TURNING POINT

March 1998

EPAct ISSUE

A Motor Challenge Publication
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In This Issue

City of Long Beach Improves Efficiency at its Waste-to-Energy Facility

Substantial energy savings were achieved by the Southeast Resource Recovery Facility (SERRF), a solid waste management facility in Long Beach, California, from modifications to improve overall operating efficiency. For this Motor Challenge Showcase Demonstration project, SERRF modified the control systems and installed variable frequency drives on induced draft fans to three boilers that burn solid waste. These changes save 3,661,200 kWh annually (approximately 1% of the energy generated by the facility), which adds up to cost savings of $329,500 per year. The electricity saved now means that SERRF can sell more power to the local utility.

SERRF is owned by Joint Powers Authority, formed by the City of Long Beach and the County Sanitation District No.2 of Los Angeles County. It began commercial operation in 1988 in response to the needs of a rapidly growing community to manage residential and commercial waste. The City contracts with Montenay Pacific Power Corporation to run SERRF.

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Larry Small, Montenay Pacific Power Corp.; Charles Tripp, City of Long Beach; John Ledbetter, Montenay Pacific Power Corp.; Steve Kaufman, FLOWCARE Engineering, Inc.; Phil Jallouk, ORNL. Additional team members not in photo: Bill Cook, Montenay Power, and David Jones, California Energy Commission.

Welcome Johnson & Johnson

Johnson & Johnson (J&J), headquartered in New Brunswick, New Jersey, recently joined the Motor Challenge Excellence Partnership, showing its strong commitment to excellence in energy. Realizing that energy management makes competitive sense, Johnson & Johnson has embarked on projects to improve the motor system efficiency at its facilities.

Here are some examples of what J&J is doing.

- At its Ethicon Endo-Surgery plant in Albuquerque, New Mexico, J&J installed ASDs and controls on the HVAC air handling units in the equipment rooms. The cost to complete this project was $40,000. The project saved 132,000 kWh and more than $10,000 annually, resulting in a payback of 3.8 years.

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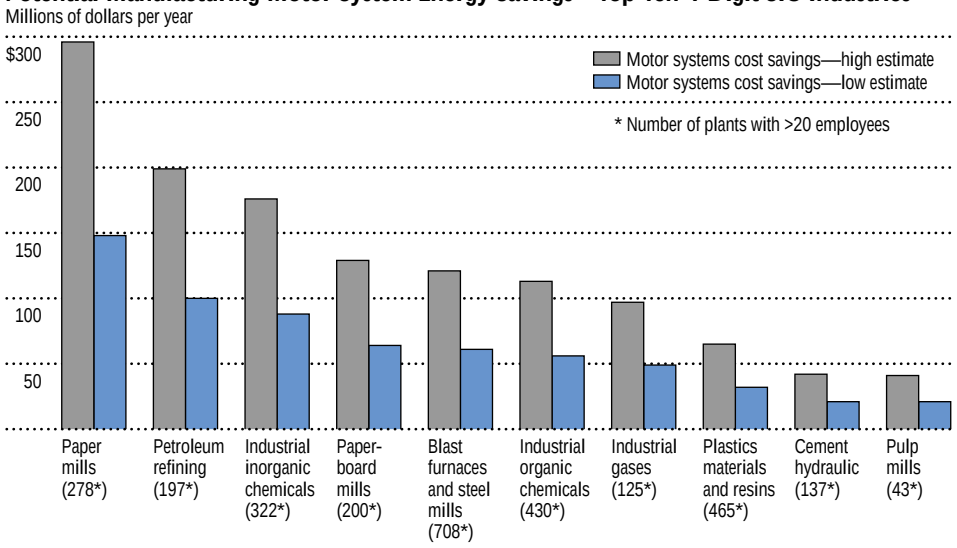
Achievable Savings by Industry from Energy-Efficient Motor Systems

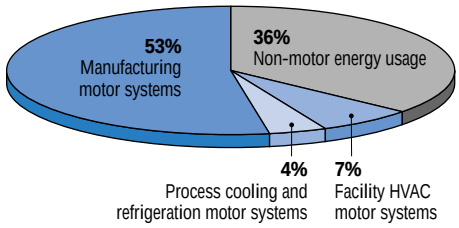
Analysis from an ongoing Motor Challenge-sponsored market assessment reveals interesting data on motor systems electricity usage in the manufacturing sector. More than half of electricity used by motor-driven equipment in the U.S. industrial sector is consumed by 10 industries. And these top 10 industries only have 2905 plants employing more than 20 people. The rest of the manufacturing sector has more than 120,000 plants with 20 employees or more. The data shows that industries can achieve significant energy savings from improving their motor systems.

The final report of the Market Assessment will be released later this year. For copies of the Interim Report, call the Clearinghouse at (800) 862-2086.

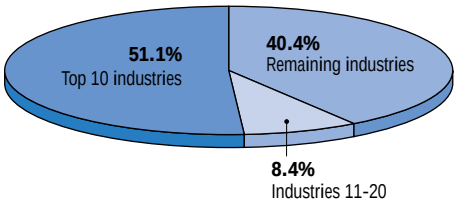
Potential Manufacturing Motor System Energy Savings—Top Ten 4-Digit SIC Industries



Manufacturing Electricity Usage



Breakdown of Manufacturing Motor Systems Electricity Usage



Improving the Way We Do Business

At the second DOE Office of Industrial Technologies' (OIT's) Customer Appreciation Day, nearly 200 members of industry, government, and academia convened to discuss how OIT could improve the way it does business with industry. Keynote speeches by Dan Reicher, Assistant Secretary for the Office of Energy Efficiency and Renewable Energy, and Denise Swink, Deputy Assistant Secretary for OIT, reaffirmed OIT's commitment to working with and listening to industry.

Following these keynote presentations, attendees divided into three small groups to discuss OIT's mission and roles, how OIT can improve partnership results, and the best communication channels between OIT and industry.

While OIT was praised for its responsiveness and commitment to industry, participants recommended that OIT decision-making occur at a pace more closely matching that of industry. In addition, participants felt that more should be done to "get the word out" that OIT is, in fact, a strong advocate and partner of industry in achieving greater energy efficiency and competitiveness. The conference closed with a renewed commitment to make an already good partnership between government and industry even better.

Guest Column

Energy-Efficient Electric Motors—*What are They?*

by Konstantin Lobodovsky, an independent consultant in energy efficiency with a focus on motor management and application.

Konstantin Lobodovsky

As of October 1997, EPAct requires manufacturers to produce electric motors that meet the energy efficiency standards of the Act. End users are now faced with having to purchase these motors. So, what exactly is an energy-efficient motor? There are many contributing factors such as electric motor efficiency, nominal efficiency, and motor losses, that are useful to know in understanding an energy-efficient motor. This article will help you understand these terms, what an energy-efficient motor is, and the differences between energy-efficient and standard motors. A follow-up article in the next issue will discuss how to apply energy-efficient motors.

Electric Motor Efficiency

The efficiency of a motor is the ratio of the mechanical power output to the electrical power input and may be expressed as:

$$\text{Efficiency} = \frac{\text{Output}}{\text{Input}} = \frac{\text{Input} - \text{Losses}}{\text{Input}} = \frac{\text{Output}}{\text{Output} + \text{Losses}}$$

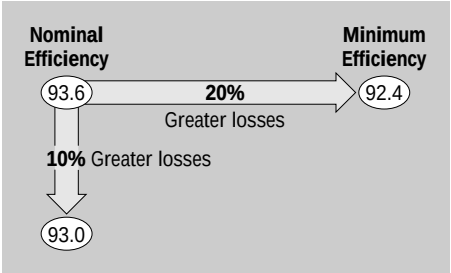
While there are many test methods for determining motor efficiency, the accepted test in the United States for electric motor efficiency is IEEE Standard 112 Method B. This method uses a load absorption device, called a dynamometer, to measure the power input and output to determine loss components and efficiency. All losses (i.e., heat losses) are accounted for when the motor's performance is measured on a dynamometer.

Efficiency Labeling Standard

No two motors of duplicate design perform exactly the same due to normal variations in materials, manufacturing, and testing. As a result, NEMA established efficiency ranges, recognizing that less than a 10% spread in losses is statistically insignificant.

In efficiency labeling, nominal and minimum efficiency values are used. NEMA defines nominal efficiency as the average efficiency of a large population of motors of the same design. Any motor tested by IEEE 112, Method B, will carry the nominal efficiency of the highest range for which the average full-load efficiency for the model is equal to or above that nominal. Minimum efficiency is the level reached when raw materials and manufacturing are at their least favorable. Possible variations in losses can be as high as plus or minus 20%.

The spread between nominal efficiency in the diagram is based on increments of 10% losses. The spread between the nominal efficiency and the associated minimum is based on an increment of 20% losses.



Standard Definition of an Energy-Efficient Motor

In 1989, NEMA developed a standard definition for an energy-efficient motor, known as MG 1-12.55. It reads as follows :

Efficiency Levels of Energy-Efficient Polyphase Squirrel-Cage Induction Motors (MG 1-12.55): *The nominal full-load efficiency determined in accordance with MG1-12.54.1, identified on the nameplate in accordance with MG 1.12.54.2, and having corresponding minimum efficiency in accordance with Column B of Table 12-6A shall equal or exceed the values listed in Table 12-6B for the motor to be classified as "energy efficient."*

Sound confusing? Well, it is. Simply stated, polyphase induction motors must meet or exceed the efficiency values listed in Table 12-6B (later renumbered to Table 12-10) of the MG1 standard to be called energy efficient.

Motor Losses

An electric motor converts electrical energy into mechanical energy and in the process heat (energy) is lost. Losses can be broken down into five categories:

Losses	% of Total Motor Losses	Factors Affecting Losses
1. Stator I^2R Losses	35 to 40	Stator conductor size
2. Rotor I^2R Losses	15 to 20	Rotor conductor size
3. Core Losses	15 to 20	Type and quantity of magnetic materials
4. Friction & Windage Losses	10 to 15	Primarily manufacturing and design methods
5. Stray Load Losses	5 to 10	Selection/design of fans and bearings

Design changes, better materials, and manufacturing improvements reduce motor losses, making energy-efficient motors more efficient than standard ones. Reduced losses mean that an energy-efficient motor produces a given amount of work with less energy input than a standard motor.

What Goes into an Energy-Efficient Motor*

To build an energy-efficient motor, manufacturers work on improving the five categories of losses mentioned previously.

1. Reducing the stator resistance loss involves both magnetic and electric modifications that allow for more copper wire to be inserted in the slots of the stator of the motor. In general, the stator lamination design has to have slots large enough to accept more copper wire.

2. The second largest loss, rotor resistance, is reduced by using special rotor designs with larger areas of aluminum conductor. Using larger rotor bars results in lower rotor resistance and less rotor energy loss.

3. Hysteresis and eddy currents are reduced in many different ways. Hysteresis loss can be reduced by using improved steels and by reducing the intensity of the magnetic field. Eddy current losses are lowered by making the individual laminations that comprise the stator (and rotor) thinner and insulating them more effectively from each other.

4. In the case of friction and windage, there is little that can be done to improve the efficiency of bearings, but if the previously outlined steps have been effective in reducing total losses, the size of the cooling fan can be reduced, which helps increase motor efficiency.

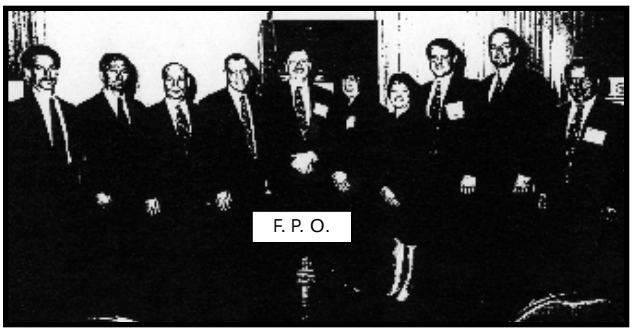
5. Various manufacturing techniques are used to reduce stray load losses.

(continued on page 5)

*Edward Cowern, P.E. Baldor Motors & Drives

It's Official! Compressed Air Challenge Kickoff Held In D.C.

On January 13, Dan Reicher, U.S. DOE Assistant Secretary for Energy Efficiency and Renewable Energy, and other DOE officials joined about 100 participants, speakers, and representatives of the press in celebrating the announcement of the Compressed Air Challenge. The Challenge is a voluntary public-private, not-for-profit collaboration to help U.S. industry improve its productivity and competitiveness through the implementation of compressed air system best practices.



From left to right: Dan Reicher, U.S. DOE; Ken Rollins, CAGI; Chris Beals, Compressor Distributors Assoc.; Marc Hoffman, CEE; Floyd Barwig, Iowa Energy Center; Barbara Caropolo, NYSERDA; Denise Swink, U.S. DOE; Gary Shafer, Honeywell; Mark Hanson, Energy Center of Wisconsin; Kevin Keena, NEES Companies

Optimization of compressed air systems using existing technology could mean energy savings of 20% to 50%. "The primary objective of the Compressed Air Challenge is to stimulate industry to reduce the inefficiencies in compressed air systems and capture the large energy savings," said Reicher. If the Challenge meets its initial goal of a 10% improvement in efficiency, savings to industry would be $150 million per year (1997 dollars). In his speech, Reicher made a commitment for the Federal Government to implement the Challenge best practices in its facilities.

Others echoed the need for the program and potential for energy and cost savings. "Compressed air represents 15-30% of our electric costs, depending on the plant," said Joseph Ghislain, Energy Efficiency Program Manager for Ford Motor Land Services. "We have started concentrating on all aspects of compressed air to reduce our energy usage...the Challenge gives me the ability to...help develop a process to reduce compressed air usage and optimize compressed air systems."

Henry Kemp, Strategic Air Concepts (representing the Compressed Air Efficiency Council, a group of compressed air system consultants), also highlighted huge opportunities for energy savings. "These savings can be accomplished with little or no major capital investment. In many cases, our audits result in compressors being turned completely off!" said Kemp. Marc Hoffman of CEE added, "We are all joined by the convergence of our interests around the Challenge's core objective—To help industry use compressed air more efficiently."

Work has already begun on a customer awareness campaign on compressed air system best practices; a nationally recognized professional development program to train plant operating personnel on compressed air best practices; and a certification program for plant operating personnel who apply these best practices.

These activities are being carried out by the Challenge's Project Development Committee and working groups. If you'd like to find out more about these working groups or become a sponsor, call the Compressed Air Challenge at the Energy Center of Wisconsin: (800) 559-4776.

A joint publication of Motor Challenge and the Compressed Air Challenge, called *Improving Compressed Air System Performance: A Sourcebook for Industry,* will be available in April 1998 from the Motor Challenge Clearinghouse.

Compressed Air Challenge Sponsors

- *Compressed Air and Gas Institute*
- *Compressor Distributors Association*
- *Consortium for Energy Efficiency (CEE)*
- *Energy Center of Wisconsin*
- *Honeywell*
- *Iowa Energy Center*
- *NEES Companies*
- *New York State Energy Research and Development Authority*
- *Northwest Energy Efficiency Alliance*
- *U.S. Department of Energy's Motor Challenge Program*

Teleconference Reminder

Don't forget to mark your calendars for the live May 19, 1998, International Motor Challenge Teleconference, entitled Efficient Motor Systems II: Your Path to Profits. This teleconference will focus on strategies for assessing and improving motor-driven performance through real world case studies and a panel of experts to answer your questions. For more information or for those organizations that are interested in hosting a downlink site, please call (800) 862-2086 or access the Web site at www.motor.doe.gov/teleconference98.htm.

Efficient Motor Systems: *Your Path to Profits*
TELECONFERENCE

Preliminary Agenda

WELCOME AND INTRODUCTIONS

VIDEO CASE STUDY I
Creating a Corporate Team for Your Program
DuPont Chambers Works

PANEL DISCUSSION

INTERACTIVE QUESTION & ANSWER SESSION

VIDEO CASE STUDIES II-IV
The Systems Approach
ITT Flygt
3M
U.S. DOE Y-12 Plant (Lockheed Martin)

PANEL DISCUSSION

INTERACTIVE QUESTION & ANSWER SESSION

ROLE PLAY
How to Sell Energy-Efficient Projects to Your Management

VIDEO CASE STUDY V
Making the Business Case
Latrobe Steel

PANEL DISCUSSION

INTERACTIVE QUESTION & ANSWER SESSION

IDENTIFICATION OF RESOURCES

CLOSING

Confirmed Panelists Include:
Jerry Aue, Consolidated Papers
Tom Bishop, Electrical Apparatus Service Association
Ziba Kellum, Advanced Energy
Roger Lawrence, Electric Power Research Institute's Adjustable Speed Drive Demonstration Office
Michael Muller, Rutgers University, Director of Industrial Assessment Center

Motor Challenge Allied Partner Gears Up for EPAct

Motor Challenge is working with a number of motor manufacturers as Allied Partners. These motor manufacturers have prepared to meet the requirements of EPAct in many different ways and to make compliance with EPAct as simple and easy to understand for their customers. Below is a glimpse at the activities of one manufacturer—Allied Partner, **U.S. Electrical Motors.** Check out future issues to find out what others are doing.

To meet the changing requirements in the motor world, U.S. Motors developed an innovative new line of energy-efficient electrical motors that complies with EPAct standards. Furthermore, to assist their authorized service stations in retrofit and replacement motors, U.S. Motors provides each shop with Motor Challenge's *MotorMaster+* software. In fact, at the EASA annual convention held in Denver in June 1997, U.S. Motors arranged for Motor Challenge Allied Partner Account Manager Jonathan Stine to provide a training session on the new *MotorMaster+ 2.0* to EASA members who are also authorized U.S. Motors distributors or shops.

Since many motor buyers and users are still uncertain how EPAct affects them, U.S. Motors has published a handbook describing the legislation as it relates to AC motors and identifying motors covered by the Act and those that are not. Moreover, U.S. Motors' Web page (www.usmotors.com) contains the full text of the Motor Challenge fact sheet *Frequently Asked Questions on EPAct* and also provides a hotlink to the Motor Challenge homepage. U.S. Motors is a division of Emerson Electric Co. in St. Louis, Missouri.

Allied Partners Sponsor Successful ASD Workshops

The ASD Training Workshop series has kicked off to a strong start. In November 1997, Allied Partners GPU Energy and Longo Industries cosponsored a workshop on ASD applications and *ASDMaster* software in Whippany, New Jersey. Lou Holzberger of GPU described the workshop as very useful. "It provided participants with another tool to help them learn about drives and drive applications. We are interested in duplicating this workshop in Pennsylvania and other areas for those who could not attend the New Jersey one," explains Mr. Holzberger. The workshop was attended by industrial customers, in-house engineers, municipalities, and consultants.

One workshop attendee, Paul McCaa of Roche Vitamins, said he gained good information with practical applications. "We're in the early stages of developing an energy efficiency program at our plant, so it was helpful to learn what is available and the opportunities for cost reduction. We'll use *ASDMaster* as a tool in our overall program," he adds.

On December 9th, 1997, another ASD workshop was held in Birmingham, Alabama, cosponsored by Allied Partners, the University of Alabama and Alabama Power. A total of 31 people attended. One participant, Alan Griffin of Boeing, exclaims, "It was an excellent program—very informative with a lot of practical information on drives. The software seems easily comprehendible. Many of our variable frequency drives are aging. The software will help us in deciding which drives need replacement, which ones we will remove, and what other systems can benefit from the application of an ASD."

Roger Lawrence and Paul Nelson of the Electric Power Research Institute's (EPRI's) Adjustable Speed Drive Demonstration Office gave thorough presentations on ASD technology, applications, and how *ASDMaster* works. Cosponsor Larry Lisenbee of Alabama Power mentioned that "attendees responded well to the workshop. We would like to offer another one for our industrial customers, many of whom were not in attendance at this one."

Motor Challenge and EPRI in cosponsorship with Motor Challenge Allied Partners are offering these workshops across the country. *(See Coming Events on back page for dates of upcoming ASD workshops.)*

ASDMaster *helps the users apply ASDs from a total system perspective, maximizing the likelihood of a successful and profitable installation.*

Guest Column

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Working on the five elements individually and collectively can achieve substantial improvements in motor efficiencies.

Example of Differences between a Standard and Energy-Efficient Motor: 5-hp 4Pole 3Phase 230/460 Volt 60Hz 184T

	Standard	Super-E
Number of Wires	2	3
Gauge	#20	#19
Winding	Concentric	Concentric
No. of Turns		
Coil 1	32	35
Coil 2	64	70
Coil 3	96	105
Resistance at	2.803 Ω	2.337 Ω
25°C High Volts	3.098 Ω	2.583 Ω
Total Weight	22.7 oz	27.8 oz
Stack Length	4.25 in	5.0 in

Third-Party Certification—Making Sure Your Motor Passes EPAct

The Energy Policy and Conservation Act, as amended by EPAct, directs DOE to require motor manufacturers to certify that each electric motor, covered by the Act, meets certain energy efficiency standards. Under proposed DOE rules, manufacturers can accomplish this through independent testing at an accredited laboratory, or through a certification program nationally recognized in the United States. DOE's proposed regulations set forth procedures to recognize the accreditation of laboratories to test and measure the energy efficiency of an electric motor, and procedures to recognize certification programs that would verify the energy efficiency of an electric motor. Until these regulations become effective, one way manufacturers can establish compliance is through the use of existing third-party certification programs. *(See EPAct—How It Works on page 8 for additional information.)*

This article introduces three third-party certifiers that are available to help manufacturers comply with EPAct. Third-party certifiers include the Canadian Standards Association (CSA), based in Toronto, Canada; Intertek Testing Services (ITS), based in Cortland, New York; and Underwriters Laboratories, Inc. (UL), based in Northbrook, Illinois. These organizations provide manufacturers with an objective source for certification of their product. Once certified, customers can be assured that they are getting what they pay for.

"Through our Energy Verification Service, UL will verify that a product complies with EPAct regulations. Furthermore, UL will continue to monitor a product to ensure that it continues to meet EPAct guidelines," said Lenore Berman, Engineering Group Leader for UL.

UL offers an Energy Verification Service through which manufacturers' production and testing operations are evaluated and representative product samples are tested to applicable government and industry standards. Products in compliance with the requirements are authorized to bear UL's Energy Verification marking. UL is already providing this service to motor manufacturers having to comply with similar Canadian requirements.

CSA, another organization conducting verification services for motor manufacturers, has been certifying motors for Canada's energy efficiency program and seeks to assist all North American motor manufacturers as a third-party certifier. CSA's program is tailored to meet EPAct requirements.

"CSA offers a verification program which covers testing of initial samples with follow-up factory inspections and retesting of randomly selected sample motors to ensure that the motors continue to comply with the energy efficiency requirements," said Trig Smith, Business Coordinator, Certification and Testing Division, of CSA. "Since most U.S. manufacturers are already verified by CSA as meeting the Canadian energy efficiency requirements, which are harmonized with U.S. requirements, these manufacturers inherently have verification to the EPAct efficiency requirements," he added.

Lastly, ITS aims to assist manufacturers in getting their labs accredited, providing laboratory support, or acting as a third-party certifier. "Motor efficiency testing is not an easy thing to do. It can cost several thousands of dollars to test a motor," said Chuck Coletta, General Manager of the Engineering Test Group, for ITS of Atlanta, Georgia.

Knowing this, ITS seeks to work with manufacturers here or abroad to make the most of their clients' facilities while satisfying EPAct compliance regulations. "If the manufacturer has their own lab, it just makes a lot more sense to have their lab accredited so they can do their own testing." ITS then incorporates a self-enforcement check, performed quarterly, where motors are pulled at random and examined at ITS facilities. This data is compared to findings taken at their clients' labs to ensure compliance.

All these measures taken by prospective nationally-recognized third-party certifiers will ensure that electric motor efficiency ratings are accurate from manufacturer to manufacturer. Manufacturers and consumers are encouraged to contact them for more information. You can reach them by calling: Trig Smith, CSA, (416) 747-4142; Charles Coletta, ITS, (404) 888-0108; and Lenore Berman, UL, (847) 272-8800.

Accreditation and Certification—What is the Difference?

Under EPAct and DOE's proposed implementing regulations, manufacturers are provided the following three options as a basis for establishing that their motors meet the energy efficiency standards of EPAct:

- *testing at their own laboratory if it is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP);*
- *testing at an accredited independent third-party laboratory;*
- *certification by a third-party, nationally-recognized certification program.*

Because it is costly for a manufacturer to have their own laboratory accredited, some may prefer to use an independent accredited laboratory or a third-party certifier. Why would you choose accreditation over certification? This choice is up to the manufacturer. Manufacturers will chose the avenue that best serves their interests. A third-party certifier is just one of three alternatives available to manufacturers.

Some third-party certifiers already have testing experience from performing safety testing on motors. For this reason, manufacturers and consumers may feel better having motors tested by a third-party certifier. This experience may also provide a marketing advantage to manufacturers who use third-party certifiers. In testing motors, third-party certifiers also review the process (i.e., the accompanying paperwork on the motor, the manufacturer's credentials), not just the motor itself.

Which ever option manufacturers choose, the outcome is the same. Motors will only be certified after meeting stringent testing or comprehensive computer modeling of a type (model) of motor.

Two accredited laboratories for motor efficiency testing are Advanced Energy (see *Guest Column,* Jan. issue) and Oak Ridge National Laboratory.

Long Beach Improves Efficiency

continued from page 1

This waste-to-energy facility processes about 1,290 tons of municipal waste each day and generates up to 38 megawatts of electricity. SERRF burns residential and commercial waste in three boilers to produce steam that in turn runs a turbine-generator, producing electricity. Some of this electricity powers the facility, and the excess is sold to Southern California Edison Company, the local utility.

To optimize SERRF's operating efficiency, the City sought ways to reduce the load, or amount of power required to operate the facility. Long Beach and Showcase Demonstration partners, Montenay Pacific Power and the California Energy Commission, analyzed the boiler system. Analysis of the original operating process demonstrated several key findings. First, to meet system requirements during startup, shutdown, and normal system operation, the induced draft fans' damper settings covered the entire range from closed to 100% open. Second, system resistance was much lower than the original design predicted, thus resulting in higher volume flows than in the original design and requiring further throttling of the fan inlet dampers to reduce flow. Finally, the control system in place allowed the fans to often exceed the motor's 500-hp rating.

To address variations in operating conditions, while improving the fan systems' efficiency, variable frequency drives were installed on the induced draft fans. Each fan was retrofitted with Allen Bradley 1557-AAA-61 Medium Voltage (2300 volts) AC drives. The drives maintain the boiler draft set point by continuously modulating fan speed. Additionally, adjustments to the control system to reduce peak demand on the motors increased motor life and reduced maintenance costs. Reducing the load of the fans also increased the amount of power that could be sold to the utility. Since this increase in power is generated by burning solid waste (a renewable resource), it reduces demand for oil and natural gas that would otherwise be needed to generate the same electrical power.

The project cost was $663,368 with a payback of 2 years. A contributing grant of $400,000 from the California Energy Commission reduced the payback to less than 10 months.

For the City of Long Beach, SERRF is a viable solution for managing municipal waste. This project demonstrates how energy efficiency measures make it even better. There are approximately 147 operable waste-to-energy facilities in the country. Modifications like those put in place at SERRF can be replicated at these facilities or at industrial boiler systems across the country, so that they too could save money and energy.

For more information or for copies of Showcase Demonstration case studies, call the Motor Challenge Information Clearinghouse at (800) 862-2086.

The Southeast Resource Recovery Facility in Long Beach, CA.

Welcome Johnson & Johnson

continued from page 1

Additionally, the company replaced low efficiency motors in the plant with higher efficiency models, saving 36,900 kWh annually, resulting in $2,952 in cost savings and a payback of 2.2 years.

- At McNeil Consumer Products in Fort Washington, Pennsylvania, J&J upgraded the chilled water piping system to primary/secondary pumping, saving $133,325. J&J will be able to pay off the project in less than 4 years. The company also replaced 11 motors that had shorted out or were inefficient with energy-efficient models. The cost for this retrofit was $12,895. With annual savings of $8,508 from these energy-efficient units, the payback was just 1.5 years.
- In addition, at its Consumer Products Company in Skillman, New Jersey, J&J implemented a total of 12 ASDs on six new, high efficiency supply fan motors and six high efficiency return air fan motors. The ASDs will reduce air flow in the off hours by 30%. The project was initiated in November 1996 and has resulted in savings of 469,050 kWh. With annual savings of $34,077, the project payback is 3.7 years.

As an Excellence Partner, Johnson & Johnson will be working with Motor Challenge to identify additional comprehensive energy management methods and opportunities for motor systems within its facilities. For more information on the Motor Challenge Excellence Partnership, call Chuck Procner at (913) 831-2010.

EPAct—How It Works

A Turning Point *interview with Jim Raba, Office of Codes and Standards, U.S. Department of Energy, on the Energy Policy Act of 1992 (EPAct).*

Briefly describe the requirements of EPAct.

EPAct contains the most recent amendments to the Energy Policy and Conservation Act of 1975 (EPCA), and it deals, in part, with commercial and industrial equipment, such as electric motors.

EPCA, as amended by EPAct, establishes energy efficiency standards and test procedures for commercial and industrial electric motors. EPCA also directs the Department of Energy (DOE) to establish efficiency labeling requirements and compliance certification requirements for motors.

EPCA defines "electric motor" as any motor which is a general purpose T-frame, single-speed, foot-mounting, polyphase squirrel-cage induction motor of the National Electrical Manufacturers Association, Design A and B, continuous rated, operating on 230/460 volts and constant 60 Hertz line power as defined in NEMA Standards Publication MG1-1987.

EPCA then prescribes efficiency standards for electric motors that are 1 through 200 horsepower, and "manufactured (alone or as a component of another piece of equipment)," except for "definite purpose motors, special purpose motors, and those motors exempted by the Secretary."

EPCA also requires that testing procedures for motor efficiency shall be the test procedures specified in NEMA Standards Publication MG1, and the Institute of Electrical and Electronics Engineers Standard 112 Test Method B for motor efficiency.

Additionally, EPCA directs DOE to prescribe rules requiring motor labeling to indicate the energy efficiency on the permanent nameplate, to display the motor energy efficiency prominently in catalogs and other marketing materials, and to include other markings to facilitate enforcement of the energy efficiency standards. The Secretary is also directed to include in such rule any other requirements likely to aid purchasers in making purchasing decisions.

Finally, EPCA directs DOE to require motor manufacturers to certify compliance with the applicable energy efficiency standards through an independent testing or certification program nationally recognized in the United States.

The "Policy Statement for Electric Motors Covered Under the Energy Policy and Conservation Act," that was published in the *Federal Register,* November 5, 1997, provides guidance concerning compliance with provisions of EPCA pertinent to electric motors. *Turning Point* readers can download a copy of the policy statement from the World Wide Web at: www.eren.doe.gov/buildings/codes_standards/rules.

Do manufacturers have to comply now, even though the final rule has not been published?

EPCA standards apply to any "electric motor," from 1 through 200 horsepower, that is manufactured, produced, assembled, or imported after October 24, 1997. Such electric motors must now be in compliance. In the case of such an electric motor which requires listing or certification by a nationally recognized safety testing laboratory, EPCA requires compliance after October 24, 1999.

What will the final rule cover?

The final rule would incorporate the efficiency standards, test procedures and other provisions (such as treatment of imported and exported motors) that EPCA prescribes for electric motors, and would address a range of issues concerning coverage, implementation, and enforcement of these requirements. It would, for example, clarify the statutory definition of "electric motor," address standards for motors rated in kilowatt/hours, establish sampling plans for compliance and enforcement testing, set forth alternative means for establishing compliance, provide for accreditation of efficiency testing laboratories, establish procedures for national recognition of certification programs, set forth the procedures for manufacturers to certify compliance, establish labeling requirements, and describe the procedures the DOE would take concerning an electric motor alleged to be in non-compliance with the applicable energy efficiency standard.

How can customers be assured that they are getting a motor that complies with EPCA, and that the motor actually operates at its required efficiency level?

EPCA requires that each electric motor, covered by the statute, have a nominal full load energy efficiency of not less than a certain specified value. EPCA directs DOE to require manufacturers to certify, through an independent testing or certification program nationally recognized in the United States, that such motor meets the applicable level of efficiency.

The aforementioned Policy Statement provides guidance as to how a manufacturer can establish compliance, until DOE's regulations become effective, with the test procedures and standards prescribed by EPCA. Manufacturers can establish such compliance through use of competent and reliable procedures or methods that give reasonable assurance of compliance. Manufacturers may also establish their compliance with EPCA standards and test procedures through use of third-party certification (see related article on page 6) or verification programs such as those recognized by Natural Resources Canada.

A customer could request, from the manufacturer, the efficiency test data pertinent to a particular motor, or have the motor independently tested in a competent laboratory.

Why do motors that comply with EPCA standards cost more?

More efficient motors typically contain, for example, thinner laminations of high quality electrical steel in the stator and rotor, and use more copper in the windings. Such additional materials would lead to a higher cost at first, compared to a motor with a lower energy efficiency. However, the life-cycle cost of a more efficient motor would be lower, because operating costs would be lower. An energy-efficient motor could pay back the difference in cost over a standard motor in 18 to 24 months, and continue to save energy and money over the life of the motor.

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Motor Challenge provides the *MotorMaster+ 2.0* software that lets a user evaluate the savings from an energy-efficient motor. NEMA's "Energy Management Guide for Selection and Use of Fixed Frequency Medium AC Squirrel-cage Polyphase Induction Motors," provides mathematical methods to evaluate the economic impact of motor efficiency.

Are there situations where compliance with electric motor efficiency standards is affected by safety testing requirements?
As stated earlier, an electric motor (manufactured alone or as a component of another piece of equipment) which is covered by EPCA and requires listing or certification by a nationally-recognized safety testing laboratory, would be required to be in compliance after October 24, 1999.

A situation could occur where the electric motor itself does not require listing or certification, but it is used as a component in another piece of equipment that does require listing or certification by a nationally-recognized safety testing laboratory. In some of these instances, the file for listing or certification specifies that the particular motor be used. No substitution could be made for the motor without review and approval of the new motor and the entire system by the safety testing laboratory. Consequently, a specified motor that does not meet EPCA standards could not be replaced by a complying motor without such review and approval. This could be a simple paperwork transaction between the safety listing or certification organization and the manufacturer of the original equipment, or it could be a more complex process involving actual testing and evaluation of the equipment with the new motor. In some cases, certain end-user equipment could become unavailable in the marketplace.

The aforementioned policy statement for electric motors, that was published in the Federal Register, November 5, 1997, provides specific guidance on DOE enforcement where an original equipment manufacturer needs to obtain a revised safety listing or certification for that piece of equipment, with a motor specified that complies with EPCA. This policy would apply only where the motor has been manufactured and specified in the approved safety listing or certification prior to October 25, 1997. The DOE policy statement provides details and specific guidance on this matter.

Are there situations where compliance with electric motor efficiency standards is affected by the size of an electric motor?
According to the policy statement for electric motors that was published in the Federal Register, November 5, 1997, where a particular electric motor is used in a piece of original equipment and manufactured in a smaller than assigned frame size or series, and the motor does not meet the applicable efficiency standard in EPCA, the DOE policy states that, "for the period of time necessary [emphasis added] for the original equipment manufacturer to re-design the piece of equipment to accommodate a motor that complies with EPCA, but in no event beyond October 24, 1999, the Department would refrain from enforcing the standard with respect to manufacture of the motor for installation in such original equipment." This policy would apply only to a model of motor that has been manufactured and included in the original equipment prior to October 25, 1997.

What is the procedure for motor manufacturers and original equipment manufacturers to notify the DOE of electric motors used as components in original equipment?
The policy statement for electric motors sets forth specific information that should be provided to DOE. In the case of motors discussed in the prior two questions as a component in another piece of equipment, each motor manufacturer and original equipment manufacturer should jointly notify the Department as to each motor they will be manufacturing and using in the belief that it is covered by the policy. The notification should set forth: (1) the name of the motor manufacturer, and a description of the motor by type, model number, and date of design or production; (2) the name of the original equipment manufacturer, and a description of the application where the motor is to be used; (3) the safety listing or safety certification organization and the existing listing or certification file or document number for which re-listing or re-certification will be requested, if applicable; (4) the reason and amount of time required for the continued production of the motor, with a statement that a substitute electric motor that complies with EPCA could not be obtained by an earlier date; and (5) the name, address, and telephone number of the person to contact for further information. The joint request should be signed by a responsible official of each requesting company, and sent to: U.S. Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Office of Codes and Standards, EE-43, Forrestal Building, 1000 Independence Avenue, SW, Room 1J-018, Washington, DC 20585-0121.

The DOE does not intend to apply this "delay of enforcement" policy to any motor for which it does not receive such a notification. Moreover, the Department may use the information, and make further inquiries to be sure motors listed in the notification meet the criteria for application of the policy.

How is EPCA going to be enforced when it comes to imports of electric motors?
Imported electric motors are required to comply with EPCA efficiency standards, just like electric motors manufactured in the United States. The U.S. Customs Service can exclude non-complying imports and DOE can bring enforcement action once they get into the United States. An electric motor imported into this country could be expected to have papers that disclose certain energy efficiency information about that electric motor.

When do the EPCA labeling requirements for electric motors become effective?
Such labeling requirements would become effective only after DOE has promulgated a final rule describing such requirements.

EPAct—An Advocate's Perspective

An interview with Neal Elliot, American Council for an Energy-Efficient Economy (ACEEE).

ACEEE is an independent, not-for-profit organization dedicated to advancing energy efficiency as a means of promoting both economic prosperity and environmental protection. ACEEE fulfills its mission by conducting in-depth policy assessments, advising governments and utilities, working with business and other organizations; publishing books, conference proceedings and reports; organizing conferences; and informing customers.

What role has ACEEE played in EPAct?
ACEEE staff have played a leadership role in promoting motor system efficiency by advocating sound motor system program designs by utilities and government, and encouraging the adoption of efficient equipment and design practices. ACEEE played a pivotal role in the development of the electric motor provisions of the 1992 EPAct and is working closely with DOE on the final rule.

Describe the benefits of EPAct.
In 1989, states were instituting individual energy efficiency standards. ACEEE viewed this as a problem for the motor industry, as the result would be 50 standards, varying from state to state. The goal was to create a consistent standard, based on industry-accepted procedures such as NEMA 12-10. ACEEE thought the creation of EPAct was a good move that eliminated confusion from multiple state standards and that will bring significant benefits to customers in the form of energy savings and a high-quality, reliable motor product.

What do you see as the challenges facing those affected by EPAct?
For 5 years, ACEEE and NEMA have been working with DOE on the final rule. The fact that there is no final rule yet poses a challenge to industry because they do not know how to comply. It also affords unfair competition to imports because many imports are non-compliant products. Not having legal guidance as to what they should be implementing does a disservice to people who are trying to comply.

What do you feel has been the impact so far of EPAct?
EPAct has forced motor manufacturers to re-engineer their product lines. I think the net result is that the consumer is getting a better, higher efficiency motor at a lower price than they were before EPAct.

Motors also are being produced with an eye towards repair. Motors being produced now are more repairable because of how they are being designed. The parts that are used are more common, so repair shops are more likely to have these parts in stock. Large industrial customers are already buying the most efficient motors. Less motor-system sophisticated companies are suffering from a lack of information or misinformation and are confused about how to comply.

How are you working to promote EPAct?
ACEEE is taking the opportunity to educate end users on not only the benefits of using energy-efficient motors but taking it one step further and applying premium efficient motors. ACEEE covers the selection and application of energy-efficient and premium efficiency motors in a number of publications. For information on ACEEE publications, call (202) 429-0063.

The information contained in this article reflects the opinions of those interviewed and does not reflect the views of the U.S. Department of Energy.

EPAct—A Manufacturer's Perspective

An interview with Lake Coulson, NEMA, and Rob Boteler, U.S. Electrical Motors

The National Electrical Manufacturers Association (NEMA) is a nonprofit trade association of manufacturers of products used in the generation, transmission, distribution, control, and end use of electricity. Headquartered in Washington, D.C., NEMA has about 550 manufacturers nationwide as members. The association develops and publishes standards covering electric motors and drives, and participates in other standards development organizations. NEMA is active in federal and state regulatory and legislative matters affecting electric motor systems.

What has NEMA's role been in the development of EPAct?
NEMA has worked closely with DOE and ACEEE on the development of EPAct. In response to EPAct, NEMA established the Energy Management Task Force (EMTF), comprised of members from the associations's Motor and Generator Section, to support DOE in writing clear and concise documentation. This task force has been important in bringing forward issues of concern to DOE on EPAct. EMTF has supported the intent of EPAct and has tried to apply logic to the legislation.

What has been the number one issue facing manufacturers with EPAct?
The number one priority of manufacturers was product definition—finding out what motors would be covered in EPAct. When the Act took effect this past October, there was a lot of confusion on the part of manufacturers as to which motors were affected. Believing that the definition of general, definite, and special purpose motors was too vague and open to interpretation, EMTF worked with DOE to develop the policy statement issued in September 1997 that clarifies which motors are covered. NEMA gave DOE the matrix that was included in the policy statement on examples of common features or motor modifications to illustrate how EPAct definitions and DOE guidelines would be applied to motor categories.

Now that clarification of products has been addressed, manufacturers are using the policy statement to go about their business. Some are using the guidance to produce products that are legitimately not covered under EPAct.

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Northeast Premium Efficient Motor Initiative Underway

In the Northeast Region including New England, New York, and New Jersey, commercial and industrial electric customers use 97 billion kWh annually to drive electric motor systems. To help these customers save energy and money, several electric utilities have joined together to form an exciting new program, the Northeast Premium Efficient Motors Initiative, which will begin this year.

"Participating utilities find the regional initiative attractive for many reasons. For one, since electric motors are distributed in the Northeast region along commercial distribution channels, not according to utility service territory boundaries, a regional approach is more expedient for transforming the market. Also, there are obvious economies of combining efforts rather than duplicating tasks within different utilities. Finally, regulatory bodies recognize the economic and technical potential of the regional approach and are encouraging utilities to participate," explains Jon Linn, Program Coordinator of the initiative.

As manufacturers retool motors to meet EPAct standards and customers consider new purchase decisions, the initiative hopes to stimulate demand in the Northeast region for three-phase motors rated "premium efficient" (i.e., surpassing the EPAct energy-efficient motor standards) by the Consortium for Energy Efficiency. The initiative's goal is to "transform the market," so that the majority of sales for new and replacement motors will be qualifying "premium" efficiency units. To accomplish this goal, the initiative uses marketing information and vendor assistance to promote the use and selection of energy-efficient motors. It also plans to encourage customers to purchase "premium" efficient motors by offering cash rebates to offset the higher price of these units.

Coordinated by Motor Challenge Allied Partner, the Northeast Energy Efficiency Partnerships Inc., the initiative's initial target of providing 7,500 rebates on qualifying purchases will total about $700,000 in cash incentives during the first year. A longer term goal is to reach at least 42% of the new and replacement motor market by the end of 2001. To help reach these targets, the initiative will turn to Motor Challenge materials and tools where appropriate.

While the initial thrust of the initiative is to make a significant impact on sales of qualifying "premium" motors, the participants are considering expanding the services of the initiative in the future to cover a variety of motor systems approaches. These include: compressors, transformers, motor repair, specialty motors, etc. By improving the performance of the whole motor-driven system, customers will be able to save even more energy and money.

By transforming the market for "premium"efficient motors, this initiative will lead to lower operating costs for customers, conservation of resources for utilities, and improved environmental performance from power generation.

For more information on this initiative, call Jon Linn at (207) 948-2660.

EPAct—A Manufacturers Perspective

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What other EPAct topics are concerning manufacturers?

The number two issue concerns clarification on the sampling, certification, testing, and compliance verification requirements for EPAct. Additionally, a continuing concern is how EPAct will be enforced with imports—how customs will enforce the Act if no official labeling requirements currently exist. All along, NEMA has been striving to create a level playing field for all manufacturers affected by EPAct. We are anxious to have the final rule out on EPAct so we understand the requirements and know what we have to do to comply.

How are manufacturers dealing with their customers on the increased price of motors?

As explained by Rob Boteler, USEM, manufacturers are publishing new price books and putting new prices into *MotorMaster+* software. They also let customers know months ago that there was going to be a price increase as a result of complying with EPAct. The customers who are really impacted are OEMs. Now they have to use and pay more for an energy-efficient motor in equipment, such as air conditioners, that they are building. However, even though these higher efficiency motors cost more initially, use of them will improve the customer's bottom line and save them money in the end.

The information contained in this article reflects the opinions of those interviewed and does not reflect the views of the U.S. Department of Energy.

Kyoto Protocol: A Step Toward Preventing Global Warming

When the Third Conference of the Parties to the United Nations Framework Convention of Climate Change ended in Kyoto, Japan, on December 11, 1997, the first global, legally-binding agreement to curtail emissions of greenhouse gases had been adopted.

Under the Kyoto Protocol, 39 developed nations set emissions reduction targets for the next 15 years. By 2010, they are expected to cut emissions to 1990 levels. Among them, the European Union agreed to reduce emissions by 8%, the United States by 7%, and Japan by 6%, with an average reduction of 5.2% among developed countries. Important issues, such as participation of developing nations and establishment of an emissions trading system, remain to be resolved.

Now the agreement is subject to ratification by the U.S. Congress and the other participating countries' legislative processes and then will be open for signature at the United Nations from March 16, 1998, to March 15, 1999. At next year's conference, negotiations on the agreement will continue.

Coming Events 1998

March 16-19	National Plant Engineering and Management Show and Conference, Chicago, IL; call (203) 840-5568
March 26	Selection and application of energy-efficient motors and drives, Ft. Smith, AR; call Al Drinkwater (501) 682-7325
April 1	ASD Training Workshop cosponsored by Motor Challenge Allied Partners, Shelton, CT; call Sharon Sniffen at (301) 572-0299
April 6	ASD Training Workshop cosponsored by Motor Challenge Allied Partners, Cleveland, OH; call Sharon Sniffen at (301) 572-0299
April 7	Motor Challenge Performance Optimization Workshop for water and wastewater plants, White Plains, NY; call Sharon Sniffen (301) 572-0299
April 8-9	West Coast Energy Management Congress, Anaheim, CA; call (770) 447-5083, ext. 224
April 14	ASD Training Workshop cosponsored by Motor Challenge Allied Partners, Atlanta, GA; call Sharon Sniffen at (301) 572-0299
April 21-23	Industrial Energy Technology Conference, Houston, TX; call Dawna Rosenkranz (409) 847-8950
May 14	ASD Training Workshop cosponsored by Motor Challenge Allied Partners, Denver, CO; call Sharon Sniffen at (301) 572-0299
May 19	Motor Challenge Teleconference, Broadcast Live 9am to 11am Pacific; call (800) 862-2086 or access the Web site at www.motor.doe.gov/teleconference98.htm
June 16-18	Air & Waste Management, San Diego, CA; call (412) 232-3444

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INFORMATION CLEARINGHOUSE

Do you have questions about using energy-efficient electric motor systems? Call the Motor Challenge Information Clearinghouse for answers, Monday through Friday 9:00 a.m. to 8:00 p.m. (EST).

HOTLINE: (800) 862-2086

Fax: (360) 586-8303, or access our homepage at www.motor.doe. gov

Motor Workshops

The New York chapter of the American Water Works Association (AWWA), in cooperation with the New York State Energy Research and Development Authority, is putting on the following motor workshops to help participants improve the efficiency of motors, drives, and pumping applications in the municipal water industry:

- May 11, 1998, Albany, NY
- May 12, 1998, Westchester, NY
- June 11, 1998, Buffalo, NY
- June 12, 1998, Syracuse, NY
- September 10, 1998, Long Island, NY
- September 11, 1998, New York City, NY

To register, please call Mona Cavalcoli, AWWA's New York chapter, at (315) 455-2614.

Optimizing Performance of Industrial Systems: Fan, Pump, and Blower Systems Training

The Energy Center of Wisconsin (ECW), University of Wisconsin at Madison, and Motor Challenge will be cosponsoring a two-day interactive workshop that focuses on optimizing fan, pump, and blower systems for industries such as foundries, paper mills, food processors, and wastewater treatment facilities. For more information, contact Ron Wroblewski, ECW, at 608-238-8276, ext. 25 or e-mail to industrial@ecw.org.

Date: early June, 1998; Location: Wisconsin

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