DEVELOPMENT OF A NATIONAL INDUSTRIAL ELECTRIC MOTOR SYSTEMS STRATEGY AND PROGRAM

Paul Scheihing, Henry Kenchington, Richard Been, Chris Cockrill, Julia Oliver; U.S. Department of Energy; Mitch Olszewski, Oak Ridge National Laboratory; Al Puente, National Renewable Energy Laboratory

ABSTRACT

Over 40 million electric motors convert electricity into useful work in U. S. manufacturing operations. Industry spends over $30 billion annually on electricity dedicated to electric motor-driven systems. Because nearly 70% of all electricity used in industry is consumed by motor systems, increases in the energy efficiency of existing motor systems will lead to dramatic nationwide energy savings.

The United States Department of Energy's (DOE) Motor Challenge program is an industry/government partnership designed to help industry capture 25 billion kilowatt-hours per year of electricity savings by the year 2000. These savings translate to $1.25 billion in energy cost savings and 6 million metric tons of carbon equivalent (MMTCE) of emissions reduction per year.

The origin, status, and accomplishments of the Motor Challenge program are summarized as well as the vision of the over-arching strategic elements required to assist industry in transforming the motor-driven systems market over the next 5 years.

BACKGROUND OF THE MOTOR CHALLENGE PROGRAM

The United States Department of Energy's (DOE) Motor Challenge program is an industry/government partnership designed to help industry capture 25 billion kilowatt-hours per year of electricity savings by the year 2000. Initiated in 1993 as part of the Department's renewed attention to energy conservation efforts, the program's official mission is to "create a partnership with our allies to deliver products and services that assist our customers in gaining a competitive advantage in managing their electric motor systems while saving energy and enhancing environmental quality." A specific goal is to increase the market penetration of energy-efficient industrial electric motor-driven systems by helping industry adopt the systems approach in developing, purchasing, and managing motors, drives, and motor-driven equipment such as pumps, fans, and compressors.

The operational goals of the Program relate to how many people employed by end-user companies respond to the challenge and commit to learning and adopting the systems approach in selecting and operating electric motors and the equipment they drive. This will be measured by the participation of plant personnel in Motor Challenge activities (e.g., training, Clearinghouse services, and use of new tools). Correspondingly, targeted market transformation activities involving original equipment manufacturer (OEM) supplier groups (e.g., pump, fan, blower, and compressor manufacturers), distributors, engineering firms, utilities, and end users will result in the development and adoption of specific energy-efficient equipment and systems, or services that improve overall system performance.

HISTORICAL PERSPECTIVE: The 1980"s

During the 1980s, DOE's focus on motor systems as an opportunity for increasing energy efficiency was minimal. DOE primarily supported only a handful of research and development activities (e.g., permanent magnet motors, etc.). The agency's lack of interest in motor systems was partly due to a deemphasis of energy conservation programs during the Reagan Administration, but more specifically, was a result of a DOE-sponsored study completed in 1980[1] that surveyed and assessed the opportunity of energy-efficient motors and pumps. This report was prepared in response to possible Federal regulation of electric motors under consideration during the Carter Administration.

The report's findings led DOE to regard the benefits of a national energy conservation effort aimed at efficient motors to be somewhat small, and to conclude that DOE's active involvement to promote this opportunity was not justified. The report presumed that rising electricity prices and marketing by motor manufactures would drive the penetration of energy efficient motors to more than 60 percent. In retrospect, the market penetration of efficient electric motors reached a level of 25 to 30 percent by 1990 for motors between 20 HP and 250 HP[2] .

TAKING ANOTHER LOOK: The 1990's

At the start of the 1990s, and during the Bush Administration, attention to DOE energy conservation initiatives was renewed. In early 1991, the DOE Office of Industrial Technologies (OIT) identified industrial electric motors as a potential new technology and application area to consider. First, a review of potential opportunities and benefits on a national level was assessed. Second, OIT was asked by DOE management to clearly define the role that the Federal government should play, if any, to assist industry and the market in accelerating the energy savings opportunity of electric motors.

Initial screening showed the opportunity to be very large since, as mentioned, over 70 percent of all industrial electricity was dedicated to motors. Energy savings of 240 billion kWh/year by the year 2010 were estimated. More significantly, it was realized that the national energy saving potential was not primarily in the efficiency improvement of electric motors themselves, but in the implementation of AC electronic adjustable speed drives (ASDs) that were starting to rapidly enter the market and, more broadly, in the adoption of a systems approach in the way motor-driven equipment and systems are optimized within processes (see text box and Figures 1 and 2 next page).

NATIONAL PLANNING EFFORT: 1992

In 1992, OIT worked with a variety of internal DOE groups (e.g., the Regional Support Offices, the Bonneville Power Administration, the Office of Building Technologies, the Federal Energy Management Program, and the Naval Petroleum Reserve) to develop an Electric Motor Systems Strategic Plan[3]. The strategic plan called for a highly coordinated effort by DOE that would focus primarily on deploying commercially available energy-efficient motor systems. In parallel, DOE started to work with other stakeholder groups (e.g., the Electric Power Research Institute [EPRI], the National Electrical Manufacturers Association [NEMA], and the National Association of Manufacturers [NAM]), to plan collaborative efforts to raise the visibility of the motor systems opportunity to a national level.

IDENTIFYING BARRIERS AND SOLUTIONS: 1993 Roundtable on Efficient Electric Motor Systems for Industry

The first major event sponsored by DOE-OIT was the National Energy Efficient Electric Motor Systems Conference, which was cosponsored by EPRI and was held in February 1993 in Baltimore, MD. In conjunction with the conference, DOE and EPRI convened a Roundtable on Efficient Electric Motor Systems for Industry[4] to draw together participants involved in the market distribution chain. The meeting helped to:

- Characterize the complex industrial electric motor system market delivery system (see Figure 3);
- Identify problems impeding market penetration of efficient industrial electric motor systems, and;
- Suggest solutions for mitigating these barriers.

This Roundtable and subsequent research revealed a range of economic, institutional, and technical barriers that impede

the rapid and widespread adoption of energy-efficient electric motor systems. Fundamentally, these barriers are a function of price/performance characteristics and the perspectives of various stakeholders. In general, the incentives of the people involved in motor systems decisions do not naturally lead to a systems approach, or when considering

THE SYSTEMS APPROACH AND ENERGY EFFICIENT ELECTRIC MOTOR-DRIVEN SYSTEMS

The efficiency of electric motor-driven systems derives from the efficiency of individual components (motors, drives, pumps, fans, blowers, compressors) and the integration of these components into an operating system. The greater energy efficiency opportunities are found in the system integration rather than the selection of individual components (**Figure 1**).

DOE-OIT estimated that approximately only 20 percent of the potential energy savings is associated with improvements in the efficiencies of motors themselves. The remaining 80 percent can be attributed to better matching of the motor and mechanical system components (e.g., with adjustable speed drives); electrical distribution correction; and process optimization actions, such as implementing more efficient mechanical/motor-driven equipment (**Figure 2**). Substantial improvement opportunities can be uncovered, therefore, when the design, control, and operations and maintenance of the driven equipment are examined along with motors and drives.

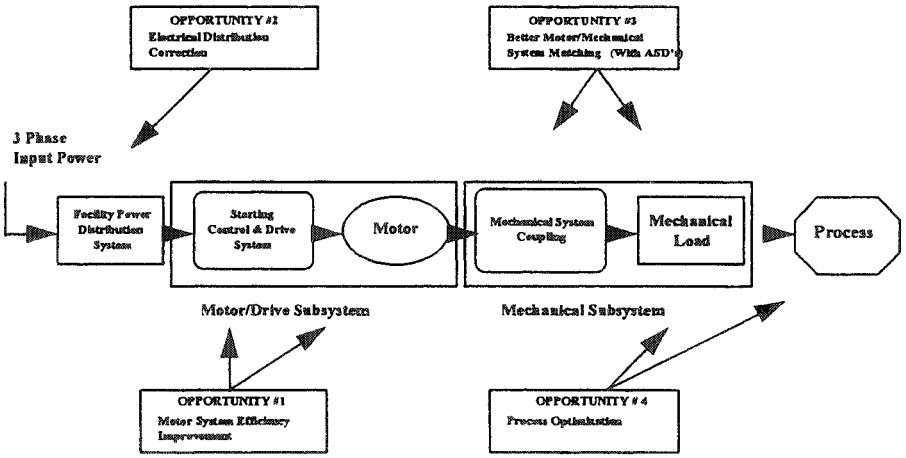

Figure 1: Electric Motor System (EMS)

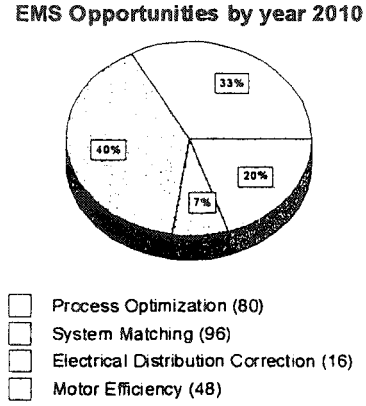

Figure 2: National EMS Energy Savings Opportunities (billion kWhr/year)

the

motor itself, the selection of a more efficient product. Moreover, even when the benefits of a systems approach or energy-efficient motor are sought, the information and analytic methodologies are lacking to provide confidence to decision makers. Examples of barriers include:

- **Customers' major criterion is first cost.** End users are unwilling to pay the cost premium for energy-efficient motors, drives, and driven equipment.

- **Lack of long-term ownership.** Various methods for developing, operating, and financing industrial facilities provide diverse incentives for stakeholders. Design-build, build-leaseback, and facilities operations contracts all introduce decision criteria that may argue against expenditures on more efficient motor systems that may offer superior life-cycle costs.

- **Lack of system responsibility.** The electric motor system, even broadly construed, is often part of a much more extensive operation. The responsibility for operating these systems may be distributed in ways that provide little incentive for individuals to promote motor system efficiency activities.

- **Insufficient information to make informed decisions.** The paucity of data on markets and end-use applications for motor systems constrains analysts and decision makers.

- **Lack of technical expertise.** In many instances, ASDs and systems components are not commodity products and require complicated and complex engineering, economic and reliability considerations. In this context, some specifiers/agents to end users have limited familiarity with applications of ASDs and insufficient technical expertise.

- **Lack of consistent and reliable performance data.** The acceptance of efficient motor systems and components (e.g., motors, ASDs, pumps, etc.) has been slowed by the lack of consistent and reliable data. Testing methods vary, published data are often difficult to compare, and required information is not easily available.

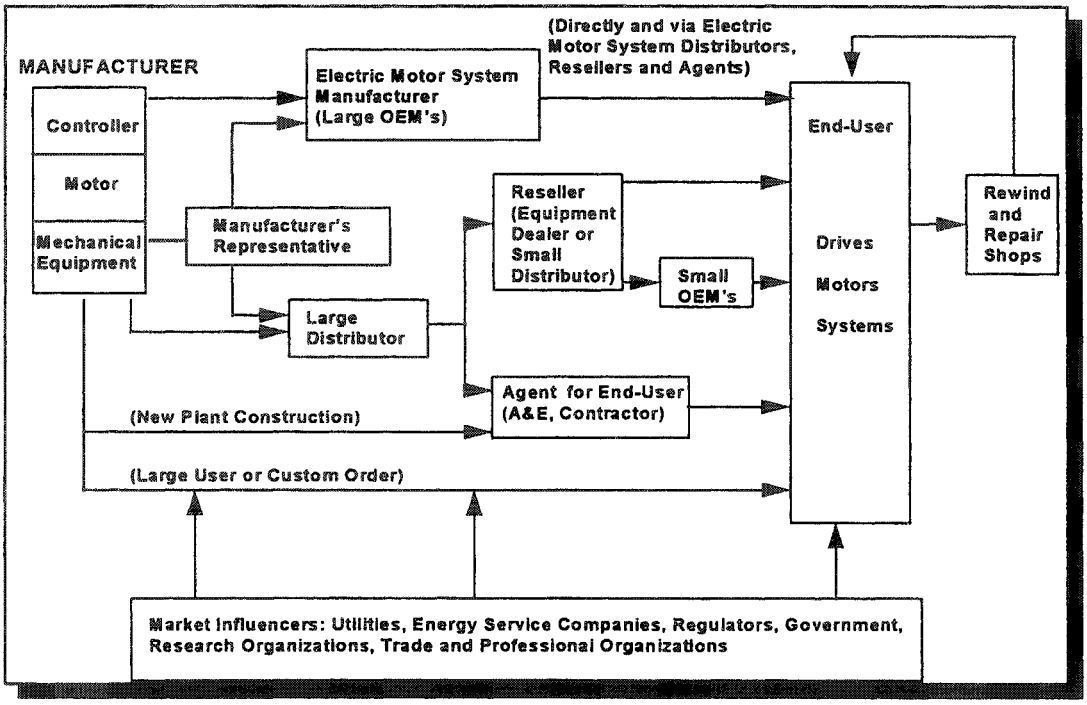

Figure 3: Complex Electric Motor System Market Delivery Structure

CREATION OF THE MOTOR CHALLENGE:

Responding to industry's guidance from the Roundtable

The wealth of ideas from the 1993 Roundtable left DOE with a range of opportunities to target. DOE's challenge was to bring these ideas together in a strategic manner while involving the widely diverse stakeholders that comprise the electric motor system market delivery network, and their respective perspectives, to collectively plan, develop, and implement initiatives. Principally, the input by industry at the Roundtable identified DOE's role as being threefold:

1) Providing national leadership and coordination to encourage the application of the systems approach to electric motor systems;
2) Collecting, developing, and disseminating information on efficient motor systems; and most importantly,
3) Breaking down barriers by engaging stakeholders at all levels to build a foundation of better information and knowledge.

With this mandate, DOE began to actively work with industry groups such as NAM, EPRI (i.e., EPRI's National Motor and Drive Steering Committee), and NEMA to determine how to deploy a national program that would best serve industrial end users' needs.

While the strategic guidance by industry was clear, the tactical basis on which to initiate a national program and to congeal industry's interest in a comprehensive national deployment effort was not as clear. DOE's response to this challenge was to propose the idea of Showcase Demonstrations as a focused effort. Showcase Demonstrations implemented at specific industrial plants would put industry in a leadership position with the plants demonstrating how the benefits of efficient motor systems can be cost effectively captured in varied settings. The Showcase Demonstrations would highlight the techniques, approaches, and best practices adopted and would be used to encourage other companies to replicate the validated results. With the Showcase Demonstration concept forming the kernel of the DOE program, the Motor Challenge program was conceived.

Somewhat coincident and serendipitous to developing the idea of the Motor Challenge was an initiative by the White House and Clinton Administration to develop a Climate Change Action Plan (CCAP) in response to the Rio De Janeiro International Accord of 1992 to address the issue of Global Warming. Accordingly, Motor Challenge was one of many potential actions proposed as part of an industry working group within the White House CCAP Conference. By July 1993, the CCAP industry working group had selected a series of proposals for further consideration, including Motor Challenge.

With the CCAP industry working group's endorsement, a follow-on meeting was held by NEMA, NAM, EPRI, and Edison Electric Institute (EEI) with Secretary of Energy Hazel O'Leary and the OIT on July 22, 1993, to pursue the Secretary's support in initiating the National Motor Challenge program. The outcome of this meeting was pivotal: Secretary O'Leary strongly endorsed the program, since, in her opinion, it was directly in line with the Clinton Administration's and DOE's pursuit of voluntary industry/government initiatives that are industry-driven and provide an alternative to the more traditional (regulatory) approaches to addressing environmental issues. That is, the Secretary believed that recognition of industry's voluntary achievements in environmental improvement would be another important role and benefit of Motor Challenge. Finally, Secretary O'Leary recommended the development of a Compact between industry and DOE that would consummate and solidify an understanding on the guiding principles of the Motor Challenge.

After 3 months of communications and discussions with industry (August to October 1993), the Motor Challenge program was officially launched by the signing of the *Motor Challenge Compact* on October 19, 1993, by Secretary O'Leary along with 44 organizations who then became Charter Motor Challenge Partners. The highlights of the Compact were as follows:

1) The Compact stated the purpose of the MOTOR CHALLENGE Program was to "demonstrate, evaluate, and accelerate the market penetration of efficient electric motor systems [i.e., system integrated efficient electric motors, adjustable speed drives, and motor-driven equipment and processes] to achieve energy, economic, and environmental benefits."

2) The Compact described three program activities:

a) A MOTOR CHALLENGE Partnership where private companies, associations, institutions, and the public sector could participate in MOTOR CHALLENGE Program informational exchange activities;

b) Showcase Demonstrations of efficient electric motor systems;

c) Development of a National Electric Motor Systems Database to facilitate exchange of performance data and to recognize efficient electric motor systems deployment progress from the Showcase Demonstrations or other non-Showcase Demonstration experiences that industry may voluntarily report.

3) The Compact also suggested that "future MOTOR CHALLENGE Program activities will involve a follow-on voluntary MOTOR CHALLENGE deployment that will emphasize the recognition of individual industrial end users' excellence achieved in implementing and managing efficient electric motor systems within their facilities. The follow-on voluntary MOTOR CHALLENGE deployment will build upon the knowledge gained in the Showcase Demonstrations and parallel experiences of the informational exchange within the Partnership and Electric Motor Systems Database."

This last item was significant because it implied a desire by both industry and DOE to actively work together for the first 2 years of the Program's development (FY 1994 and FY 1995), to refine and plan the strategies, policies, and activities that would make the most sense, and be most relevant to meeting industrial end users' needs. That is, the process of developing and shaping the Motor Challenge would be industry-driven.

MOTOR CHALLENGE PROGRAM ELEMENTS

As configured currently, the Motor Challenge program is comprised of five integrated program elements (Figure 4). These program elements are discrete, but are necessarily coordinated and interrelated. The program elements are as follows:

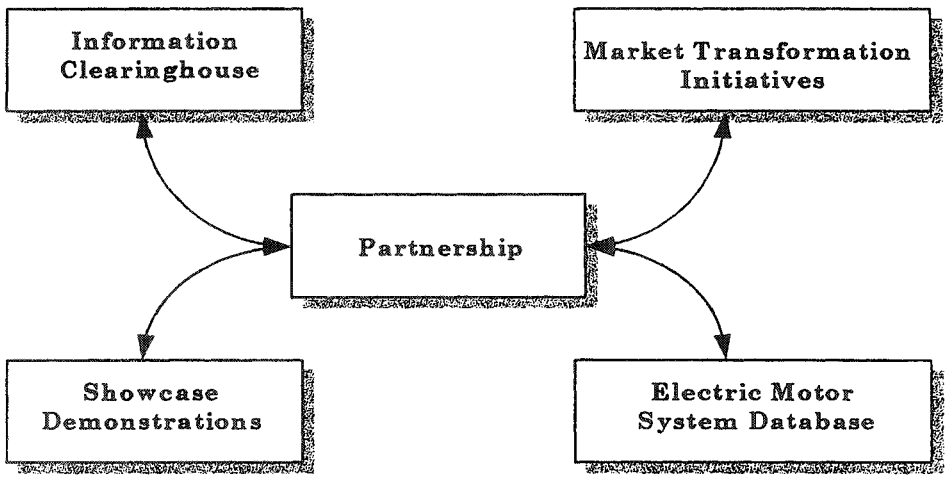

Figure 4: Motor Challenge Program Elements

Motor Challenge Partnership

The Partnership is intended to involve all types of stakeholders in various activities, ranging from program design and planning, to implementation, and program evaluation. By involving stakeholders in a meaningful way, DOE ensures that the Program reflects needs and opportunities in all aspects of electric motor-driven systems (i.e., design, manufacture, selection, purchasing, operation, and maintenance), each of which may be viewed from a different perspective by various stakeholders. The Partnership allows these perspectives to converge and contribute to a

common set of goals, which, in turn, will drive a coordinated marketing strategy, as well as a promotion and deployment effort. Partnership activities are both national and regional, and are designed to deliver the best information about electric motor-driven systems to the people who can use it. Initially focused on the system's motor and drive elements, the Partnership activities will increasingly address the integrated elements of the systems, and deal specifically with barriers and opportunities associated with the pumps, fans, blowers, and compressors (see reference 8). Specific Partnership activities include:

1) Workshops, conferences, and information exchanges;
2) Training curriculum development and training sessions;
3) Industry program planning meetings and roundtables
4) Program marketing and communications efforts and activities.

These activities are coordinated with the DOE Regional Support Offices (RSOs), and the Program's Allied Partners to focus on Customer/End-User Partners (see the Program Vision section for more about the Allied Partner and End-User Partner concept).

Information Clearinghouse

The Clearinghouse was established to provide reliable up-to-date information on the Motor Challenge program and energy-efficient motor system technologies. The Clearinghouse serves as a one-stop shop that provides stakeholders with easy access to unique resources. Located at the Washington State Energy Office, the Clearinghouse disseminates written materials, decision tools (such as the Motor Master software package), and education and training materials; provides information about upcoming conferences and workshops; and manages an electronic bulletin board system (BBS). Available for use by Motor Challenge partners only is the Clearinghouse's National Technical Assistance Service. Through this service, Partners have access to the Clearinghouse engineering staff to gain insights concerning possible solutions to actual problems faced at their facilities. The Clearinghouse can be contacted through a toll-free hotline (800/862-2086).

Showcase Demonstrations

As mentioned, the Showcase Demonstration projects will target electric motor-driven system efficiency and productivity opportunities in specific industrial applications. It is expected that the Showcase Demonstrations will prove that efficiency potentials can be realized in a cost-effective manner and will encourage replication at other facilities. Industrial end users of electric motor-driven systems provide the leadership roles for each demonstration team, which also may include other team participants, such as motor and drive manufacturers, original equipment manufacturers, utilities, universities, distributors, and consulting firms. The teams submitted proposals detailing an action plan that would demonstrate important efficiency benefits. Teams were given the option to propose a demonstration of existing or new applications of efficient motor-driven systems. With technical assistance from DOE, participants will develop better strategies, establish enduring alliances, and gain recognition for their efforts. Specifically, DOE will support the Showcase Demonstration teams by:

1) **Helping to develop tools and best practices.** DOE will support the development of design-decision tools, best practices, and guidelines on various electric motor systems applications. A key tool under development is the Motor Master Plus software, which will upgrade the current version of Motor Master so a plant-wide motor analysis, documentation (inventory), and energy savings assessment can be performed. Motor Master Plus will be beta-tested as part of the Showcase Demonstration projects.[9]

2) **Validate performance.** DOE will contract with consulting engineers to advise Showcase Demonstration teams on performance validation issues. These consultants will help develop and design reliable experimental and performance measurement techniques. Upon project completion, they will prepare independent performance validation reports.

3) **Document and disseminate case studies.** DOE will document and distribute a comprehensive case history for each Showcase Demonstration project.

4) **Sponsor workshops.** DOE will sponsor special Showcase Demonstration workshops to provide team members with forums to exchange information and discuss common implementation challenges and opportunities.

Electric Motor Systems Database

The Electric Motor Systems Database serves as one mechanism for providing public recognition and documentation of industry's achievements in implementing efficient motor systems with the corresponding energy savings and environmental benefits. The tool to track energy savings and environmental emission reductions will be through the Savings Tracker computer analysis software that will be a submodule of Motor Master Plus. (The Database and Savings Tracker will be discussed in the follow-on Program Metrics, Evaluation, and Market Assessment section).

Market Transformation Initiatives

Market transformation initiatives will be designed to expand and enhance the reach of the Motor Challenge deployment activities by promoting the development and delivery of more efficient motor-driven OEM technologies (e.g., pumps, fans, blowers, and compressors) and the services associated with designing, maintaining, and upgrading these technologies. These initiatives aim to leverage the substantial market position of large industrial motor system end users, electric utilities, States, and the Federal Government (as a consumer of motor systems) to create a demand-pull for motor system equipment with improved system-level efficiency. Motor system users will demand improved system-level performance. The transformed markets for higher performance motor system equipment created through the purchasing commitments of major users will provide a clear business opportunity and incentive for designers and manufacturers. Manufacturers and design engineers who are capable of responding will be rewarded in the market. For a more detailed explanation on the advancement of these strategies, refer to the paper, "*Strategies to Achieve Voluntary and Sustainable Market Transformation in Industrial Electric Motor System Markets.*" [8]

KEY PROGRAM ACCOMPLISHMENTS

Accomplishments of the Motor Challenge from 1993 to 1995 have been, first, to develop greater awareness of the opportunities of efficient motor systems, and second, to plan and develop new and innovative strategies with industry stakeholders so as to ensure activities are relevant and valuable to the market participants. Currently, the program has enrolled over 1,000 Motor Challenge Partners, many of whom have utilized the products and services of the Motor Challenge or participated in Motor Challenge-sponsored events. Key accomplishments, in chronological order from 1993 to present, include:

Establishing a Midwest Regional Collaborative: 1993

At the Energy Efficient Electric Motor Systems Conference (February 9-10, 1993) DOE proposed the concept of a regional collaborative in an attempt to "regionalize" the deployment of the DOE Electric Motor System Program initiatives. This concept brought a high degree of interest by many parties attending the conference and through post-conference discussions.

Through the leadership of the DOE Kansas City Regional Support Office in cooperation with the Wisconsin Center for Demand-side Research, formation of a Midwest Motor Systems Collaborative was begun in early 1994. In numerous meetings throughout 1994, participants sought to define relationships between stakeholders and their motivation for collaboration, identify and prioritize market opportunities, specify key leveraging issues, and identify basic elements of a successful collaborative.

This collaborative officially announced itself October 26, 1994, as the "Midwest Motor Systems Consortium" and currently comprises members from Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, Ohio, and Wisconsin. Activities to be carried out through the consortium include the development of workshops, case studies, shared expertise functions, and technical articles for publication.

Establishing the Motor Challenge Information Clearinghouse: February 1994

In February 1994, the Motor Challenge Information Clearinghouse opened at the Washington State Energy Office

(WSEO). As mentioned, the Clearinghouse serves as the initial public point of contact for information about the Motor Challenge program, and also services existing partners. For example, Partners may now receive the Motor Master software through the Clearinghouse free of charge. To date, the Clearinghouse has serviced over 2,500 cases for technical information, library research, technical assistance and general information on the program.

Tools and Protocols Workshop: September 1994

The Motor Challenge Program held a successful Tools and Protocols Workshop in Chicago, IL, from September 22-23, 1994.[10] The event hosted about 40 participants who heard topics focused on: 1) the Electric Motor System Database; 2) tool and protocol development to support the Showcase Demonstration projects; and 3) a session that addressed industry needs and concerns for implementing efficient electric motor systems. The objective of the workshop was to inform industry peers of the progress the Motor Challenge and other industry participants were making in developing tools for the implementation of efficient motor systems, as well as to receive feedback from industry.

Performance Optimization Service Workshop and Motor System Management Training: February 1995

To help Motor Challenge Partners better identify opportunities for motor-driven system energy efficiency, the Motor Challenge program sponsored a 3-day technical training session on Performance Optimization Service (POS). The POS workshop was conducted by the Wisconsin Center for Demand-Side Research at the University of Wisconsin in Madison, WI, and focused on fan, pump, and blower technology applications and the optimization of these systems. The training course topics included field testing, data analysis, formulating conclusions, and summarizing findings. Classes were conducted by industry experts and included off-site field testing. Participants learned to examine the entire manufacturing process and identify opportunities to improve total system performance. The POS workshop is now one of many training segments to be offered by the Motor Challenge or through the Program's Allied Partners.

A training course currently under development is "Motor System Management Training." Due out around September 1995, this course is aimed at tackling motor system management issues in the industrial setting. The course will be presented in modules and will include varying degrees of technical depth. Topics to be covered in the initial training curriculum include: 1) motor repair or replace decisionmaking, 2) a module on evaluating and selecting motors using Motor Master software, 3) Energy Policy Act (EPact) motor issues, 4) best practices for field measurement on electric motors, 5) a brief overview on POS, 6) an overview on ASD applications, 7) electrical system tune-ups, and 8) motor basics.

Partner Coordinating Committee Formed: March 1995

In an effort to seek industry's and the Motor Challenge partner's input and guidance on the direction and vision of the Program, the Partner Coordinating Committee was formed in March 1995.[11] The committee consists of 27 representatives of Partner companies of which more than half represent end-user companies. Three subgroups were formed to focus on: 1) The role of Motor Challenge products and services in market transformation; 2) Motor Challenge partnership, collaboration, and communication; and 3) Measuring program effectiveness and recognizing partner achievement. The committee will act as the body to guide the Program and will meet semi-annually.

Roundtable on Market Transformations Held: April 1995

DOE held a Roundtable, which was organized to bring together a broad-range of industry representatives and other stakeholders from across the United States and Canada to develop a framework to encourage industry cooperation, and to accelerate and support transformation of the electric motor system markets for pumps, fans, blowers, and compressors. The meeting provided a forum for these stakeholders to identify strategic business opportunities and areas where commonalities exist to collaborate in developing market-based initiatives.

The 2-day session pointed to a number of common themes that provide the foundation for subsequent market transformation activities. These themes included: 1) the need to develop sophisticated and demanding buyers with regard to energy efficiency; 2) balancing efficient product supply and demand; 3) closing the information gap; 4) targeting end-user non-energy benefits; 5) segmenting the market and segmenting the industrial end-user sectors; 6)

making products easier to use and understand; and 7) applying unbiased objectivity by third parties to ensure credibility of data and analysis tools.

As these initiatives progress, DOE will play the facilitation role in the market transformation process. For more detailed information on this meeting, refer the meeting's proceedings.[4]

Showcase Demonstrations Selected: May 1995

In response to a solicitation for industry proposals for Showcase Demonstration projects, 22 projects were selected in May 1995 by the Motor Challenge program (see Table 1). These projects represent a good cross-section from industry for efficient electric motor system applications. Aggregate industry investment for these projects amounts to over $15 million with an impressive estimated energy savings of over 100 million kWhr/year worth over $4 million. A few of these projects have already been completed and the majority are slated to be completed by Fall 1996.

Table 1 - Motor Challenge Showcase Demonstrations

Team (End-user Lead)	Location	Application
3M	Minneapolis, MN	Multiple facilities; 1000 motor systems
Alumax	Goose Creek, SC	4 large fans; ASDs installed
Boeing Company	Tukwila, WA	Transonic wind tunnel upgrade
City of Milford, CT	Municipal water system	System optimization
City of Trumbull, CT	Municipal water system	System optimization
City of Long Beach, CA **	Resource Recovery Facility	Efficient motors and drives
Eastman Kodak	Kodak Park; Rochester, NY	Multiple facilities; 100,000 motor systems
Enron Corporation	Hubbard compressor station, Hubbard, IO	Installation of electric drive
Fluor Daniels	DOE Naval Petroleum Reserve, WY	Oil field beam pumps
General Motors/Delphi Chassis Systems	World Headquarters; Dayton, OH	Motors and ASDs for lab facility
General Motors	Pontiac, MI manufacturing operations	Pump system upgrade
General Motors	Pontiac East, MI assembly plant	Paint spray booth upgrade
General Motors	Saginaw, MI	Laser alignment of motor/transmission
Greenville Tube **	Clarksville, AR	Improved motor/drive on process
H&R 1871 **	Gardner, MA	Energy efficient motors & air compressor
ICF Kaiser	DOE site; Hanford, WA	Major water pump system upgrade
Johnson & Johnson(J&J)	New Brunswick, NJ	Energy efficient motors and drives
J & J/Merck Consumer Products	Lancaster, PA	Energy efficient motors and drives
Johnson & Johnson	Mil Pitas, CA	Energy efficient motors and drives
Martin Marietta Armament Systems	Burlington, VT	Motors and drives on fan system
OXY USA	Multiple sites throughout Kansas	Oil field pumping systems
Peabody Holding Company	Randolph facility; Marissa, IL	Coal slurry pump

** All or part of project already completed

National Teleconference: May 1995

On May 23rd, the Motor Challenge program sponsored a national teleconference, "Efficient Motor Systems: Strategies for Success." The teleconference aired with 232 confirmed downlink sites and an estimated audience of about 8,000 people. Topics discussed by a panel of experts included how industry might embrace the benefits of energy-efficient motor systems; issues on motor repair, rewind, and replacement; EPact issues; implementation concerns with ASDs; highlights on motor and drive resource centers in the United States and Canada; customer service issues from the utilities perspective; and others. Viewers phoned or faxed in over 400 questions to the teleconference operations center, all of which will be answered by the Motor Challenge Information Clearinghouse.

PROGRAM VISION AND DEVELOPMENT

Moving the Motor Challenge forward to achieving the aggressive goal of saving 25 billion kWh/year by 2010 will require intensive coordination, interaction, and leveraging with the market players and with all types of stakeholder groups. With DOE having no vested interest in the motor systems market opportunity other than to achieve the national benefits afforded by the aggregate industry energy savings, DOE plays a unique role to marshall the widely divergent interests toward a common vision. While the time required to completely transform the motor systems market is debatable, DOE's vision of the transformed market could broadly be described as follows:

DOE's Vision of the Transformed Market

"On a widespread basis, industrial companies and their employees (e.g., plant managers, engineers, maintenance staff, and purchasing agents) will take benefit of information, tools, and best practices to assist them in applying a systems approach when managing, designing, upgrading, or maintaining their motor systems, whenever cost effectively justified. When implementing these quality management practices, industrial companies will be able to easily quantify the profitability and productivity benefits that will further motivate them to continually improve their motor systems. Also, companies will be able to easily quantify, and be publicly recognized for, the associated energy resource conservation and environmental benefits that are making a positive contribution to society."

Program Tactics and Development Supporting the Vision

Current Motor Challenge activities are contributing toward this vision; however, the program's tactics in motivating industrial companies and the market will require further program development. The following tactical program initiatives will be developed beginning in FY 1996 to more actively involve Industry with the program.

Allied Partners and Customer End-User Partners

The program will move in FY 1996 to segregate the Motor Challenge Partners into two types: Allied Partners and Customer/End-User Partners (see Table 2 below and Figure 5 next page). Formation of these two very distinct categories for the various partner organizations allows the program to more strategically focus resources and leverage off the existing market structure where delivery mechanisms for products and services are in place. Through these existing delivery mechanisms, Motor Challenge is providing value-added products, services, and information to Allied Partners that carries a third-party, unbiased message to the Allied Partner's customers while ultimately assisting End-User Partners to accelerate their adoption of efficient motor system technologies.

The breakdown of types of Allied Partners versus Customer/End-User Partners is depicted in Table 2 below.

Allied Partners	Customer/End-user Partners
▸ Suppliers/Distributors/OEMs ▸ Utilities ▸ Engineering Firms ▸ Energy Service Companies/Financial Institutions ▸ Universities/Research Institutions ▸ State Energy Offices/Agencies ▸ Trade Associations	▸ Executives/Corporate Energy Managers ▸ Plant Managers/Operations and Maintenance Personnel ▸ Engineering Managers/ Design Engineers ▸ Purchasing

Table 2 : Allied and Customer/End-user Partners

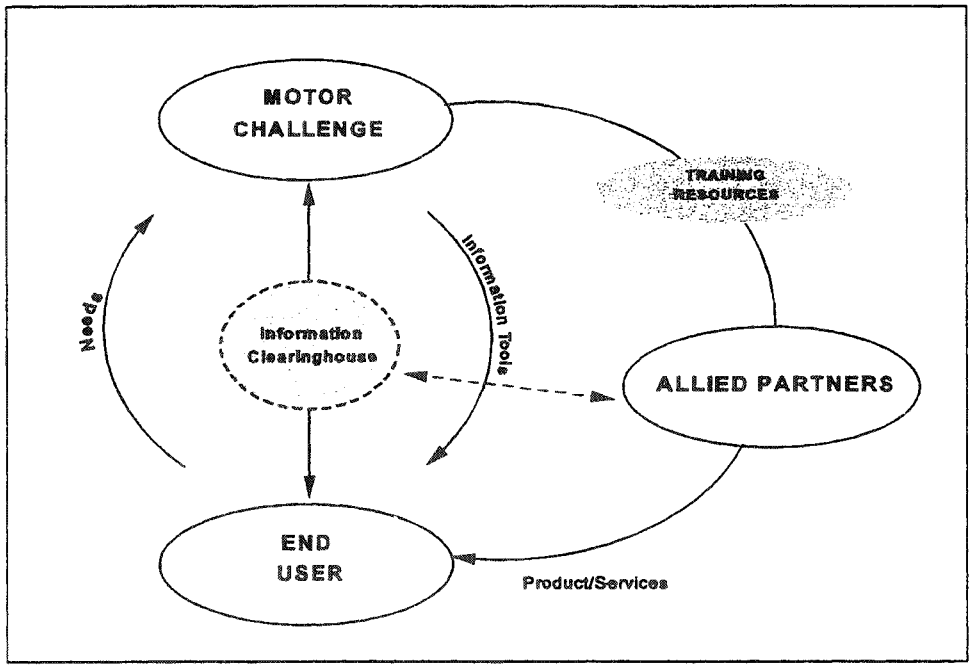

Figure 5 - Delivering Resources to the Motor Challenge Customer - Industrial End-Users

Recognizing Excellence of Efficient Motor Systems Management

The Motor Challenge Compact promised a "follow-on voluntary Motor Challenge deployment program that will emphasize the recognition of individual industrial end-users' excellence achieved in implementing and managing efficient electric motor systems within their facilities." Towards this end, the Program has begun development with

the Partner Coordinating Committee of an Excellence Partner program. The Excellence Partner program provides for a two-tier approach to the Partnership— 1) partners who have joined the program and agreed to address the opportunities of efficient motor-driven systems, and 2) the Excellence Partners who have achieved a certain level of quality and achievement. The intent is to recognize those companies that have implemented internal corporate management practices and policies, and engineering design and operating procedures that are focused on efficient motor-driven systems in an exemplary and high-quality manner. Recognizing the industry leaders will encourage other companies to emulate the leaders' examples.

Supporting Market Transformation Initiatives

A variety of market transformation initiatives will be initiated in FY1996. Activities will focus on motor-driven equipment/OEM technologies (ie., pumps, fans, blowers, and compressors). Initiatives will use many of the recommendations from the Market Transformation Roundtable.[4] DOE will leverage with key OEM trade associations, such as the Compressed Air and Gas Institute (CAGI), Hydraulic Institute (HI) and the Air Movement and Control Associations (AMCA), and utility-based groups, such as the Consortium for Energy Efficiency (CEE). Examples activities include: developing specifier guides for pumps, fans/blowers and air compressors; supporting end-user buying collaboratives that create market-pull for efficient motor-driven equipment; and supporting technology-specific design-decision tools that will provide reliable cost/performance data for end-users.

Providing Easy Access of Products and Services to Allied Partners: Delivering Resources to the End-user

The array of unique products and services available through the Motor Challenge program is continuously growing. Likewise, the demand for these products and the services provided by the Clearinghouse is constantly increasing as the number of Motor Challenge partners grow. Likewise, the training curriculum materials will be rolled out in the Fall of 1996 covering all types of motor systems topics. As mentioned, to maximize the delivery of products and services from the Clearinghouse to end-users, the Motor Challenge will be working with Allied Partners. Allied Partners will be able to complement their individual marketing materials, and products and services with Motor Challenge technical briefs, training curriculum materials, and Motor Master software. Additionally, Allied Partners will be able to obtain products that have been customized to their company organization. An example, would be the customization of the Motor Master software for a utility with their respective rebate data installed on the software. This type of leveraging will maximize the resources of the Motor Challenge. The Program will need to rely on the market to carry the message of energy efficiency as embedded in their individual marketing efforts.

Replicating Showcase Demonstrations

The Showcase Demonstrations will provide a wealth of real-life experiences of the technological challenges and best practices to implementing efficient motor systems. Likewise, the management strategies used amongst the teams to bring the project to successful completion will be invaluable to encouraging other end-users to champion and replicate the Showcase Demonstration projects. With the validation of the Showcase Demonstration projects, including the preparation of the case studies, the Motor Challenge will work aggressively to inform other companies to implement the projects. DOE will use a variety of forums and media to "get the word out" on the Showcase Demonstration projects, including: training workshops, videoconferences, trade magazine articles, etc.

PROGRAM METRICS, EVALUATION, AND MARKET ASSESSMENT: Measuring and Knowing How We Are Doing

Critical to the Motor Challenge development is the analysis and assessment of how the market is moving toward greater energy efficiency, and to what extent the program is impacting the market. Therefore, the Metrics of the Motor Challenge program are defined by two broad areas: (1) overall market performance indicators and trends and (2) Motor Challenge program performance and progress. Each area is discussed below.

Market Performance Measurement and Evaluation—Measurement and evaluation of how the market is moving, and to what extent industry is implementing, efficient motor-driven system technology will be assessed through the following two Motor Challenge-supported activities (see Figure 6 next page):

— Electric Motor-Driven Systems Market Assessment, which will provide the most comprehensive market intelligence of 1) how the market is moving, and 2) what impact Motor Challenge has had, or could have, on the market. The assessment will help target the emphasis of DOE strategies by providing a blueprint for pursuing electric motor-driven system efficiency opportunities. The Market Assessment will include developing the following:

  - A comprehensive and reliable baseline of the current installed base of operating electric motor-driven systems equipment within the industrial sector;
  - A methodology for continually reevaluating and assessing national industrial electric motor-driven systems efficiency improvement, market trends, and the rate of adoption of efficient electric motor-driven systems technology within the industrial sector; and
  - A methodology for continually assessing the effect of DOE's Motor Challenge program on moving the market and reducing greenhouse gas emissions.

— Electric Motor Systems Database, which will document the experience of energy savings being made by end users and how the Motor Challenge program may have supported end users' achievements. The Database will serve as the primary mechanism to recognize industry's achievements and the source of bottom-up data on how the overall market is implementing efficient equipment. The Savings Tracker software within Motor Master Plus will be the primary tool for Industry to document, calculate, and report energy savings and emission reductions to DOE. The Database also will, to some degree, show where end users used a Motor Challenge technical assistance service or product/tool in the course of implementing their project.

Program Progress Measurement and Evaluation—Measurement and evaluation of the progress made in the Motor Challenge Program will be assessed through a variety of efforts. The program will continuously evaluate program activities and redirect efforts to increase program effectiveness and efficiency. One element of this assessment will be customer satisfaction and "fine-tuning" the program to maximize satisfaction of partner needs. The program will continuously monitor partners to determine if and how Motor Challenge products (i.e., tools, software, and technical guides) and services (e.g., Clearinghouse and training courses) are being used, how they could be improved, and what new technical assistance activities could be offered to assist in accelerating efficient equipment in industry, generally, or in a particular market segment.

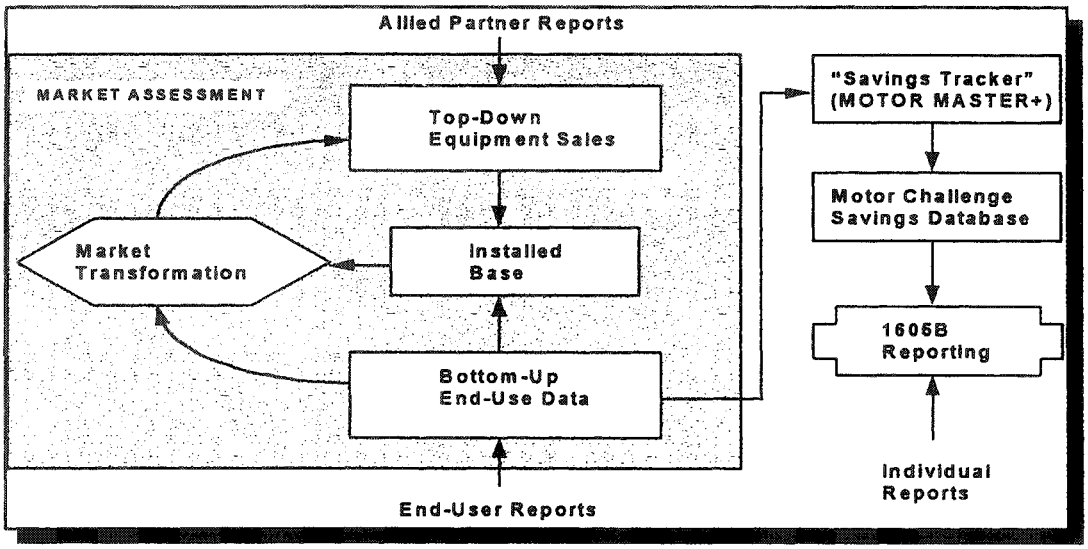

Figure 6 - Market Characterization, Data Collection, and Electric Motor Systems Database

SUMMARY

Put simply, DOE and the Motor Challenge program is acting predominantly as a facilitator to encourage and promote initiatives, involving various stakeholders, that don't naturally occur under the prevailing incentives in the marketplace so that end-users may capture the benefits of energy efficient motor systems more rapidly. The Program will be increasingly relying on its Allied Partners to deliver products and services to the industrial end-user customers. The message of improved energy efficiency must be pragmatically sold to Industry as part of their overall motivations to improve productivity and profitability. Program development efforts will require a high degree of industry input and involvement, especially from industrial end-user companies. Likewise, in light of the current tight Federal fiscal situation, Motor Challenge activities will need high leveraging from the private sector so as to maximize Federal resources. While the enormous opportunities and benefits afforded by more efficient motor systems to Industry are significant, the key to capturing these opportunities will be the development of strong partnerships amongst all of the market players to focus on a systems approach and the needs of the end-user.

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