small electric motors.

DOE seeks to identify and obtain detailed data on the typical applications and end-use profiles for the motors considered in this rulemaking. If the range of energy use determined for each motor type is large enough, DOE will conduct a sensitivity analysis to determine how high and low estimates of energy use might impact the economic feasibility of any amended energy conservation standards.

Item 19 *DOE welcomes recommendations on sources of data that would provide end-use operating profiles for each of the motor types covered under this rulemaking.*

Item 20 *DOE welcomes comment on whether the end-use operating profiles are different for each of the motor types covered under this rulemaking, and if so, how.*

Item 21 *DOE welcomes comment on other engineering issues that could impact the engineering analysis.*

7 MARKUPS FOR EQUIPMENT PRICE DETERMINATION

DOE uses manufacturer-to-consumer markups to convert the manufacturer selling price estimates from the engineering analysis to consumer prices. The manufacturer-to-consumer markups are in addition to the markups on production costs that DOE uses to estimate manufacturer selling price in the engineering analysis described in section 5.3 above. DOE then uses the consumer (retail) prices calculated from these markups in the LCC and payback period analysis, and in the national impact analysis. Retail prices are needed for the baseline efficiency level and all other efficiency levels under consideration. As noted above, DOE will obtain these retail prices by applying manufacturer-to-consumer markups to manufacturer-selling-price estimates, and then to validate these markups, DOE will attempt to collect data on existing prices in the market either by purchasing large data sets or by downloading data from distributor internet sites.

However, before it can develop markup information, DOE must first identify distribution channels (*i.e.*, how a motor is distributed from the manufacturer to the consumer). Once it establishes proper distribution channels for each of the motor types, DOE will rely on economic census data from the U.S. Census Bureau, as well as input from the electric motor industry and motor experts, to develop an understanding of the markups applied as a motor moves from the manufacturer to the consumer. To the extent possible, DOE also will use collected retail price data to determine overall manufacturer-to-consumer markups.

This analysis will generate retail prices based on the marked-up manufacturing prices from the engineering analysis. Because DOE expects to generate a range of price estimates, it plans to describe new retail prices within a range of uncertainty. If the range of retail prices for each motor type is large enough, DOE will conduct a sensitivity analysis to determine how high and low estimates of retail price might impact the economic feasibility of any potential amended energy conservation standard.

Item 22 *DOE welcomes comment on the distribution chain for small electric motors, the key stakeholders in those distribution chains, the typical markups applied by those stakeholders, and the overall markup from manufacturer selling price to consumer retail price.*

8 LIFE-CYCLE COST AND PAYBACK PERIOD ANALYSIS

The effects of increased energy conservation standards on consumers include a change in operating expense (usually decreased) and a change in purchase price (usually increased). DOE analyzes the net effect on consumers by calculating the LCC and payback period using the engineering performance data (section 5), the energy-use and end-use load characterization data (section 6), and the equipment retail prices (section 7). Inputs to the LCC calculation include the installed cost to the consumer (purchase price plus installation cost), operating expenses (energy expenses, and, if applicable, repair costs and maintenance costs), the lifetime of the equipment or other defined period of analysis, and a discount rate.

For the ANOPR, DOE will conduct the LCC analysis using typical values to reflect conditions in the field for equipment retail price and life, energy costs, energy usage, and discount rates. If DOE determines that there is significant variability in any of the above inputs, it will conduct sensitivity analyses to determine how the LCC and payback period are impacted by high and low estimates for each of the inputs. For any sensitivity analyses that it conducts, DOE will account for correlations that may exist between inputs (*e.g.*, energy usage may be correlated to energy prices). The detailed impact calculation, which DOE will conduct after the ANOPR, may include an assessment of impacts on subgroups of consumers, as described in section 11.

Based on the results of the LCC analysis, DOE will select candidate standard levels (CSLs) for the ANOPR analysis. The range of CSLs typically will include the motor efficiency level with the lowest LCC, the highest efficiency level that is technologically feasible, and other intermediate levels DOE has not yet determined.

For the NOPR, DOE will carefully review all of the comments it receives on the ANOPR LCC analysis, make any necessary revisions to the analysis, and evaluate additional parameters not included in the ANOPR analysis, if necessary.

For small electric motors, DOE will need to determine input values for several variables. The following sections discuss the methodologies DOE plans to use to develop energy prices, discount rates, maintenance/repair/installation costs, and motor lifetimes.

8.1 Energy Prices

For consumers of small electric motors, DOE will survey residential, commercial and industrial energy tariffs[9] as a means for establishing marginal electricity prices. DOE will also use data from the Commercial Building Energy Consumption Survey[10] conducted by the Energy Information Administration (EIA) to estimate building energy use characteristics that impact electricity prices. If the tariff survey and EIA data demonstrate a large variability in electricity prices, DOE will conduct a sensitivity analysis to determine how high and low electricity price estimates might impact the economic feasibility of any amended energy conservation standards.

[9] "Energy tariffs" are the rules for calculating energy bills. DOE contractors maintain a database of hundreds of tariffs that can be used to calculate incremental energy bill impacts from energy savings. See: http://tariffs.lbl.gov/
[10] See: http://www.eia.doe.gov/emeu/cbecs/

DOE will use projections of national average energy prices for residential, commercial and industrial consumers—principally from EIA's *Annual Energy Outlook* (*AEO*) from the most recent year available—to estimate future energy prices in its LCC analysis

Item 23 *DOE welcomes input on the proposed methodology for estimating current and future electricity prices.*

8.2 Life-Cycle Cost Discount Rates

The calculation of consumer LCC requires the use of an appropriate discount rate. For consumers of small electric motors, DOE will derive the discount rates for commercial and industrial consumers by estimating the cost of capital of companies that purchase commercial equipment. The cost of capital is commonly used to estimate the present value of cash flows to be derived from a typical company project or investment. Most companies use both debt and equity capital to fund investments, so the cost of capital is the weighted-average cost of equity and debt financing. This corporate finance approach is referred to as the weighted-average cost of capital. For instance, the set of commercial or industrial companies purchasing small electric motors may differ from those who purchase distribution transformers, which would result in different discount rates being developed for this rulemaking.

DOE will publish the discount rates and associated documentation on the derivation of these discount rates in the ANOPR. It will invite stakeholders to comment specifically on the issue of consumer discount rates during the ANOPR comment period.

Item 24 *DOE welcomes input on the proposed approaches for estimating discount rates for consumers of small motors covered under this rulemaking.*

8.3 Maintenance, Repair, and Installation Costs

Typically, DOE will take into consideration any expected changes to maintenance, repair, and installation costs for the equipment covered in a rulemaking. Often, small incremental changes in equipment efficiency would incur little or no change in repair and maintenance costs over baseline equipment. For equipment with significant energy efficiency improvements over the baseline, there may be increased repair and maintenance costs since such equipment is more likely to incorporate technologies that are not widely available. For motors, DOE expects that maintenance and repair costs will not change with increased efficiency. DOE invites comment on how repair costs may change for more efficient motors that may be more expensive than motors currently in the market. With regard to installation costs, DOE is aware that there is variability in the costs for commercial and industrial sector small motor installations. However, DOE does not believe that existing installation practices would necessarily change under an energy conservation standard, but larger, more efficient motors may be more difficult and expensive to install in constrained spaces or configurations.

Item 25 *DOE welcomes comment on whether and how to develop maintenance, repair, and installation costs for small electric motors. Specifically DOE invites comment on how efficiency requirements may affect the ability of motor designs to fit in constrained spaces and configurations.*

8.4 Motor Lifetimes

DOE will use information from catalogues and various literature sources, and input from manufacturers and other stakeholders, to establish small motor lifetimes for use in the LCC and subsequent analyses.

Based on consideration of the comments received for the ANOPR, DOE will make necessary changes to the analysis. These changes will be reflected in the documentation of the NOPR.

Item 26 *DOE welcomes comment on appropriate small motor lifetimes for the small motor types covered in this rulemaking.*

9 SHIPMENTS ANALYSIS

DOE requires shipment forecasts to calculate the national impacts of standards on energy consumption, NPV, and future manufacturer cash flows. DOE plans to develop shipments forecasts based on an analysis of key market drivers for the covered motors.

9.1 Base Case Forecast

To evaluate the various impacts of standards, DOE develops a base case forecast against which to compare forecasts for higher efficiency levels. DOE will design the base case forecast to depict what will happen to energy consumption and energy costs over time if it does not adopt energy conservation standards for the motors covered under this rulemaking. In determining the base case forecast, DOE will consider historical shipments, the mix of motor efficiencies currently sold in the absence of regulation, and how that mix might change over time. For these purposes, DOE needs data on historical equipment shipments and the market shares of the different efficiency levels offered in each equipment class.

DOE seeks data on historical shipments for small, single-phase capacitor-start electric motors (both induction-run and capacitor-run) and small, polyphase electric motors. DOE is considering manufacturers and industry organizations as potential sources of such information. Alternatively, to arrive at this information, DOE is considering purchasing national market reports or extrapolating historical sales data from the United States Bureau of Census. The United States Bureau of Census publishes limited information on the quantity and dollar-value of equipment shipments. However, the Census data does not disaggregate the motors according to motor type or energy conservation standard equipment class.

DOE hopes to collect shipment data within each equipment class, as well as market share efficiency data (*i.e.*, data on the distribution of equipment shipments by motor efficiency), if applicable, for each equipment class. DOE recognizes that this information may be difficult to collect, and may, therefore, consider other methods to estimate the efficiency distribution in the market. For instance, if market share efficiency data are not available, DOE may develop, as a proxy, efficiency distributions based on available models and information from motor experts.

Item 27 *DOE welcomes recommendations on sources of data that would provide information on shipments of small electric motors by different equipment classes and long-term trends in small electric motor shipments .*

9.2 Accounting Methodology

DOE proposes to determine annual shipments in the base case by accounting for new motor installation, motor replacements due to failure, and motor retrofits. Each of these three impacts on the accounting methodology is discussed below:

- *New Construction* – the new motors that are installed each year due to equipment growth in a particular sector. DOE proposes to determine this by using the National Energy Modeling System (NEMS) growth projections for the commercial and industrial equipment sectors.

- *Replacements* – the motors that have failed or which are included in equipment that fails. DOE bases this calculation on equipment sales and retirement rates.

- *Retrofits* – the motors replacing existing motors during renovation and/or repair of equipment. This replacement may occur before the original motor has failed.

DOE intends to use an accounting model method to prepare shipment scenarios for the base case and the standards level cases. The model will keep track of the aging and replacement of small electric motors given a projection of future motor sales growth.

Item 28 *DOE welcomes comment on the accounting methodology described above for each of the motor types covered in this rulemaking.*

9.3 Standards Impacts on Motor Shipments

For each motor type, DOE will develop a set of shipment forecasts for the covered motors for each set of standards analyzed. It will use these standards case forecasts to evaluate the impacts of standards on motor shipments. DOE derives standards case forecasts using the same data sets as base case forecasts. However, because the standards case forecasts take into account the increase in purchase price and the decrease in operating costs caused by standards, forecasted shipments typically deviate from the base case. The magnitude of the difference between the standards case and base case shipment forecasts depends on the estimated purchase-price-increase, as well as the operating-cost savings from the standard. Because the purchase

price tends to have a larger impact than operating cost on equipment purchase decisions, standards case forecasts typically do show an elasticity of demand, manifested as a drop in shipments relative to the base case.

Market-pull programs, such as consumer rebate programs that encourage the purchase of more efficient small motors and manufacturer tax credits that encourage the production of more efficient small motors, also affect standards case forecasts. To the extent that such programs exist, DOE will consider their impact on the forecast of both standards case and base case shipments.

Item 29 *DOE welcomes comment on how any standard for small electric motors might impact shipments of these motors. DOE also invites information about market-pull programs that promote the adoption of more efficient motors.*

10 NATIONAL IMPACT ANALYSIS

Section 8 discusses methods for estimating the LCC savings and payback period for individual consumers. This section discusses DOE's assessment of the aggregate impacts of proposed efficiency standards at the national level. Measures of impact that DOE will report include future NES from candidate motor standards (*i.e.*, the cumulative incremental energy savings from a small electric motors efficiency standard relative to a base case of no national standard over a specified forecast period) and the NPV of total consumer LCC.

10.1 Inputs to Forecasts

Analyzing impacts of Federal energy conservation standards for small electric motors requires a comparison of projected United States energy consumption with, and without, new energy conservation standards. The forecasts contain projections of unit energy consumption of new motors, annual equipment shipments, and the price of purchased equipment. The derivations of the base case shipments forecasts are discussed in section 9. Approaches to determine retail prices for equipment are described in section 7, while approaches to determine unit energy consumption are described in section 6.

10.2 Calculation of National Energy Savings

DOE intends to calculate national energy consumption for each year beginning with the expected effective date of the standards. It will calculate national electricity consumption for the base case and each standard level analyzed. DOE plans to perform this calculation through the use of a spreadsheet model that effectively multiplies annual shipment forecasts by unit energy savings, thereby accounting for the stock of equipment affected by standards.

In response to comments by stakeholders who asked for a simple, transparent model, DOE developed NES spreadsheet models for its standards rulemakings starting in 1996, to

project energy savings and to demonstrate how the growth in efficiency can be accounted for over time.[11] Although these models are specific to each product, their general framework is applicable to the entire small motors market. It is DOE's expectation that the NES spreadsheet model will provide a credible, stand-alone forecast of national energy savings and NPV for small electric motors.

Item 30 *DOE welcomes comment on the NES spreadsheet models it proposes to use for estimating national impacts of energy conservation standards for small electric motors.*

10.3 Net Present Value

DOE calculates the national NPV of energy conservation standards in conjunction with the NES. It calculates annual energy expenditures from annual energy consumption by incorporating forecasted energy prices, using the shipment and average energy efficiency forecasts described in section 9. DOE calculates annual equipment expenditures by multiplying the price per unit by the forecasted shipments. The difference between a base case and a standards case scenario will likely contribute to an NES offset against increased expenditures on motors. The difference each year between energy bill savings and increased equipment expenditures is the net savings (if positive) or net costs (if negative). DOE will discount these annual values to the present time and sum them to provide a net present value. According to Office of Management and Budget (OMB) requirements, DOE will conduct two NPV calculations, one using a real discount rate of three percent and another using a real discount rate of seven percent (OMB, Circular A-4: Regulatory Analysis. 2003). Based on consideration of the comments received on the ANOPR, DOE will make any necessary changes to the analysis and the CSLs.

11 LIFE-CYCLE COST SUBGROUP ANALYSIS

This section describes how DOE analyzes consumer impacts by dividing consumers into subgroups and accounting for variations in key inputs to the LCC analysis. A consumer subgroup comprises a subset of the population that is likely, for one reason or another, to be affected disproportionately by new or revised energy conservation standards (*e.g.*, small businesses, ethnic minorities, and low-income or senior consumers). The purpose of a subgroup analysis is to determine the extent of this disproportional impact. DOE will work with stakeholders early in the rulemaking process to identify any subgroups for this consideration. However, it will not analyze the consumer subgroups until the NOPR stage of the analysis.

In comparing potential impacts on the different consumer subgroups, DOE will evaluate variations in regional electricity prices, variations in usage profiles, and variations in installation costs that might affect the NPV of an energy conservation standard to certain consumer subgroups. To the extent possible, DOE may obtain estimates of the variability in each input

[11] Several examples of NES spreadsheet models from previous rulemakings can be found on DOE's website at www.eere.energy.gov/buildings/appliance_standards/.

factor and consider this variability in its calculation of consumer impacts. It will discuss with stakeholders the variability in each input factor and likely sources of information.

Item 31 *DOE welcomes comment on what, if any, consumer subgroups are appropriate in considering standards for small electric motors.*

12 MANUFACTURER IMPACT ANALYSIS

DOE announced changes to the manufacturer impact analysis format in a report issued to Congress on January 31, 2006 (as required by section 141 of the Energy Policy Act of 2005). This report, entitled "Energy Conservation Standards Activities," (Standards Activities) is available on the DOE website at: http://www.eere.energy.gov/buildings/appliance_standards/2006_schedule_setting.html.

Previously, DOE did not report any manufacturer impact analysis results during the ANOPR phase; however, under this new format, DOE will collect, evaluate, and report preliminary information and data in the ANOPR. (See Standards Activities, page 48.) Such preliminary information includes the anticipated conversion capital expenditures by efficiency level and the corresponding, anticipated impacts on employment. DOE will invite further input on these issues during its ANOPR manufacturer interviews.

DOE intends the manufacturer impact analysis to provide an assessment of the potential impacts of energy conservation standards on manufacturers of small electric motors. DOE intends to conduct a separate manufacturer impact analysis for each of the motor types covered under this rulemaking. In addition to financial impacts, a wide range of quantitative and qualitative effects may occur following adoption of a standard that may require changes to the manufacturing practices for these motors. DOE will identify these effects through interviews with manufacturers and other experts.

12.1 Sources of Information for the Manufacturer Impact Analysis

Many of the analyses described earlier provide important information that DOE will use as inputs for the manufacturer impact analysis. Such information includes financial parameters developed in the market assessment (section 3.1), manufacturing costs and prices from the engineering analysis (sections 5.2 and 5.3), retail price forecasts (section 7), and shipments forecasts (section 9). DOE will supplement this information with information gathered during manufacturer interviews. The interview process plays a key role in the manufacturer impact analysis, because it provides an opportunity for directly affected parties to express their views on important issues.

To this end, DOE will conduct detailed interviews with manufacturers to gain insight into the range of potential impacts from standards. During the interviews, DOE will take note of information on the possible impacts on manufacturing costs, equipment prices, sales, direct

employment, capital assets, and industry competitiveness. Both qualitative and quantitative information are valuable in terms of this analysis. DOE will schedule interviews well in advance to provide every opportunity for key individuals to be available to participate.

DOE will ask interview participants to identify all confidential information provided in writing or orally, and DOE will determine whether the information submitted is entitled to confidential treatment. It will consider the information gathered, as appropriate, in the energy conservation standard decision-making process. DOE will also ask participants to identify any information that they wish to have included in the public record, but that they do not want to have associated with their interview (thereby identifying that particular manufacturer); DOE will incorporate this information into the public record, but will report it without attribution.

DOE will collate the interview results and prepare a summary of the major issues and outcomes. This summary will become part of the technical support document for this rulemaking.

12.2 Industry Cash Flow Analysis

The industry cash flow analysis will rely primarily on the Government Regulatory Impact Model (GRIM). DOE uses the GRIM to analyze the financial impacts of new or more stringent energy conservation standards on the industry that produces the equipment covered by the standard.

The GRIM analysis uses a number of factors—annual expected revenues, manufacturer costs such as costs of goods sold, SG&A costs, taxes, and capital expenditures (both ordinary capital expenditures and those related to standards)—to determine annual cash flows associated with a new standard, beginning from the announcement of the standard and continuing for several years after its implementation. DOE compares the results against base case projections that involve no new standards. The financial impact of new standards is the difference between the two sets of discounted annual cash flows. Other performance metrics, such as return on invested capital, are also available from the GRIM.

12.3 Manufacturer Subgroup Analysis

It is possible that the use of average industry cost values will not adequately assess differential impacts among subgroups of motor manufacturers. DOE recognizes that smaller manufacturers, niche players, and manufacturers exhibiting a cost structure that differs significantly from the industry average may be impacted differently by the imposition of standards. Ideally, DOE would consider the impact on every firm individually. In highly concentrated industries, this may be possible. In industries having numerous participants, however, DOE uses the results of the market and technology assessment to group manufacturers into subgroups, as appropriate. For small motors, DOE does not intend to assess the impacts on every manufacturer individually and, therefore, is interested in stakeholder feedback about potential subgroups.

Item 32 *DOE welcomes comment on, if appropriate, what potential subgroups of motor manufacturers DOE should consider in a manufacturer subgroup analysis.*

12.4 Competitive Impacts Analysis

EPCA directs DOE to consider any lessening of competition that is likely to result from an imposition of standards. (42 U.S.C. 6295(o)(2)(B)(i)(V)) It further directs the Attorney General to determine in writing the impacts, if any, of any lessening of competition. (42 U.S.C. 6295(o)(2)(B)(ii))

DOE will make a determined effort to gather firm-specific financial information and impacts, and it will then report the aggregated impact of the standard on manufacturers. The competitive impacts analysis will focus on assessing the impacts to smaller, yet significant, manufacturers. DOE will base the assessment on manufacturing cost data and on information collected from interviews with manufacturers. The manufacturer interviews will focus on gathering information that would help in assessing asymmetrical cost increases to some manufacturers, increased proportion of fixed costs potentially increasing business risks, and potential barriers to market entry (*e.g.*, proprietary technologies). DOE will provide the Attorney General with a copy of the NOPR for consideration in an evaluation of the impact of standards on the lessening of competition.

12.5 Cumulative Regulatory Burden

DOE is aware that other regulations may apply to equipment covered under this rulemaking, as well as to other equipment produced by the same manufacturers of equipment covered under this rulemaking. Multiple regulations may result in a significant, cumulative regulatory burden on these manufacturers. DOE will analyze and consider the impact on motor manufacturers of multiple, equipment-specific regulatory actions.

Regulations that could affect the industry impacted by this rulemaking include:

- Existing energy conservation standards for 1 to 200 horsepower electric motors established by DOE on October 5, 1999 (64 FR 54114).
- Standards applicable to products that incorporate small motors which are already regulated, such as residential air conditioners and heat pumps, furnaces, refrigerators and freezers, clothes washers and dryers, commercial packaged air-conditioning and heating equipment, and commercial refrigeration equipment.
- Safety or other requirements associated with covered equipment.

Item 33 *DOE welcomes comment on what other regulations or pending regulations it should consider in its examination of cumulative regulatory burden.*

13 UTILITY IMPACT ANALYSIS

To estimate the effects of energy conservation standards for small electric motors on the electric utility industry, DOE plans to use a variant of EIA's NEMS, called NEMS-BT (BT refers to DOE's Building Technologies Program). NEMS is a large, multi-sectoral partial equilibrium model of the U.S. energy sector, used primarily for the purpose of preparing the *AEO*. NEMS-BT produces a widely-recognized reference case forecast for the United States through 2030 and is available in the public domain.

The utility impact analysis is a comparison between the NEMS-BT model results for the base case and standards cases. Outputs of the utility impact analysis usually parallel results that appear in the latest *AEO*, with some additions. Typical outputs include forecasts of electricity generation, sales, price, and avoided capacity. DOE plans to conduct the utility impact analysis as a scenario departing from the latest *AEO* reference case. In other words, it will model the energy savings impacts from energy conservation standards for small motors using NEMS-BT to generate forecasts that deviate from the *AEO* reference case.[12]

Item 34 *DOE welcomes input from stakeholders on its proposed use of NEMS-BT to conduct the utility impact analysis.*

14 EMPLOYMENT IMPACT ANALYSIS

The Process Rule includes employment impacts among the factors for DOE to consider in selecting a proposed efficiency standard, and it also provides guidance for consideration of the impact of CSLs on both direct and indirect employment. The Process Rule states a general presumption against any CSL that would directly cause plant closures or significant loss of domestic employment, unless specifically identified expected benefits of the standard would outweigh such adverse effects. (See the Process Rule, 10 CFR Part 430, Subpart C, Appendix A, sections 4(d)(7)(ii) and (vi), and 5(e)(3)(i)(B).)

DOE estimates the impacts of standards on employment for equipment manufacturers, relevant service industries, energy suppliers, and the economy in general. Its analysis covers both direct and indirect employment impacts. Direct employment impacts would result if standards led to a change in the number of employees at manufacturing plants and related supply and service firms. Direct impact estimates are covered in the manufacturer impact analysis.

Indirect employment impacts are impacts on the national economy other than in the manufacturing sector being regulated. Indirect impacts may result both from expenditures shifting among goods (the substitution effect) and changes in income that lead to a change in overall expenditure levels (the income effect). DOE defines indirect employment impacts from standards as net jobs eliminated or created in the general economy as a result of increased

[12] Several NEMS-BT models from previous rulemakings can be found on the DOE's website at www.eere.energy.gov/buildings/appliance_standards/.

spending driven by the increased equipment prices and reduced spending on energy. DOE expects new standards for small electric motors to increase the total installed cost of equipment (which includes manufacturer selling price, sales taxes, distribution chain markups, and installation cost). DOE also expects the new standards to decrease energy consumption, and thus expenditures on energy. Over time, increased total installed cost is paid back through energy savings. The savings in energy expenditures may be spent on new commercial investment and other items.

DOE intends to investigate the indirect employment impacts of small electric motor standards using the Impact of Building Energy Efficiency Programs (IMBUILD) spreadsheet model.[13] DOE's Building Technologies Program office developed IMBUILD, which is a special version of the Impact Analysis for Planning (IMPLAN) national input-output model. IMPLAN specifically estimates the employment and income effects of building energy technologies. The IMBUILD model is an economic analysis system that focuses on those sectors most relevant to buildings and characterizes the interconnections among 35 sectors as national input-output matrices using data from the Bureau of Labor Statistics. The IMBUILD model estimates changes in employment, industry output, and wage income in the overall U.S. economy resulting from changes in expenditures in the various sectors of the economy. Changes in expenditures due to equipment standards can be introduced into IMBUILD as changes in existing economic flows. IMBUILD can then estimate the resulting net national impact on jobs by sector. Although DOE intends to use IMBUILD for its analysis of indirect employment impacts, it welcomes input on other tools and factors it might consider.

Item 35 *DOE welcomes feedback on its proposed approach to assessing national employment impacts, both direct and indirect.*

15 ENVIRONMENTAL ASSESSMENT

The intent of the environmental assessment is to provide emissions results estimates, and to fulfill requirements to properly quantify and consider the environmental effects of all new Federal rules. The primary environmental effects of energy conservation standards for small electric motors are likely to be reduced emissions resulting from reduced electricity consumption. Accordingly, the environmental assessment for this rulemaking will focus on the significant pollutants and emissions of electricity-generating power plants. Specifically, the environmental assessment will consider three pollutants -- sulfur dioxide (SO_2), nitrous oxide (NO_x), and mercury (Hg); it will also consider one emission -- carbon dioxide (CO_2).

At the NOPR rulemaking stage, for each of the trial standard levels, DOE will calculate total undiscounted and discounted power plant emissions using NEMS-BT, and will use other methods to calculate site emissions. The environmental assessment performed in this

[13] Several employment analyses using the IMBUILD model from previous rulemakings can be found on the DOE's website at www.eere.energy.gov/buildings/appliance_standards/.

rulemaking will be conducted as an incremental policy impact (*i.e.*, a standard for the product under evaluation) of the most current *AEO* forecast, applying the same basic set of assumptions used in *AEO*. Also, forecasts conducted with NEMS-BT consider the supply-side and demand-side effects on the electric utility industry. Thus, DOE's analysis will account for any factors affecting the type of electricity generation and, in turn, the type and amount of airborne emissions generated by the utility industry.

The NEMS-BT model tracks CO_2 emissions with a specialized carbon emissions estimation subroutine, producing reasonably accurate results due to the broad coverage of all sectors and inclusion of interactive effects. Past experience with carbon results from NEMS suggests that emissions estimates are somewhat lower than emissions based on simple average factors. One of the reasons for this divergence is that NEMS tends to predict that conservation displaces generating capacity in future years. On the whole, NEMS-BT provides carbon emissions results of reasonable accuracy, at a level consistent with other published Federal results.

NEMS-BT also reports SO_2, NO_x, and mercury, which DOE has reported in past analyses. The Clean Air Act Amendments of 1990 set an SO_2 emissions cap on all power generation. The attainment of this target, however, is flexible among generators through the use of emissions allowances and tradable permits. Although NEMS includes a module for SO_2 allowance trading and delivers a forecast of SO_2 allowance prices, accurate simulation of SO_2 trading implies that the effect of efficiency standards on physical emissions will be zero because emissions will always be at or near the ceiling. However, there is an SO_2 benefit from energy conservation, in the form of a lower SO_2 allowance price. But since the impact of any one standard on the allowance price is likely small and highly uncertain, DOE does not plan to monetize the SO_2 benefit.

NEMS-BT also has an algorithm for estimating NO_x emissions from power generation. The impact of these emissions, however, will be affected by the Clean Air Interstate Rule (CAIR), which the EPA issued on March 10, 2005 and finalized on May 12, 2005; CAIR will permanently cap emissions of NO_x in 28 eastern states and the District of Columbia. 70 FR 25162 (May 12, 2005). As with SO_2 emissions, a cap on NO_x emissions means that equipment efficiency standards may have little or no physical effect on these emissions. When NO_x emissions are subject to emissions caps, DOE's emissions reduction estimate corresponds to incremental changes in the prices of emissions allowances in cap-and-trade emissions markets rather than physical emissions reductions. Therefore, while the emissions cap may mean that physical emissions reductions will not result from standards, standards could produce an environmentally-related economic benefit in the form of lower prices for emissions allowance credits. However, as with SO_2 allowance prices, DOE does not plan to monetize this benefit because the impact on the NO_x allowance price from any single energy conservation standard is likely small and highly uncertain.

Item 36 *DOE welcomes feedback on its proposed approach to assessing national environmental impacts.*

16 REGULATORY IMPACT ANALYSIS

In the NOPR stage of this rulemaking, DOE will prepare a regulatory impact analysis, which addresses the potential for non-regulatory approaches to supplant or augment energy conservation standards to improve the efficiency of small electric motors in the market. The regulatory impact analysis will consider the likely effects of non-regulatory initiatives on motor energy use, consumer utility, and life-cycle costs. DOE will take into account the actual impacts of any existing initiatives to date, but also will consider historical information presented that may reasonably estimate the impacts that any such initiative might have in the future. It will use the NES spreadsheet model (as discussed in section 10.2, "Calculation of National Energy Savings") to calculate the NES and NPV for alternatives to the proposed conservation standards.

If DOE proposes energy conservation standards for certain small electric motors and the NOPR constitutes a significant regulatory action, DOE would prepare and submit to OMB for review the assessment of costs and benefits required under section 6(a)(3) of Executive Order 12866, "Regulatory Planning and Review," 58 FR 51735 (October 4, 1993). The Executive Order requires agencies to identify the specific market failure or other specific problem that is that basis for agency action, as well as assess the significance of that problem, in order to permit assessment of whether any new regulation is warranted. (Executive Order 12866, §1(b)(1)).

DOE's preliminary analysis suggests that accounting for the market value of energy savings alone (*i.e.*, excluding any possible additional "externality" benefits such as those noted below) would yield net benefits across a wide array of equipment and circumstances. These results, if correct, imply the existence of a market failure in the small electric motors market. DOE requests data on and suggestions for testing the existence and extent of these potential market failures, in order to complete an assessment in the proposed rule regarding the significance of these failures and the anticipated net benefits of regulation.

DOE believes that there is a lack of consumer information and/or information processing capability about energy efficiency opportunities in the small electric motors market. If this is in fact the case, DOE would expect the energy efficiency for small electric motors to be randomly distributed across key variables such as energy prices and usage levels. DOE seeks data on the efficiency levels of existing small electric motors in use by application (*e.g.*, pumps, conveyors, compressors) and electricity price (and/or geographic region of the country). DOE plans to use these data to test the extent to which purchasers of this equipment behave as if they are unaware of the costs associated with their energy consumption.

There are likely to be certain "external" benefits resulting from the improved efficiency of units that are not captured by the users of such equipment. These include both environmental and energy security-related externalities that are not already reflected in energy prices such as reduced emissions of greenhouse gases and reduced use of natural gas and oil for electricity generation. DOE invites comments on the weight that should be given to these factors in DOE's determination of the maximum efficiency level at which the total benefits are likely to exceed the total burdens resulting from a DOE standard.

APPENDIX A – ENERGY POLICY AND CONSERVATION ACT DIRECTIVES REGARDING SMALL MOTORS

This appendix provides an excerpt from EPCA under which DOE is exerting its authority under 42 U.S.C. 6317(b) through (f).

Sec. 6317. Energy conservation standards for high-intensity discharge lamps, distribution transformers, and small electric motors

(b) Small electric motors

(1) The Secretary shall, within 30 months after October 24, 1992, prescribe testing requirements for those small electric motors for which the Secretary makes a determination that energy conservation standards would be technologically feasible and economically justified, and would result in significant energy savings.

(2) The Secretary shall, within 18 months after the date on which testing requirements are prescribed by the Secretary pursuant to paragraph (1), prescribe, by rule, energy conservation standards for those small electric motors for which the Secretary prescribed testing requirements under paragraph (1).

(3) Any standard prescribed under paragraph (2) shall apply to small electric motors manufactured 60 months after the date such rule is published or, in the case of small electric motors which require listing or certification by a nationally recognized testing laboratory, 84 months after such date. Such standards shall not apply to any small electric motor which is a component of a covered product under section 6292(a) of this title or a covered equipment under section 6311 of this title.

(c) Consideration of criteria under other law

In establishing any standard under this section, the Secretary shall take into consideration the criteria contained in section 6295(n) of this title.

(d) Prescription of labeling requirements by Secretary

The Secretary shall, within six months after the date on which energy conservation standards are prescribed by the Secretary for high-intensity discharge lamps and distribution transformers pursuant to subsection (a)(2) of this section and small electric motors pursuant to subsection (b)(2) of this section, prescribe labeling requirements for such lamps, transformers, and small electric motors.

(e) Compliance by manufacturers with labeling requirements

Beginning on the date which occurs six months after the date on which a labeling rule is prescribed for a product under subsection (d) of this section, each manufacturer of a

product to which such a rule applies shall provide a label which meets, and is displayed in accordance with, the requirements of such rule.

(f) New covered products; distribution of non-conforming products prohibited; construction with other law

(1) After the date on which a manufacturer must provide a label for a product pursuant to subsection (e) of this section--

(A) each such product shall be considered, for purposes of paragraphs (1) and (2) of section 6302(a) of this title, a new covered product to which a rule under section 6294 of this title applies; and

(B) it shall be unlawful for any manufacturer or private labeler to distribute in commerce any new product for which an energy conservation standard is prescribed under subsection (a)(2) or (b)(2) of this section which is not in conformity with the applicable energy conservation standard.

(2) For purposes of section 6303(a) of this title, paragraph (1) of this subsection shall be considered to be a part of section 6302 of this title.

APPENDIX B – SUMMARY OF ITEMS FOR STAKEHOLDER COMMENT

Summary of all items for stakeholder comment contained in the framework document.

Item 1 DOE welcomes comment on additional covered products that contain small motors or other factors that would affect the scope of the small electric motors rulemaking. 2

Item 2 DOE welcomes comment on any additional test procedures that should be considered or comments about the test procedures listed. 5

Item 3 DOE welcomes input on shipments, manufacturing costs, distribution channels, and estimates of market shares for the small electric motors covered in this rulemaking. For DOE to be able to use the data to conduct energy savings calculations, a degree of disaggregation (e.g., equipment class, frame size, and horsepower) is desirable. 11

Item 4 DOE welcomes comment on equipment classes for single-phase, capacitor-start, induction-run electric motors. 12

Item 5 DOE welcomes comment on equipment classes for single-phase, capacitor-start, capacitor-run electric motors. 12

Item 6 DOE welcomes comment on equipment classes for polyphase electric motors..... 12

Item 7 DOE welcomes comment on the preliminary design options identified in this section. DOE welcomes comment on whether there are other technology options that it should also consider. 14

Item 8 DOE welcomes comment on which baseline models should be selected from the representative equipment classes and why. 14

Item 9 DOE welcomes comment on the scaling of findings from the representative equipment classes to other equipment classes that it does not analyze. 14

Item 10 DOE welcomes comment on how the above four screening criteria might apply to a technology design option(s) that a stakeholder recommends to DOE. 15

Item 11 For each equipment class, DOE welcomes stakeholder comment on methods and approaches employed to improve the efficiency of the motors, including the max tech model. Detailed information on the motor performance and the incremental manufacturing costs (e.g., material costs, labor costs, overhead costs (excluding depreciation), building conversion capital expenditures, tooling/equipment conversion capital expenditures associated with more efficient designs, R&D expenses, and marketing expenses) would be useful. 16

Item 12 DOE welcomes comment from stakeholders on current prices for materials used in the construction of small electric motors. 17

Item 13 DOE welcomes comment on the above-described approach to determining the relationship between manufacturer selling price and motor efficiency. 17

Item 14 DOE welcomes comment from stakeholders on which software tool is the best one to use for its engineering analysis and why. 18

Item 15 DOE welcomes comment on the markup approach proposed for developing estimates of manufacturer selling prices. 18

Item 16 DOE welcomes comment on whether there are proprietary designs it should consider for any of the motor types under consideration in this rulemaking and, if so, how DOE should acquire the cost data necessary for evaluating these designs. 18

Item 17 DOE welcomes comment on whether there are outside issues that DOE should consider in its analysis of small electric motors. 19

Item 18 DOE welcomes comment on whether there are small electric motor designs that are used for general purposes as well as for regulated appliances. 19

Item 19 DOE welcomes recommendations on sources of data that would provide end-use operating profiles for each of the motor types covered under this rulemaking. 19

Item 20 DOE welcomes comment on whether the end-use operating profiles are different for each of the motor types covered under this rulemaking, and if so, how. 19

Item 21 DOE welcomes comment on other engineering issues that could impact the engineering analysis. 20

Item 22 DOE welcomes comment on the distribution chain for small electric motors, the key stakeholders in those distribution chains, the typical markups applied by those stakeholders, and the overall markup from manufacturer selling price to consumer retail price. 20

Item 23 DOE welcomes input on the proposed methodology for estimating current and future electricity prices. 22

Item 24 DOE welcomes input on the proposed approaches for estimating discount rates for consumers of small motors covered under this rulemaking. 22

Item 25 DOE welcomes comment on whether and how to develop maintenance, repair, and installation costs for small electric motors. Specifically DOE invites comment on how efficiency requirements may affect the ability of motor designs to fit in constrained spaces and configurations. 23

Item 26 DOE welcomes comment on appropriate small motor lifetimes for the small motor types covered in this rulemaking. 23

Item 27 DOE welcomes recommendations on sources of data that would provide information on shipments of small electric motors by different equipment classes and long-term trends in small electric motor shipments 24

Item 28 DOE welcomes comment on the accounting methodology described above for each of the motor types covered in this rulemaking..... 24

Item 29 DOE welcomes comment on how any standard for small electric motors might impact shipments of these motors. DOE also invites information about market-pull programs that promote the adoption of more efficient motors. 25

Item 30 DOE welcomes comment on the NES spreadsheet models it proposes to use for estimating national impacts of energy conservation standards for small electric motors..... 26

Item 31 DOE welcomes comment on what, if any, consumer subgroups are appropriate in considering standards for small electric motors..... 27

Item 32 DOE welcomes comment on, if appropriate, what potential subgroups of motor manufacturers DOE should consider in a manufacturer subgroup analysis. 29

Item 33 DOE welcomes comment on what other regulations or pending regulations it should consider in its examination of cumulative regulatory burden..... 29

Item 34 DOE welcomes input from stakeholders on its proposed use of NEMS-BT to conduct the utility impact analysis..... 30

Item 35 DOE welcomes feedback on its proposed approach to assessing national employment impacts, both direct and indirect..... 31

Item 36 DOE welcomes feedback on its proposed approach to assessing national environmental impacts. 32