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Assessing Energy Efficiency Opportunities in US Industrial and Commercial Building Motor Systems

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Abstract:

In 2002, the United States Department of Energy (USDOE) published an energy efficiency assessment of U.S. industrial sector motor systems titled *United States Industrial Electric Motor Systems Market Opportunities Assessment.* The assessment advanced motor system efficiency by providing a greater understanding of the energy consumption, use characteristics, and energy efficiency improvement potential of industrial sector motor systems in the U.S. Since 2002, regulations such as Minimum Energy Performance Standards, cost reductions for motor system components such as variable frequency drives, system-integrated motor-driven equipment, and awareness programs for motor system energy efficiency have changed the landscape of U.S. motor system energy consumption.

To capture the new landscape, the USDOE has initiated a three-year Motor System Market Assessment (MSMA), led by Lawrence Berkeley National Laboratory (LBNL). The MSMA will assess the energy consumption, operational and maintenance characteristics, and efficiency improvement opportunity of U.S. industrial sector and commercial building motor systems.

As part of the MSMA, a significant effort is currently underway to conduct field assessments of motor systems from a sample of facilities representative of U.S. commercial and industrial motor system energy consumption. The Field Assessment Plan used for these assessments builds on recent LBNL research presented at EEMODS 2011 and EEMODS 2013 using methods for characterizing and determining regional motor system energy efficiency opportunities.

This paper provides an update on the development and progress of the MSMA, focusing on the Field Assessment Plan and the framework for assessing the global supply chain for emerging motors and drive technologies.

Introduction

Research and development into advanced motor system technologies and the design of effective energy efficiency policy (e.g. awareness campaigns, technology deployment, regulations, incentives) require information on installed motor system performance. However, collecting and analyzing the information to assess installed motor system performance is a significant effort. As a result, there have been few comprehensive assessments of the energy performance of the installed motor system base at a national level using the results of current field assessments.

In the United States, the most notable assessment of industrial motor systems using current field information was initiated by the U.S. Department of Energy (USDOE) in 1995 as part of the then-USDOE Motor Challenge Program [9]. The results were published in 2002 in *The United States Industrial Electric Motor Systems Market Opportunities Assessment*[1] (2002 Assessment) and:

- led to a greater understanding of motor system energy consumption and the opportunity for improvement within the U.S. industrial sector, and
- provided the information required for manufacturers, utility and energy efficiency programs, and government agencies to develop products and programs that increased the uptake of energy efficient technologies

Since its publication, the 2002 Assessment has guided the development of motor system program offerings both at the government and the utility level, been cited numerous times in research, and influenced the marketing and product design decisions of motor and motor system manufacturers. Similarly, the most notable comprehensive national assessment of commercial motor driven equipment using field information

[1]Originally published in 1998, and republished in 2002 with minor corrections

was conducted by the USDOE in 1999 [1]. Since these two reports are the only national-level assessments of the motor and motor related equipment stock in the U.S. industrial and commercial sectors, they remain influential despite outdated information.

Neither of these reports reflects the current industrial and commercial motor system energy consumption baseline and reduction opportunity. The results from the 2002 Assessment were based on the state of U.S. industrial motor systems in 1997 and the results of the USDOE commercial motor driven equipment assessment were reflective of the installed base in 1995. Additionally, the U.S. Bureau of the Census discontinued its collection of data on motor and generator importation, manufacture, shipment and sales more than a decade ago, thereby eliminating a valuable stream of publicly available and up-to-date motor market information. Since the publication of both motor system reports, the energy efficiency of these systems has improved due to:

- higher efficiency of motors being available for sale in response to standards and labeling initiatives,
- the use of variable speed drives greatly increasing due to greater awareness of their benefits, reduced capital costs and various incentive programs, and
- the use of DOE and electric utility initiatives that provided software tools, training and information.

In addition to improvements to the overall efficiency of motor systems, U.S. industry itself has experienced significant changes since the 2002 Assessment. Manufacturing facilities have moved offshore, expanded U.S. oil and natural gas extraction has led to new manufacturing facilities with intensive motor system use, global competition for materials and motor driven system components is greater, and the increased availability of, and reliance on, real time data and use of robotics has had profound effects on both end user and motor and motor-driven system manufacturing processes. Further, advanced motor technologies and materials for meeting specific demands have emerged.

Recent studies on motor system energy efficiency improvement potential have all noted the lack of current and comprehensive information on motor system energy use and consumption as a limiting factor to their findings [3-5]. At EEMODS 2011, LBNL presented results from constructing energy conservation supply curves developed for pumping, fan, and compressed air systems in the U.S., Canada, EU, Thailand, Vietnam, and Brazil. The precision of the curves was limited by the lack of available regional information [6].

This lack of information affects a broad range of stakeholder groups:

- Government agencies must rely on outdated information to direct their research opportunities, policy measures, and awareness campaigns;
- Utility and energy efficiency programs cannot accurately target their programs or evaluate the impact of a potential incentive program or energy efficiency campaign;
- Motor, drive, and motor driven equipment manufacturers do not have reliable information on the energy efficiency characteristics of their markets to better evaluate and serve their customers' interests, and
- End users are unable to assess their own motor system performance and operating practices with respect to their peers to identify potential methods for reducing motor system energy consumption.

The collective result from this "information gap" is the inability to reliably assess the potential for new technologies and operating practices to improve regional motor system energy performance, thus creating a barrier to their adoption.

To address these concerns, the USDOE initiated a new Motor System Market Assessment (MSMA) in 2014, to be led by LBNL. This paper provides an overview of the MSMA, and provides details on methodologies to meet the study's objectives. The new motor systems market assessment will help motor system component manufacturers, policymakers, and researchers better assess the energy consumption of the motor and the system in which it operates, and identify the potential for energy efficiency improvement.

Overview of US Motor System Market Assessment Update

The MSMA includes two major tasks:

Task 1: Motor System Field Assessments - An assessment of the installed motor system base in the U.S. industrial and commercial sectors, including the energy consumption, operational and maintenance practices, and their potential for greater energy efficiency

Task 2: Supply Chain Assessment - A study of the global supply chain for advanced motor and drive technologies.

Objectives:

The objectives for each of the two tasks of the MSMA are:

1. Motor System Field Assessments:
   - Develop a detailed profile of the stock of the motors and motor systems in commercial and industrial facilities in the U.S.
   - Develop a profile of commercial and industrial motor and motor system purchase and maintenance practices
   - Analyze the opportunities (by market segment) for improved energy efficiency and cost savings available through implementation of efficient motors, control technologies, system optimization, and new and future advanced motor and motor system designs

2. Supply Chain Assessment:
   - Evaluate the state of the global supply chain that supports motor and drive technologies including: the accessibility and sustainability of key materials and components, the progress of R&D directed at decreasing the quantity of heavy rare earth materials required in high energy-density permanent magnets, and the factors impacting the manufacturing of motor and drive technologies.

To meet the objectives, the MSMA will combine a bottom-up and top-down approach. The bottom-up approach will include on-site motor system assessments of several hundred industrial and commercial facilities in the U.S. This will provide the primary assessments required to develop the analysis for the MSMA. The results of the bottom-up approach will be compared to top-down estimates based on the available literature to verify the findings from the bottom-up approach.

Scope:

The MSMA will cover the following sectors within the U.S.:

- Manufacturing sector as categorized within series 31-33 of the North American Industry Classification System (NAICS)[2] and the water/wastewater treatment sector
- Commercial building sector as categorized by the USDOE's Commercial Building Energy Consumption Survey 2003 (CBECS)

The sectors covered by the MSMA are an expansion of the sectors covered by the 2002 Assessment. The 2002 Assessment excluded both the commercial building and the water/wastewater sector.

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[2] "The North American Industry Classification System (NAICS) is the standard used by [US] Federal statistical agencies in classifying business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. business economy" [8].

Motor systems in the assessment will include those driven by polyphase motors 1 horsepower and greater regardless of end-use (e.g., compressed air, pumping, fan). Large (i.e., greater than 50 horsepower) DC motors observed will also be included. The "motor system" includes the drive and controller, the motor, power transmission, motor driven equipment, and distribution system.

USDOE Interest:

The USDOE Office of Energy Efficiency and Renewable Energy is interested in the update of the MSMA so as to increase manufacturing, municipal and commercial sector end users awareness of motor system energy efficiency and cost saving opportunities through improved operating practices and best-available and advanced technologies. The USDOE also wants to identify research needs that will drive greater increases in motor system energy efficiencies, as well as, to enable a more competitive US motor and motor system manufacturing equipment industry.

Timeline:

The MSMA was initiated in the summer of 2014 and the results are expected to be released by the end of 2017. LBNL is planning an interim report to be released in 2016. Site visits for the Motor System Field Assessment task will be conducted through 2016.

The balance of this paper will outline the methodology for completing each of the two tasks.

Methodology for completing Motor System Field Assessments

The Motor System Field Assessments will update and build upon the results from the 2002 Assessment by conducting field assessments and using the findings to determine the energy consumption baseline, operational and maintenance practices, and energy efficiency improvement potential for motor systems in the U.S. commercial and industrial sectors. Methodologies used in other countries and regions for evaluating motor and/or motor system energy efficiency potential, such as those used to evaluate EuP Lot 30 in the EU, will be reviewed and incorporated where beneficial [2].

Stakeholders and audience members:

Recognizing that the results from this task will serve the interests of several stakeholder groups and audience members, LBNL and USDOE organized meetings with various groups to determine the desired outcomes for the task. To that end, the stakeholders and audience members for the MSMA were identified as being:

- End users and their trade associations;
- Motor and drive manufacturers, motor distributors, motor repair practitioners, and their trade organizations;
- Motor drive equipment manufacturers, their trade associations, and distributors;
- Electric utilities and their member organizations;
- Energy efficiency program administrators and their member organizations;
- Energy efficiency service providers, energy efficiency consultants, and end users' purchasing agents;
- Regional, state, and national government, including the USDOE, and
- Researchers studying motor system energy efficiency principles and design.

Desired outcomes for Motor System Field Assessment

The stakeholder meetings included representatives from the motor and motor system manufacturing community, energy efficiency advocacy groups, the USDOE, and electric utility and energy efficiency program administrators. From these meetings, the following were identified as the *desired outcomes* from the Motor System Field Assessment task of the MSMA:

1. Summary of the installed motor system base providing insight into installed motor systems identifying information and overall energy consumption;
2. Characterize energy management practices in industrial and commercial facilities, as related to the design, operations, and maintenance of the installed motor and motor system base;
3. Assessment of the practical energy efficiency and electric demand potential utilizing existing and advanced technologies and their potential impacts on production;
4. Assessment of the investment required to implement existing and cost effective energy efficiency actions, and
5. Comparison of current installed motor system base to the results of the 2002 assessment, where applicable.

Additionally, the final report will include a description of the types of facilities and motor systems assessed and the assessment methodology in order to provide context for and confidence in the MSMA results.

Findings in support of desired outcomes

The MSMA team identified several findings from the MSMA that would support these *desired outcomes*. Divided into two categories, key and detailed, the findings represent the intended results from the analysis for the MSMA, once completed. *Key findings* are intended to be high level findings on energy consumption, operating practices, and savings potential of motor systems. *Detailed findings* are intended to provide information on energy consumption, operating practices, and savings potential specific to sectors. (e.g., by NAICS code or buildings type). Examples of each are provided below. Note that the examples are intended to illustrate the types of results sought from the MSMA. The final results will be dependent upon the outcomes from the field assessments, the desired level of statistical accuracy, and the relevance of the key/detailed finding upon reviewing the results. Also, where applicable, the findings will focus on the electricity and cost savings potential from cost effective (≤ 2 year payback) practices and technologies. This will allow motor system end users to identify practices and technologies that meet their business case requirements.

Examples of key findings:

- The total motor system electricity consumption and cost broken out by sector (e.g. industrial, commercial)
- Potential percent improvement and associated annual electricity consumption and cost savings through the adoption of cost effective (≤ 2 year payback) practices and technologies with a breakdown of electricity savings by category of measure (e.g., operational practice, capital expenditure, or advanced technologies) and sector (e.g. industrial, commercial)
- Distribution of typical load factors for motor systems in the industrial and commercial sectors and the potential for cost effective (≤ 2 year payback) installation of VFDs
- Annual energy consumption, energy costs, energy consumption savings, and energy cost savings by motor system type
- Sectors exhibiting the greatest potential for adoption of advanced and emerging motor system technologies as demonstrated by adoption rates of energy management practices

Examples of detailed findings:

- Breakout of the percent improvement in energy efficiency opportunity and electricity savings opportunity by system size

- For several industrial sectors at the 3 digit NAICS code level and commercial building types, the total motor system electricity consumption and cost broken out by motor system type
- For several industrial sectors at the 3 digit NAICS code level and commercial building types, potential percent improvement and associated annual electricity savings through the adoption of cost effective (≤ 2 year payback) practices and technologies with a breakdown of electricity savings by category of measure (e.g. operational practice, capital expenditure, or advanced technologies)
- Identification of the most common types of motor repairs and the commonly used decision making processes for deciding when to repair or replace a failed, failing, or aging motor system
- Use of third party assistance to identify, implement, or offset the implementation costs of motor system energy efficiency improvements

Achieving the desired outcomes

Results from field assessments will form the basis for the analysis conducted to meet the desired outcomes for the Motor System Field Assessment task. Where possible, available data sets can provide additional detail or highlight findings. However, since available data sets were collected for other purposes, they will most likely not include all of the information sought in support of the desired Motor System Field Assessment outcomes. For example, LBNL reviewed data compiled for the purposes of evaluating the impact of proposed USDOE motor efficiency standards [10]. The data compiled was not intended to assess the current energy consumption baseline for motor systems in the U.S. industrial and commercial sectors, but rather it was collected to determine the impact on energy consumption from proposed energy efficiency rules on future motor sales in the U.S. While the data compiled will be very useful to better understand the impact of motor regulations, motor system assessments conducted to meet the objectives and desired outcomes of the Motor System Field Assessment are still required. To this end, a robust and statistically accurate sampling plan coupled with a Field Assessment Plan outlining the requirements of the motor system assessments is under development at the time of this paper's publication.

Sampling plan

The U.S. industrial sector is comprised of over 200,000 facilities and the commercial sector is comprised of approximately 5,000,000 facilities. The primary objective of the Motor System Field Assessment sampling plan is to develop a statistically valid sample of motor system energy consumption, operating characteristics, and energy efficiency improvement potential for the U.S. industrial and commercial sectors. Since it is impossible to assess every U.S. industrial and commercial facility, a stratification scheme will be developed to determine the number of facilities to be sampled from each sector specific stratum. The stratification scheme will capture the statistical distribution of motor system energy consumption within the each sector.

For the industrial sector, subsectors characterized by three-digit NAICS code will be used as the sampling stratum. Information from the Manufacturing Energy Consumption Surveys (MECS) collected by USDOE Energy Information Administration (EIA) will be used to estimate motor system energy consumption for each subsector. MECS is a national-level survey conducted by the EIA every four years to gather energy-related data from several thousand U.S. industrial facilities for the purpose of estimating the energy consumption, energy use characteristics, and facility demographics of the U.S. industrial sector. The results are aggregated in several ways, including by end-use within each industrial subsector, and made public. Proxies for motor system energy consumption for each subsector can be developed by summing the estimated electricity consumption across all end-uses driven by motor systems within each subsector. The motor system driven end-uses, as categorized by MECS, include: process cooling and refrigeration, machine drive, and facility HVAC. Subsectors with greater motor system energy consumption will be more heavily sampled than others in order to capture the distribution of motor system energy consumption within U.S. industry. For example, Paper and Allied Products (NAICS code 322) will be more heavily sampled than an industry with a lower amount of energy for motor systems, such as Leather and Allied Products (NAICS code 316).

For the commercial sector, subsectors characterized by the classification scheme in the EIA's CBECS were used as the sampling stratum. CBECS is the analog to MECS for the commercial sector. Like MECS, CBECS aggregates and makes public the results by end use and commercial building type. Proxies for motor system electricity consumption for each commercial building type can be made by summing the electricity consumption across all motor system related end-uses within each commercial building type. End uses as categorized by CBECS that are driven by motor systems include: cooling, ventilation, refrigeration, and other. 'Other' includes miscellaneous motor system end uses. Here again, building types with greater motor system energy consumption, such as "offices", will be more heavily sampled than building types with less motor system energy consumption, such as "service".

The number of facilities assessed will depend on both the requirements for statistical accuracy and the available resources to conduct assessments. The 2002 Assessment included 270 assessments of industrial facilities. The current MSMA will include a similar number of assessments for the industrial sector and less for the commercial sector. Given the greater homogeneity in the commercial sector with regards to motor system energy use, the statistical distribution of motor system energy use can be captured with fewer samples the commercial sector than in the industrial sector.

In order to achieve a high level of confidence in the MSMA results, a statistical sample of motor system energy consumption should be random. This presents at least two challenges when executing the motor system assessments. The first challenge is to gain access to the facilities which requires the MSMA team to: 1) identify an appropriate contact person with knowledge of the facility's motor systems and 2) be granted access to the facility. The facilities must be willing to provide access to their motor systems, provide a representative to escort the assessors through the facility as required, and provide relevant details regarding their motor systems. As of the writing of this paper, LBNL and USDOE are considering providing the facilities that agree to participate in the field assessments a summary of the motor system assessment conducted at their facility along with recognition from USDOE for participation (i.e. a certificate). The second challenge is to develop a blind methodology for identifying facilities to assess. Several convenient techniques for selecting facilities to sample would lead to a biased sample. Examples of these techniques include: sampling multiple facilities owned by the same parent company, identifying facilities through their participation in energy efficiency programs (such as utility incentive programs), and identifying facilities through past experiences working with the MSMA team or stakeholders. While selecting facilities to assess using one of these approaches would help overcome the challenge of gaining access to facilities, the resulting sample, and by extension the results from the MSMA, would not be representative of the U.S. industrial and commercial sectors. This challenge can be overcome through the use of comprehensive directories of U.S. industrial and commercial facilities to identify assessment sites and providing incentives as described above to the facilities for granting access to the MSMA team.

Field assessment plan

The Field Assessment Plan outlines the objectives of the facility-level motor assessments and the requirements for the resulting report regarding the facility's motor system energy use and consumption. It will be executed at each facility ensuring consistency across all motor system assessments conducted for this effort. The goal for each field assessment is to develop a quantitative and qualitative understanding of typical motor system usage characteristics, including energy consumption, and to evaluate the potential for motor system energy savings at each facility assessed. The Field Assessment Plan employs a combination of staff interviews, visual observations, and spot measurements to determine the energy consumption and energy efficiency improvement potential of a given motor system.

At the 2013 EEMODS, LBNL outlined an assessment framework for conducting motor system assessment and a methodology for assessing the potential for energy efficiency improvement. The assessment framework outlined by LBNL approaches the assessment in stages─ collecting basic facility and motor system information first followed by information related to the energy efficiency of the system [7]. The methodology outlined for assessing energy efficiency improvement potential is based on the methodology employed by McKane and Hasanbeigi to develop motor system energy efficiency supply curves for several countries and regions [5, 6]. That methodology assigns an energy efficiency scenario (e.g. high, medium, low) to a given stock of motor systems based on the operational characteristics of the system as determined through system expert interviews and results from system assessments. Each scenario was assigned a band of energy efficiency. Energy efficiency improvement potential was then determined based on impact of a particular energy saving measure on each scenario. For example, ranges of system energy efficiency (expressed as a percent) were developed for each motor system scenario considered. The stock of motor systems in each country/region (e.g. all pumping systems in the US) was assigned a scenario based on its current operational characteristics as determined through interviews with system experts and the results of system assessments. To illustrate this concept, **Table 1** shows the pump system energy efficiency ranges for each scenario used in the analysis by McKane and Hasanbeigi. Pump systems in the US were assigned to the medium scenario.

Table 1: Pump system energy efficiency ranges for each scenario used in McKane and Hasanbeigi [5]

	Low end (%)	**High end (%)**	**Average (%)**
Low scenario	20	40	30
Medium scenario	40	60	50
High scenario	60	75	67.5

Energy efficiency improvement potential associated with moving from a lower to higher scenario was based on energy efficiency improvement potential associated with a list of pre-selected measures. For example, a stock of pumping systems may have several leaks, damaged seals, or worn packing that would improve if they were fixed. The improvement potential is determined by the assigned system efficiency scenario with greater improvement potential for lower base case scenarios. To illustrate this concept, **Table 2** provides the percent improvement in energy efficiency over the base case for pump system maintenance measures as determined and used by McKane and Hasanbeigi [5].

Table 2: Percent improvement in energy efficiency over base case for pump system maintenance upgrades as used in McKane and Hasanbeigi [5]

Pump System Energy Efficiency Measure	**Typical % improvement in energy efficiency over current pumping system efficiency practice**		
	% improvement over low efficiency base case	**% improvement over medium efficiency base case**	**% improvement over high efficiency base case**
Fix leaks, damaged seals, and packing	3.5	2.5	1
Remove scale from components such as heat exchangers	10	5	2
Remove sediment/scale buildup from piping	12	7	3

The Field Assessment Plan for the MSMA builds upon this past work and refines the approaches to fit the needs and resources available for the MSMA. The Field Assessment Plan calls for the motor systems to be assessed at three levels: facility characteristics impacting motor system energy consumption ('general information'), a description of each motor system ('system information'), and a more comprehensive estimate of the energy efficiency improvement potential for larger motor systems ('system energy efficiency'). Every facility will be assessed at the general information and system information levels. The system energy efficiency level assessment will be reserved for motor systems meeting certain criteria for minimum system size and operating hours

At the general level, the motor system assessment focuses on understanding the environment in which the motor system operates. Examples of information assessed at this level include: basic facility level information, facility annual electricity consumption, facility-level energy management practices, and facility-wide motor system practices such as repair/replace policies, maintenance schedules, or use of energy efficiency assessments.

At the system information level, the motor system assessment focuses on evaluating general information about a specific motor system. Much of assessment at this level will rely on quantitative information. Examples of information assessed at this level include: system nameplate information, motor nameplate information, use of VSDs or their potential applicability, load profiles and duty factors as determined through staff interviews.

At the system efficiency level, the motor system assessment focuses on gaining a better understanding of the energy efficiency of the largest energy consuming motor systems. Energy efficiency checklists will be developed for this purpose. They will combine observations, short interviews of facility staff, and simple spot measurements to quickly assess the energy efficiency level of a stock of motor systems relative to best available technology and maintenance/operational practices. As of the publication of this paper, LBNL is in the process of developing the energy efficiency checklists. Preliminary examples of information under consideration for inclusion are: description of system components (e.g. transmission type, type of pump or compressor), evaluation of distribution system (e.g. excessive bends, use of throttles or bypasses), system sizing considerations (e.g. the demand to which the system was sized), maintenance history (e.g. frequency and components of leak inspection program, motor repair history), and evaluation of sequence of operations (e.g. control strategy, sequencing scheme). The methodology for assessing energy efficiency improvement potential for these large motor systems will be based on the approach employed by McKane and Hasanbeigi with the scenarios further refined based on: 1) consultation with motor system experts 2) development of aforementioned energy efficiency checklists and 3) results from field execution of energy efficiency checklist. Estimates of the potential for energy efficiency improvement through the adoption of best available technologies, advanced/emerging technologies, and implementation of best practices for operations and maintenance will be based on the energy efficiency level of the facilities.

Methodology for completing Global Supply Chain Assessment

The Global Supply Chain Assessment (Task 2) will evaluate the market flows for motors and drives used, sold, and exported from the U.S., and also identify the factors impacting the supply chain for these products. This will include collection of readily available data to assess the current market and supply chains, as well as expected future trends. Another goal of this part of the study is to identify technology and research needs that could be met through joint industry and government partnership.

Data collection for this part of the project is anticipated to have three major areas of focus:

- Characterizing the export and import of motors and drives across U.S borders (e.g. country of origin, motor type, drive type, total shipped value);
- Characterizing the global supply chain for these motors and drives, - countries, industries, relationships – including the use, access, and sustainability of key materials and components, including rare earth materials,

- Identifying notable trends, such as the manufacturing characteristics of advanced motors and drives, emerging technologies, and the current state of research and development.

Beyond performing this market research, LBNL will convene experts to advise on advanced and emerging motors and drives that will impact the market, including expected future trends and preliminary estimates of their energy savings potential, and identify markets for these advanced and emerging motors and drives by application.

LBNL will also identify any factors impacting motor and drive manufacturing, including advanced technologies, materials, and components (e.g. wide band gap semiconductors for drives and soft magnetic materials for motors). Identification of any technology and research needs that could be met through joint industry and government partnership will also be included as part of this task. LBNL will also assess the impact of advanced motors and drives manufacturing on the U.S. economy.

Conclusion

This paper provides an overview of the USDOE initiated and LBNL led MSMA to: 1) develop a detailed profile of motor system energy consumption, operational and maintenance practices, and potential for energy efficiency improvement for the U.S. industrial and commercial sector and 2) evaluate the global supply chain for advanced motor and drive technologies. The MSMA provides an update to the 2002 Assessment conducted by USDOE, which was similar in its objectives but smaller in scope. By basing the assessment on sampled field assessments, the MSMA will provide a much needed current and comprehensive assessment of motor system use in the U.S. The results will bridge a knowledge gap that has hampered policymakers, manufacturers, and researchers alike seeking to improve the energy efficiency of the installed motor system base in the U.S. industrial and commercial sectors.

Through providing insight into the current state of motor system energy use and consumption in the U.S., it is hoped that the MSMA will lead to greater and sustained penetration of operational and maintenance best practices and the adoption of advanced technologies for commercial and industrial motor systems. Further, it is hoped that the MSMA will build upon the success of the 2002 Assessment by identifying several areas of potential improvement for U.S. motor systems and spurring the motor system community to research, develop, and deploy new technologies and practices to meet the challenges faced by motor system users today. It is hoped that the benefits derived from MSMA may serve as a motivating factor for other countries to initiate motor system assessments. Others seeking to conduct similar assessments may benefit from leveraging both the approach and the lessons learned from MSMA. The results from MSMA could be combined with the results of additional motor system assessments, allowing for greater knowledge sharing and benchmarking of motor systems energy efficiency and opportunities for improvement.

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