APPENDIX 12A. SMALL ELECTRIC MOTORS MANUFACTURER'S INTERVIEW GUIDE

TABLE OF CONTENTS

LIST OF TABLES

APPENDIX 12A. SMALL ELECTRIC MOTORS MANUFACTURER'S INTERVIEW GUIDE

12A.1 INTRODUCTION

Navigant Consulting, Inc. (NCI) has prepared the following manufacturer's interview guide with the understanding that certain information asked for is sensitive to the manufacturer. Therefore, NCI wishes to enter into a non-disclosure agreement with your company in order to ensure any data you provide in response to this guide is held in the strictest confidence. NCI will combine your response with responses from several other companies to develop a representative industry 'average' relationship between a manufacturer's cost and efficiency for small electric motors. If you have any questions about the questionnaire, please feel free to contact either:

Contacts at Navigant Consulting, Inc.

Matthew Nardotti	Michael Scholand
Tel: (202) 481-7546	Tel: (202) 973-2482
matthew.nardotti@navigantconsulting.com	mscholand@navigantconsulting.com

Purpose: NCI is seeking your input to an engineering analysis that estimates the average relationship between a manufacturer's cost and the efficiency for small electric motors. NCI is also seeking your input on market-related information and any anticipated manufacturer impacts. This guide is broken into three sections: A) the Engineering Analysis, B) the Market Questionnaire, and C) the Manufacturer Impact Questionnaire. The interview guide is part of a larger standards rulemaking process in which the U.S. Department of Energy is considering energy conservation standards for small electric motors.[1]

Request: Please review the attached interview guide and then contact NCI to discuss whether you are interested in participating in this process. If so, then NCI will work with you to establish an non-disclosure agreement, and we will schedule a conference call to discuss your inputs at your earliest convenience.

Schedule: Due to DOE's schedule to publish the Advance Notice of Proposed Rulemaking in September 2008, NCI will be looking to start holding calls with manufacturers to obtain your responses to the questions in this Guide starting the week of November 19, 2007.

[1] DOE published a positive determination for Small Electric Motors on July 10, 2006. DOE maintains a website for Small Electric Motors where it publishes documentation associated with this rulemaking, including the July 2006 determination notice: http://www.eere.energy.gov/buildings/appliance_standards/commercial/small_electric_motors.html

12A.2 ENGINEERING ANALYSIS

PART A. ENGINEERING ANALYSIS

The engineering analysis will represent general purpose, alternating-current, induction motors, built in a two-digit frame number series. Of these, there are three major types being analyzed:

- Polyphase motors
- Capacitor-start, induction-run motors (CSIR)
- Capacitor-start, capacitor-run (or two-value capacitor) motors (CSCR)

For each of the small motors proposed for analysis, NCI is seeking an understanding of the discrete design steps you would undertake to achieve the efficiency level shown in the table. In each case, start with a baseline motor (i.e., the typical efficiency level you would sell), and identify the specific design improvements you would incorporate in order to increase the efficiency of the motor.

The following are the four motors are the ones NCI is seeking input on:

Small Motor A.1 Polyphase: 1 HP, 56 Frame, 4 Poles
Small Motor A.2 Capacitor-start, induction-run: ½ HP, 56 Frame, 4 Poles
Small Motor A.3 Capacitor-start, induction-run: ½ HP, 48 Frame, 4 Poles
Small Motor A.4 Capacitor-start, capacitor-run: ¾ HP, 56 Frame, 4 Poles

We need to construct a curve that denotes the relationship between cost and efficiency, and therefore we are asking you to provide detailed information on incremental step increases in efficiency from the baseline to a level called the "maximum efficiency" level. The maximum efficiency level may be a motor that you don't make today, but is one that represents the highest efficiency level you could achieve if price were no object, and you incorporated every measure you could think of to increase efficiency. That said, when considering the design of the maximum efficiency level, please do not consider exotic core steel, such as boron-based material, please use the best grade of conventional steel. In order to describe the cost-efficiency curve with some degree of accuracy, NCI is asking you to provide the baseline and maximum efficiency, as well as four interim efficiency values. To summarize, the requested designs would be at the following efficiency points:

0. Baseline motor efficiency – your typical efficiency for the specified motor.
1. Incremental level
2. Incremental level
3. Maximum efficiency level seen in market today (i.e., commercially available)
4. Gap fill between maximum market and maximum feasible
5. The maximum efficiency level feasible regardless of price yet using conventional, non-exotic materials.

For each design change, please also provide an estimate of your incremental production cost over the baseline, as well as the total unit selling price to an OEM or distributor. In case it is not possible to list the increase in cost per design change, please specify the total bill-of-materials cost increase for all the improvements.

We recognize that detailed designs may be difficult to prepare; therefore, in the interests of generating reasonable results in a short period of time, we invite you to use your best judgment and experience when completing the following tables.

Please use the following design specifications for all small electric motors (or please indicate to us if one or more of these are problematic):

Table 12A-1. Covered Motor Characteristics

Application:	General Purpose
Motor Type:	Induction motor
Frame Size:	NEMA Two-Digit
Input:	Alternating-Current, 60 Hz
Speed:	Single Speed
Duty:	Continuous Duty
Construction:	Open

The following example illustrates the kind of information that would be helpful for NCI in compiling an aggregate engineering analysis. In this particular example, we show a set of improvements for increasing the efficiency of a polyphase, 4 pole, 1 HP, 56 frame size motor (note: this example is purely illustrative as it's "Defining Design Characteristics" are not completely accurate of a motor of this type, nor is its incremental value of efficiency). This table is intended only to provide an indication of the degree of detail being requested in this Interview Guide.

Table 12A-2. Example of Filled Out Engineering Table

Example: Polyphase: ***1 HP, 56 Frame, 4 Poles***					
#	**Level**	**Rated Full Load Efficiency**	**Defining Design Characteristics**	**Mfr. Production Cost**	**Total Mfr. Unit Selling Price**
0	Baseline: lowest cost motor	78.5%[2]	Stack Length = 10 inches	-	$275[3]
			Slot Fill = 55%	-	
			Steel Type = Cold rolled, Grade A, (4.51 W/lb @ 15kg, 60 Hz)	-	
			AWG = 25	-	
#	**Level**	**Rated Full Load Efficiency**	**Design Changes of Baseline to Meet Efficiency Level**	**Incremental Cost (over Baseline) per Improvement[4]**	**Total Mfr. Unit Selling Price**
1	Incremental value	80%	Increase Stack length to 10.25 inches	+$20	$350
			Upgrade steel to Cold rolled, Grade B, (4.15 W/lb @ 15 kg, 60 Hz)	+$15	
			Additional steel processing operation	+$5	
			Miscellaneous additional components (e.g. XXXX)	+$10	

[2] Baseline efficiencies are estimates based on information gathered from various product catalogs.
[3] Price is an estimate based on information gathered from various product catalogs.
[4] The values in this column are based on estimates shown in the Technical Support Document for small electric motors; again, they are purely illustrative.

Table 12A-3. Small Motor A.1 Polyphase: 1 HP, 56 Frame, 4 Poles

#	Level	Rated Full Load Efficiency	Defining Design Characteristics	Mfr. Production Cost	Total Mfr. Unit Selling Price
0	Baseline: lowest cost motor	78.5%[5]			
#	**Level**	**Rated Full Load Efficiency**	**Design Changes of Baseline to Meet Efficiency Level**	**Incremental Cost (over Baseline) per Improvement**	**Total Mfr. Unit Selling Price**
1	Incremental value				
2	Incremental value				
3	Maximum value in market today	85.5%			
4	Gap fill between maximum in market and maximum feasible				
5	Maximum technology feasible				

[5] Efficiency value was taken from composite catalog data. Please modify if this number is incorrect.

Table 12A-4. Small Motor A.2 Capacitor-start, induction-run: ½ HP, 56 Frame, 4 Poles

#	Level	Rated Full Load Efficiency	Defining Design Characteristics	Mfr. Production Cost	Total Mfr. Unit Selling Price
0	Baseline: lowest cost motor	61.4%[6]			
#	Level	Rated Full Load Efficiency	Design Changes of Baseline to Meet Efficiency Level	Incremental Cost (over Baseline) per Improvement	Total Mfr. Unit Selling Price
1	Incremental value				
2	Incremental value				
3	Maximum value in market today	68.7%			
4	Gap fill between maximum in market and maximum feasible				
5	Maximum technology feasible				

[6] Efficiency value was taken from composite catalog data. Please modify if this number is incorrect.

Table 12A-5. Small Motor A.3 Capacitor-start, induction-run: ½ HP, 48 Frame, 4 Poles

#	Level	Rated Full Load Efficiency	Defining Design Characteristics	Mfr. Production Cost	Total Mfr. Unit Selling Price
0	Baseline: lowest cost motor	64%[7]			
#	**Level**	**Rated Full Load Efficiency**	**Design Changes of Baseline to Meet Efficiency Level**	**Incremental Cost (over Baseline) per Improvement**	**Total Mfr. Unit Selling Price**
1	Incremental value				
2	Incremental value				
3	Maximum value in market today	68.7%			
4	Gap fill between maximum in market and maximum feasible				
5	Maximum technology feasible				

[7] Efficiency value was taken from composite catalog data. Please modify if this number is incorrect.

Table 12A-6. Small Motor A.4 Capacitor-start, capacitor-run: ¾ HP, 56 Frame, 4 Poles

#	Level	Rated Full Load Efficiency	Defining Design Characteristics	Mfr. Production Cost	Total Mfr. Unit Selling Price
0	Baseline: lowest cost motor	67.8%[8]			
#	**Level**	**Rated Full Load Efficiency**	**Design Changes of Baseline to Meet Efficiency Level**	**Incremental Cost (over Baseline) per Improvement**	**Total Mfr. Unit Selling Price**
1	Incremental value				
2	Incremental value				
3	Maximum value in market today	85.2%			
4	Gap fill between maximum in market and maximum feasible				
5	Maximum technology feasible				

[8] Efficiency value was taken from composite catalog data. Please modify if this number is incorrect.

12A.3 SMALL ELECTRIC MOTORS MARKET DATA

PART B. ADDITIONAL ISSUES FOR DISCUSSION

DOE's rulemaking is focusing on general purpose, alternating-current, induction motors, built in a two-digit frame number series, including: capacitor-start induction-run, capacitor-start capacitor-run, and polyphase induction motors. All of your responses to the following questions should be in the context of these small motors.

B.1 **Extrapolating Results**. The Team will need to extrapolate findings from the analyzed motors to other motors. Can you recommend a method of extrapolation that might be applied across horsepower ratings and numbers of poles?

B.2 **Shipments Estimate**. Can you provide an estimate of the total national shipments for the CSIR, CSCR, and polyphase induction motors? This would be your estimate of the total national shipments for the US market, not your company's shipments or proportion of those shipments.

B.3 **Shipments Breakdown**. Can you estimate the approximate percentage shipped in frame sizes 42, in 48, and in 56? Do you observe any trends in your customer orders for these frame sizes (e.g., increasing, decreasing volumes)?

DOE will need to develop a distribution chain model to understand how motors move through the market from manufacturer to end-user, as well as some of the final operating characteristics. DOE is interested in understanding both the proportion (volume) of products that move through certain channels and the mark-ups applied.

B.4 **Distribution Chain.** In the Determination Analysis, DOE estimated that the shipments from motor manufacturers to original equipment manufacturers (OEMs) was 40%, from motor manufacturers to distributors to OEMs was 25%, and from motor manufacturers to distributors to end users was 35%. Do you agree with these national estimates? What are the typical mark-ups by stakeholder in each of these channels?

B.5 **End-Use Sectors**. Which end-use sectors (e.g., industrial, commercial, agricultural) tend to purchase motors using the three channels identified in B.4? If its easier, please respond to this question by completing the following table.

Table 12A-7. Apportioning End-use Consumers of Motors by Sales Channel

Sales Channel	Industrial	Commercial	Agricultural	Other	Totals
OEMs					100%
Distributors to OEMs					100%
Distributors to End-users					100%
Totals	100%	100%	100%	100%	

B.6 **End-Use Application Operating Hours and Frame Size Apportionment**. In the Determination Analysis, DOE estimated the following annual operating hours by application (these are repeated in the table below for convenience)? Do you agree with these national average estimates? Do the average annual operating hours vary significantly by motor type or size? Also, approximately what percentage of small motor shipments are used in the applications listed below? Please complete the following table with your estimate of the applications breakdown by frame size.

Table 12A-8. Operating Hours and Frame Size Apportionment

End-Use Application	Operating Hours /Year	Percentage Using…			Totals:
		42-Frame	48-Frame	56-Frame	
Air and gas compressors	800				100%
Commercial and Industrial HVAC / refrigeration equipment	2500				100%
Commercial laundry machinery	2000				100%
Conveyors	3000				100%
Farm machinery	1000				100%
Food machinery	3000				100%
General industrial machinery	2000				100%
Industrial and commercial fans and blowers	5000				100%
Machine tools	2000				100%
Packaging machinery	3000				100%
Pumps and pumping equipment	3000				100%
Service industry machinery	1500				100%
Textile machinery	3000				100%
Woodworking machinery	2000				100%
Totals:		100%	100%	100%	

12A.4 PRELIMINARY MANUFACTURER IMPACT ANALYSIS

Part C. Preliminary Manufacturer Impact Analysis

C.1 **Key Issues**. What are the key issues for your company regarding any new energy conservation standards for small electric motors?

C.2 **Your Company's Niches**. What are your product lines, niches and relative strengths in the small motors market?

C.3 **Company Demographics**. Where are your production facilities located, and what is the product mix manufactured at each location? Does the bulk of your company's small motor production occur domestically? What are your employment levels at these facilities? Are there any manufacturing or employment issues that DOE should be aware of in terms of producing more energy efficient motors at your facility/facilities?

C.4 **Materials and Material Prices**. Are the materials necessary to build more energy-efficient motors readily available? How would material price changes affect your company's business?

C.5 **Impacts**. Generally how would new efficiency standards on small motors impact your customer mix, distribution channels and corresponding profit margins? Please explain.

C.6 **Capital Investment**. What level of capital expenditure and product conversion costs would you anticipate you may need to make at higher standard levels? Please describe these capital investments and provide your best estimate of their respective magnitudes.

C.7 **Small Businesses.** To what extent will new standards require small businesses to acquire new equipment or cause manufacturing process changes that could destabilize their business?

C.8 **Facility Impacts.** How would the imposition of new energy efficiency standards affect capacity utilization and manufacturing assets at your domestic production facilities? Would a new standard result in stranded capital assets? Would any facilities be closed or downsized? Added or upgraded?

C.9 **Depreciation**. What are the depreciation periods for the three types of capital expenditures (building, equipment, tooling)?

C.10 **Compliance Costs.** What specific annual compliance costs (after the effective date) do you anticipate incurring to comply with standards? Will they vary with standard level? Would these costs vary over time?

C.11 **Exports and Competition**. Would new standards change your projected export sales? Would new standards have an impact on the portion of the domestic market served by foreign competition?

C.12 **Industry Consolidation**. In the absence of new standards, do you expect any industry consolidation?

C.13 **Competitive Positioning**. How would new standards affect your ability to compete? Could new standards disproportionately advance or harm the competitive positions of some firms?

C.14 **IP Issues**. Are there concerns over intellectual property, patent licensing or other related issue?

C.15 **Impacts on Consumers**. Could new standards result in disproportionate economic or performance penalties for particular consumer/user subgroups? Beyond price and energy efficiency, could new standards result in products that will be more or less desirable to consumers due to changes in product functionality, utility or other features?

C.16 **Regulatory Burden**. Are there recent or impending regulations on small motors or related products that do or will impose a cumulative burden on the industry? How might an energy efficiency standard impact the cumulative regulatory burden faced by your company? What is the total expected impact of those other regulations?

C.17 **Federal Tax Incentives**. Are there any federal tax credits or other incentive programs to encourage you to produce energy efficient small motors (covered or subsidized for covered)?