CEE

Consortium for Energy Efficiency
Motor Systems Initiative[1]

Introduction

The energy efficiency opportunity in industrial motor systems is great. In 1994, electric motor-driven systems consumed 23 percent of all electricity sold in the United States, making up by far the largest single category of electricity end-use in the American economy. In response to the Energy Policy Act (EPAct), CEE launched its Premium-Efficiency Motors Initiative as the first of four identified motor system opportunities; the other three were motor repair, performance optimization, and original equipment manufacturers (OEMs). In 1999, the Department of Energy issued a final rulemaking outlining implementation procedures for EPAct. The rulemaking firmly established new federal minimum standards for motor efficiency and clarified CEE's specifications as the premium-efficient alternative. With this achievement, CEE had the opportunity to press its motors initiative forward and explore other opportunities to transform the motors systems market.

In 1999, CEE's Motor Systems Working Group recommended a strategy that both taps motor systems savings opportunities and meets members' diverse industrial programming needs. The strategy entails:

1. **Creating a common platform for CEE activities relating to motor systems**
2. **Developing and delivering a motor systems toolkit to help program staff in the field convince their customers to implement motor systems projects**
3. **Delivering the toolkit through a national motor systems campaign in collaboration with other national motor organizations**
4. **Adding additional tools to the toolkit as appropriate in the future**

This initiative is intended to be useful to members with ongoing motors programs as well as those that might be interested in initiating a new motors effort, e.g., programs created with systems-benefit funds. By targeting the needs of program field representatives, this effort is both complementary to, and distinct from, the Motor Challenge program. While a number of excellent motor system resources are currently available from organizations such as CEE, DOE-OIT, and EPRI, what has been missing is a unifying framework in which to package these resources and a strategy to introduce them to the market. Much like the Super Efficient Home Appliances (SEAH) Initiative, CEE is proposing a Motor Systems Initiative to unify its motor-related activities for the industrial sector.

[1] This project has been funded in part by grant support from the U.S. Department of Energy. The Consortium for Energy Efficiency is funded by members' dues as well as by grants from the U.S. Department of Energy and the U.S. Environmental Protection Agency.

In short, the Motor Systems Initiative's plan of attack is to develop and promote a national level message, empower CEE members that are champions for motor system efficiency, and partner with those influencing decisions at the local level – such as repair shops and motor distributors. Taking a motor systems approach will help transform the way motor systems are sold, purchased, repaired and managed.

Initiative Goals and Objectives

The goals of Motor Systems Initiative are to:

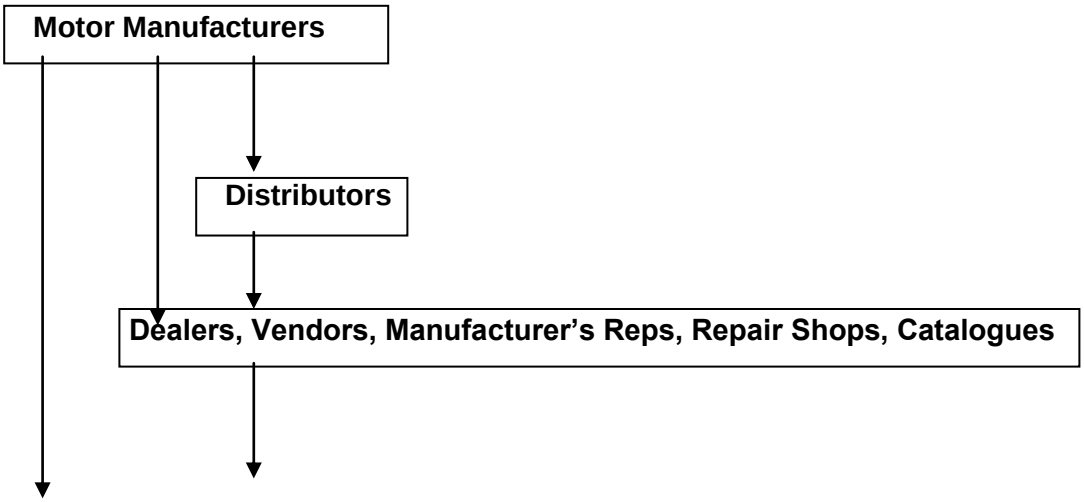
1. Increase the demand for energy-efficient motor systems
2. Motor systems suppliers provide energy efficient solutions as standard business practice

In support of this goal, CEE has the following objectives:

1. Understand the motivations of industrial motor systems decision-makers
2. Provide targeted solutions, tools, and other motor system resources
3. Package the solutions in an easy to use format and disseminate it to program staff
4. Secure participation of motor systems stakeholder organizations and associations
5. Establishing a forum for practitioners to exchange lessons learned

Initiative Scope

The initiative is limited to participants in the industrial motors market and sales through motor manufacturers, distributors, vendors, and repair shops. According to DOE, there are approximately 12.4 million electric motors of more than 1 horsepower in service in U.S. manufacturing plants. Approximately 2.9 million motors fail every year with 600,000 resulting in replacements. The rest are repaired. Annual motor sales are almost $1 billion. There are 12 major motor manufacturers represented in this market. Forty percent of new motors reach end-users as discrete components. Most of these are sold by distributors who may be large electrical supply houses, motor repair shops, or specialty distributors. The remaining 60 percent are sold to original equipment manufacturers for use as components in motor-driven equipment.



Industrial Customers

Motor Systems Opportunity

Electric motor-driven systems consume 23 percent of all electricity sold in the United States, making up by far the largest single category of electricity end-use in the American economy. Research by DOE has shown that industrial motor energy use could be reduced by 11 to 18 percent (62 to 104 billion kWh per year) if industrial facilities undertook all cost-effective measures of mature efficiency technologies and practices.[2] These savings are valued at $3.0 to $5 billion per year and would avoid the release of 15 to 26 million metric tons of carbon per year. Approximately 28 percent of the savings opportunity can be achieved through more efficient motors; the rest can be addressed through motor systems opportunities. See table below. In addition industrial customers would benefit from improved control production processes, reduction in waste materials, and improved environmental compliance.

Summary of Motor Energy Savings Opportunities by Measure in Manufacturing Facilities

Measure	Potential Energy Savings (Gwh/Yr.)
Motor Efficiency Upgrade • EPAct • CEE • Improve Rewind Practices	**24,577**
Systems Level Efficiency • Correct Motor Sizing • Pump System Optimization • Fan Systems Optimization • Compressed Air System Optimization • Specialized Systems	**60,579**
Total	**85,156**

Source: *United States Industrial Motor Systems Market Opportunities Assessment: Executive Summary*. US DOE-OIT, December 1998. Page 11.

Of course, this full potential cannot be met all at once. That would require expenditures of $11-$17 billion, roughly 10 percent of total new capital expenditures by all manufacturers in 1994. Unfortunately, the competing demands for capital and management resources are great even when faced with motor systems savings. Without a motor systems initiative, it will take 15 to 20 years for the current population of 1-200 horsepower motors to be 80 percent replaced. Therefore, a Motor Systems Initiative should accelerate the pace of replacement and address the larger motor systems savings opportunity.

[2] *United States Industrial Motor Systems Market Opportunities Assessment: Executive Summary*. US DOE-OIT, December 1998. Pgs. 1-2.

Why Motor Systems

There are two basic categories of motor system energy efficiency measures: those that improve the efficiency of the motor, alone, and those that improve the efficiency of the motor-driven machine as a whole. Motor system efficiency improvements can be approached through a number of maintenance, engineering or management strategies.

Successful implementation of a Motor Systems Initiative requires careful market analysis for both motors and motor-driven equipment. The initiative is limited to participants in the industrial motors market and sales through motor manufacturers, distributors, vendors, and repair shops.

According to DOE, motor efficiency upgrades can achieve potential savings of about 19.8 billion kWh per year. Improved methods of repairing motors can contribute an additional 4.8 billion kWh. Energy savings from motor system efficiency improvements are potentially much larger: 37 to 79 billion kWh per year. Most motor efficiency upgrades can be achieved fairly easily by selecting the most efficient available motor for the application at hand. System efficiency measures, on the other hand, often require a significant amount of effort on the part of industrial end-users, and their vendors to identify, design, implement, and maintain.[3]

According to a survey of 275 chief financial officers, electric utilities are viewed as the primary source of information on upgrading and/or retrofitting equipment. Over half indicated that they would go to their utility first to get more information; consultants and electrical manufacturers were also highly ranked.[4] In addition, out of a number of different costs in corporate America (labor, travel, marketing, rent, etc), CFOs felt that they had the least control over electrical energy costs. Marketing and labor costs were considered to be the most controllable.

The research above indicates that there is a significant opportunity to improve motor system energy performance and that industrial decisionmakers are receptive to rate-payer programs. The fact that industrial customers are unaware of motor system opportunities or choose to spend their capital and management resources elsewhere represents a barrier that the Motor Systems Initiative addresses. Additional market barriers are more directly addressed below.

Market Barriers

Despite the success of a few, vanguard companies that have aggressive, in-house, motor system programs and the relative maturity of motor system technologies used to achieve motor systems efficiency, the level of knowledge and adoption of system efficiency measures among industrial facilities managers is very low.[5] The Motor Systems Initiative seeks to increase the penetration of motor system efficiency

[3] *United States Industrial Motor Systems Market Opportunities Assessment: Executive Summary*. US DOE-OIT, December 1998. Pgs. 2-3

[4] Energy Cost Savings Council CFO Magazine Survey Results:Final Report. Oct. 1998. Pg 16.

[5] For instance, motor systems equipped with adjustable speed drives account for only 4% of manufacturing motor system energy, compared to a potential level of application between 18% and 25%. IBID. pg. 3

measures by addressing these market barriers as well as the ones listed in the table below.

Market Barriers to Motor System Efficiency

1. Low priority of energy efficiency among capital investment and operating objectives. Within manufacturing as a whole, motor system energy costs constitute less than 1 percent of total operating costs. This figure is considerably higher for a small number of energy-intensive industries such as paper and chemicals.
Roughly 3,500 manufacturing facilities (1.5 percent of the total) account for nearly half of all motor system energy use and potential savings in the manufacturing sector. By focusing on a few key industries, Motor Systems Initiative has the potential to change an entire market.
2. General lack of awareness among facility managers, equipment distributors, engineers, and manufacturers' representatives of strategies to achieve motor system efficiency: their costs, management requirements, and benefits.
Using the Motor Systems Initiative toolkit, program personnel and contractors in the field are uniquely positioned to help educate industrial customers and trade allies about motor system opportunities.
3. General low level of staffing for facilities maintenance function.
By reaching out to energy service companies and those that offer maintenance services under contract, the Motor Systems Initiative can help reach facilities that have limited staff resources.
4. Conflicting incentives for suppliers regarding the promotion of energy efficient equipment and practices. For instance, compressed air distributors have greater incentive to sell additional compressors to customers with increasing load rather than to advise those customers how to control growth through better maintenance and production planning.
The Motor Systems Initiative can be instrumental in communicating a key finding of the Compressed Air Challenge program; namely that the business opportunity in maintaining, testing, balancing, servicing and managing motor-driven equipment is greater than the sales opportunity alone.

The Proposed CEE Initiative

CEE's Motor Systems Initiative is designed to increases customer awareness of motor system efficiency opportunities by empowering program staff with resources targeted to specific types of customers and motor opportunities. At launch, the Motor Systems Initiative will have two principal components: a motor systems toolkit, and a national marketing component.

Motor Systems Toolkit

In June 1999, CEE's Motor Systems Working Group identified the need for a toolkit that would enable program field representatives and contractors to promote a variety of motor-related efficiency improvements to a variety of audiences.[6] The toolkit would include both technical tools (software, checklists, guidelines, etc.) and a

[6] The Working Group includes representatives from NYSERDA, ECW, SCE, SMUD, DOE-OIT, the NW Alliance and NEES.

variety of promotional tools targeting the interests of maintenance, operation, and management personnel. It will be assembled and tested in a number of member-hosted pilots.

The toolkit will consist of both existing and new tools. The Motor Systems Working Group has identified additional materials need for the toolkit, such as performance checklists, benchmarking, and industry-specific process opportunities. See table below. Over time, tools will be added based on need and field experience.

The major benefit of toolkit development is that it will accelerate the process by which quality motor system tools get into the hands of those in the field. Development will permit leveraging of the many existing tools that need tailoring to the needs of specific industries as well as the professional development of a marketing strategy.

The Motor Systems Initiative will target specific industries and applications that have the greatest energy saving opportunities and are highly transferable to other sectors. (These industries would be excellent sites for future pilot projects.) According to DOE, industries and facilities with the highest levels of motor system energy savings are chemicals, primary metals (steel and aluminum), paper and allied products, water supply and wastewater, and mining.[7]

Motor Systems Toolkit

"Starter" Toolkit:
- Premium Efficiency Motor Initiative Products
- Compressed Air Challenge Resources
- Other Selected Resources

Anticipated Product Additions:
- Motor Repair Specifications
- Energy Star Label
- Repair/Replace Guidelines
- Performance Checklists
- Benchmarking Tools
- Industry-Specific Motor System Opportunities

Other Potential Considerations:
- Pump Optimization Tools
- Fan Optimizations Tools
- Blower Optimization Tools

Toolkit Development Process

The goal of the motor systems toolkit is to demonstrate the value of motor system projects, link the energy efficiency opportunities with "higher order" industrial priorities, and help industrial customers ask the "right" questions. CEE proposes the following four steps in developing this Motor Systems Initiative product:

[7] 1998 DOE Motors System Market Assessment, pg. 8.

1. **Research** – CEE will work with members to research the types of products and tools (or other types of assistance) that would be most useful when field representatives discuss motor systems opportunities with industrial customers.[8] The best tools will be candidates for inclusion into the toolkit. Some members have requested that their field representatives be actively consulted to determine the most effective types of motor systems information, products and tools, as well as the appropriate target audience for a pilot marketing program. They also offered to make a sample of their field staff available for this market research.
2. **Review Existing Materials -** Review existing technical materials from CEE, DOE Motor Challenge, NEMA, EASA, EPRI, and others and incorporating those that are appropriate into the toolkit.
3. **New Tool Development –** A variety of tools have been suggested for development and inclusion in the motor systems toolkit.

    - Motor Repair – The California Motors Initiative, EASA, and Motor Challenge have produced a number of excellent motor repair tools. In addition, there is a CEE working group that is developing a national motor repair specification that could ultimately be incorporated into the motor systems toolkit.
    - Benchmarking Tool – The Motor Systems Working Group suggested developing a common method to measure motor system productivity among like industrial companies (same SIC or industrial processes). A standard measure of performance will help open doors for program field representatives because it provides a clear indication of plant performance that managers can understand and value. The DOE motor system market assessment will be a key asset in developing this tool.
    - Corporate Procurement Tool – A procurement tool could help field representatives encourage industrial customers to include motor-related issues (e.g., motor procurement, operation, maintenance, repair and replacement) in corporate procurement policies and procedures. A model motor systems procurement policy could help 1) guide a corporation's procurement personnel, 2) provide an opportunity for continuity in the face of plant turnover, and 3) prevent "crisis" decision-making when motor failures occur.
    - Optimal Motor Performance Checklist - A tool containing 4-6 points/reminders for shop people to consider. This tool would be targeted to the needs of plant operations and maintenance personnel. It would most likely take the form of a poster or wallet-sized laminated card with efficiency reminders.
    - Guidelines for Making Effective Motor Decisions – A set of guidelines outlining key motor repair versus replace considerations. This tool would be targeted to the needs of those who make repair/replace decisions; presumably the plant managers and engineers, and maintenance supervisors. It would most likely be in brochure form.

[8] The intent is to target a key industries such as forest products and food processing as well as key stakeholders in the motor system decisionmaking process, such as maintenance staff, motor operators, plant engineers and managers.

- Training Support - The Motor Systems Initiative could also guide participants to appropriate Motor Challenge-sponsored training.

4. **Pilot Testing -** Initial toolkit materials will be pilot-tested by members to ensure that the contents of the toolkit are relevant to particular industry needs.

National Motor Systems Campaign
In addition to toolkit development, members identified the value of a first-class marketing approach to design and deliver the toolkit. Under this component of the Motor Systems Initiative, CEE would closely with a professional marketing firm to develop a targeted, national message on motor systems management and optimization. CEE would invite other national organizations such as DOE-OIT, FEMP, EPA, CDA, NEMA, and EASA to take part in the campaign. Essentially the campaign will highlight the benefits of premium-efficiency motor systems and encourage industrial customers to request more information from local partners. A professionally developed marketing plan will be developed that makes use of a variety of delivery mechanisms, such as media outreach, press kits, outreach to associations and trade associations, purchased advertising, and national conferences/trade shows.

During phase one of the Initiative, CEE will seek advice from marketing firms and invite the participation of national motor organizations. By the end of phase one, a professional marketing firm would be asked to develop a several strategic options for consideration. A process of participant consensus will be used to select the most appropriate marketing approach. During a second phase, CEE and/or our initiative participants will implement the agreed upon strategy.

Member Interest

According to the most recent CEE Premium Efficiency Motors UPDATE, 38 programs operated by members in 13 states have adopted the Motors Initiative with the four largest programs having an aggregate budget of nearly $5 million. The administrators of these programs have expressed interest in the Motor Systems Initiative and its development. Clearly members with active motors programs represent an interested audience.