DE-FOA-0002549: REQUEST FOR INFORMATION ON IDENTIFYING PATHWAYS TO ACCELERATE THE UPTAKE AND INTEGRATION OF SMART MANUFACTURING TECHNOLOGIES AND ENERGY MANAGEMENT PRACTICES IN THE MANUFACTURING SECTOR

ISSUE DATE: June 16, 2021
RESPONSES DUE: August 20, 2021
SUBJECT: Request for Information (RFI)

Description

Two of the greatest near term opportunities for improving the energy productivity and reducing energy expenses in the industrial sector are to increase the adoption of systematic energy management practices (energy management systems or EnMS) and investment in technologies that monitor, analyze, control, and improve the use of energy resources (smart technologies/smart manufacturing) such as energy management information systems (EMIS) and information technology and operational technology (IT/OT) platforms. Integrating technology investments with energy management systems offers the potential to optimize the use of energy even further.

The implementation of an EnMS, especially one based on the ISO 50001 Energy Management Standard, has proven to result in greater energy savings than the traditional project-by-project method and result in more sustainable year-over-year energy savings[1]. It also creates a workforce skilled in identifying opportunities to reduce operating costs, identify potential solutions, and perform cost justification analyses.

The global market for energy management hardware and software, a product category that is inclusive of smart technologies used in industry to save energy, is expected to grow at a compound annual growth rate (CAGR) of 16.2% between 2020 and 2025, according to a new report from ReportLinker[2]. The necessity of reducing carbon footprints and greenhouse gases, the need to manage energy consumption, and the growth of affordable, innovative technology are all driving the market. The growth of the market is driven by the increasing numbers of reliable information technology and operational technology (IT/OT) platforms. Smart technology platforms enable organizations to manage and maximize the use of resources by

[1] www.energy.gov/eere/amo/downloads/sep-2015-cost-benefit-analysis-paper
[2] https://www.reportlinker.com/p05778422/Energy-Management-Systems-Market-Growth-Trends-and-Forecasts.html?utm_source=GNW

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providing workers contextualized data for fault detection, corrective action, monitoring, predictive maintenance, and optimizing operations.

The adoption of energy management systems and smart technologies are uneven across industrial sectors and geographic regions. The integration of EnMS and smart manufacturing technologies plays a critical role in optimizing energy productivity and reducing energy costs from the national level to regional level and all the way to the plant and eventually to the process and equipment level. This will involve interoperation of EnMS, EMIS, and IT/OT systems that are available through cloud-based architecture and solutions[3].

The U.S. Department of Energy Advanced Manufacturing Office (AMO) is interested in identifying the drivers of and barriers to greater uptake of energy management systems and smart manufacturing technologies. It is also interested in identifying potential methods to increase and accelerate the uptake and integration of the two.

Background

Definitions

Continual Improvement: the concept of systematically and routinely engaging an entire organization in activities that reduce wastes and increase the quality and or quantity of outputs. It is often accomplished through standard operating procedures, management practices, setting of goals, and rigorous monitoring of progress.

Energy management system (EnMS): a management system that brings a systematic focus on energy use, costs, and wastes. An EnMS establishes the policies and procedures to systematically track, analyze, and improve energy efficiency. It enables organizations to manage their energy use, sustain savings from projects, and improve productivity on a per unit of energy basis.

ISO 50001 Energy Management System Standard: A voluntary global standard of requirements for energy management systems (EnMS) that enables organizations to identify top opportunities to save energy and money, ensure that savings persist and grow, establish data-driven processes and procedures to build energy efficiency, and cost-efficiently scale up energy savings across one or multiple facilities.

[3] https://www.grandviewresearch.com/industry-analysis/us-energy-management-systems-ems-market

Smart manufacturing (SM): employs computer-integrated management practices and manufacturing processes. It enables high levels of adaptability and rapid design changes. It utilizes advanced sensors, controls, software platforms and data analytics to improve productivity, precision, performance and use of material and energy resources. It also includes empowering workers with the training and skills to use technology to create a flexible production environment.

Research and development activities at National Laboratories and Manufacturing USA Institutes such as Clean Energy Smart Manufacturing Innovation Institute (CESMII) indicate there is potential for many manufacturers to significantly reduced their energy consumption, environmental impacts, and operating costs through greater adoption of the technologies and practices encompassed in smart manufacturing.

Energy management information systems (EMIS): a combination of hardware and software that collects, tracks, analyzes, reports, and predicts energy consumption. It provides information that makes energy performance visible so that individuals can make informed decisions to manage and optimize energy use. Because of their ability to harvest energy information and provide it to users in context, EMISs are critical pieces of smart manufacturing implementations.

Small and medium size manufacturers (SMM): DOE's Industrial Assessment Center (IAC) program defines SMMs as facilities with less than 500 employees, less than $100 million in annual sales, and annual energy costs between $100,000 and $2.5 million. Facilities usually do not have in-house energy management staff although they may have access to corporate resources.

Background on Energy Management Programs

Many electric and natural gas utilities administer energy-efficiency programs to help their customers save energy. These programs fulfill goals set by public utility commissions and utility management. Some of the goals are related to customer service, others related to environmental goals, and many are related to acquiring energy efficiency as a resource – a practice that treats customer investments in energy efficiency as a reliable method for meeting anticipated future demands for power or fuel. In a resource acquisition program, a utility purchases reductions in future energy consumption just as it might purchase future supplies of energy to meet its obligation to meet the energy needs of its customer base in outlying years. Because the focus is on reducing demand, they are often referred to as demand side management (DSM) programs.

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In 2017, the electric and natural gas utilities in the United States invested $8.3 billion in efficiency programs to reduce consumption of energy and fuel and demand for power. Most of the spending was by electric efficiency programs which were responsible for $6.9 billion, approximately $2 billion of which was spent on commercial and industrial (C&I) programs. Natural gas utilities spent around $300 million on C&I programs. The budgets of demand side efficiency programs have continued to increase over the past several years. The programs are effective in reducing the energy consumption of end users and for reducing the need for utilities to invest in additional generation and transmission. In 2018, program administrators reported savings of approximately 28,944 GWh of electricity and more than 449 million therms of gas through ratepayer-funded programs[4] (CEE 2017A).

Over two dozen utilities offer efficiency programs that help their customers adopt systematic practices for monitoring, measuring, and managing energy consumption. Often referred to as strategic energy management (SEM) programs, they provide combinations of awareness, training, coaching, and financial assistance that help facilities and organizations evolve from taking a project-by-project approach to a systematic and continual improvement approach to energy savings. Some programs are compatible with the ISO 50001 standard and prepare facilities to become certified.

- The Consortium for Energy Efficiency (CEE) has identified over two dozen SEM programs in the US and Canada
- SEM programs have served more than 1000 industrial sites
- 12 electric utility programs reported electric savings of 324.2 GWh in 2016.
- 6 natural gas utility programs reported savings of 9.21 million therms of natural gas in program year 2016, a 16% increase of savings reported in 2015[5] (CEE 2017B)

Many SEM programs utilize informational resources created by U.S. DOE including the 50001 Ready Navigator tool that helps facilities and organizations put in place energy management systems compatible with the ISO 50001 Energy Management Standard.

The US DOE's 50001 Ready program recognizes facilities and organizations that attest to the implementation of an energy management system based on the 25 steps contained in the Ready program. The program is a self-paced, no-cost way for organizations to build a culture of structured energy improvement that leads to deeper and sustained savings that does not require any external audits or certifications. Over a dozen utilities and other efficiency

[4] CEE 2017A: The Consortium for Energy Efficiency (CEE) Annual Industry Report. 2018 State of the Energy Efficiency Program Industry. Budgets, Expenditures, and Impacts. Middleton, MA: CEE.
[5] CEE 2017B: Sources: CEE 2017 Strategic Energy Management Program Summary

organizations use the resources of the 50001 Ready Program to help their customers implement ISO 50001-compatible energy management systems[6] (USDOE 2020).

The 50001 Ready program is one of several programmatic activities AMO undertakes to increase the implementation of energy management systems and create common best practices in the field of energy management. AMO supports the U.S. Technical Advisory Group (TAG) to the ISO energy management and energy savings technical committee (TC 301) and is the administrator for the Superior Energy Program (SEP 50001), an energy management performance program that demonstrates leadership in energy efficiency through robust measurement and verification of energy savings[7] (USDOE 2020).

Purpose

The purpose of this RFI is to solicit feedback from industry, academia, research laboratories, government agencies, utilities, and energy-efficiency program administrators, and other stakeholders on issues related to the uptake of smart manufacturing technologies, energy management system implementation, and integration of the two. EERE is specifically interested in information on how energy efficiency programs serving the industrial sector might increase awareness of and provide training and technical assistance on smart manufacturing and energy management systems to manufacturers with particular interest in manufacturers with limited internal capabilities. This is solely a request for information and not a Funding Opportunity Announcement (FOA). EERE is not accepting applications.

Disclaimer and Important Notes

This RFI is not a Funding Opportunity Announcement (FOA); therefore, EERE is not accepting applications at this time. EERE may issue a FOA in the future based on or related to the content and responses to this RFI; however, EERE may also elect not to issue a FOA. There is no guarantee that a FOA will be issued as a result of this RFI. Responding to this RFI does not provide any advantage or disadvantage to potential applicants if EERE chooses to issue a FOA regarding the subject matter. Final details, including the anticipated award size, quantity, and timing of EERE funded awards, will be subject to Congressional appropriations and direction.

EERE will not share responses to this RFI. Any information obtained as a result of this RFI is intended to be used by the Government on a non-attribution basis for planning and strategy development; this RFI does not constitute a formal solicitation for proposals or abstracts. Your response to this notice will be treated as information only. EERE will review and consider all responses in its formulation of program strategies for the identified materials of interest that

[6] USDOE 2020: https://betterbuildingssolutioncenter.energy.gov/iso-50001/50001Ready
[7] USDOE 2020: https://betterbuildingssolutioncenter.energy.gov/iso-50001/50001Ready

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are the subject of this request. EERE will not provide reimbursement for costs incurred in responding to this RFI. Respondents are advised that EERE is under no obligation to acknowledge receipt of the information received or provide feedback to respondents with respect to any information submitted under this RFI. Responses to this RFI do not bind EERE to any further actions related to this topic.

Confidential Business Information

Pursuant to 10 CFR 1004.11, any person submitting information that he or she believes to be confidential and exempt by law from public disclosure should submit via email, postal mail, or hand delivery two well-marked copies: one copy of the document marked "confidential" including all the information believed to be confidential, and one copy of the document marked "non-confidential" with the information believed to be confidential deleted. Submit these documents via email or on a CD, if feasible. DOE will make its own determination about the confidential status of the information and treat it according to its determination.

Evaluation and Administration by Federal and Non-Federal Personnel

Federal employees are subject to the non-disclosure requirements of a criminal statute, the Trade Secrets Act, 18 USC 1905. The Government may seek the advice of qualified non-Federal personnel. The Government may also use non-Federal personnel to conduct routine, nondiscretionary administrative activities. The respondents, by submitting their response, consent to EERE providing their response to non-Federal parties. Non-Federal parties given access to responses must be subject to an appropriate obligation of confidentiality prior to being given the access. Submissions may be reviewed by support contractors and private consultants.

In answering the questions below, please provide answers that apply to all manufacturers and where applicable additional information on how the answer might differ for SMMs.

Request for Information Categories and Questions

Category 1: Current state of uptake by manufacturers of smart manufacturing technologies and energy management systems.

1. What energy management practices are most popular with manufacturers?
2. What are the issues manufacturers should consider when considering investing in smart manufacturing technologies and practices?
3. Which types of manufacturing companies have the greatest difficulties adopting smart manufacturing technologies and energy management systems, and what are their most significant challenges?

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4. What are the barriers to and opportunities for greater uptake of smart manufacturing technologies?
5. What are the barriers to and opportunities for integrating smart technologies and energy management practices?
6. What are current best practices for integrating smart manufacturing and energy management systems?
7. What is the maturity of the SMMs in adopting standards for EnMS and Smart Technologies? (on a scale from Level 0 - Novice - Limited or no effort for improving energy performance, Level 1 – Compliant: Energy Management System implemented and audited, Level 2 – Baselined: Key Performance Indicators base values captured using standard methods, Level 3 – Improved: KPIs halfway to the best in class from base values, Level 4 - Best-in-Class: KPIs among the best in class.

Category 2: Existing EnMS and SM technical assistance resources available to manufacturers

1. What internal resources (if any) are available to manufacturing facilities' workers to enable them to evaluate smart manufacturing technology options?
2. What internal resources (if any) are available to manufacturing facilities' workers to enable them to implement energy management systems?
3. Which types of facilities are more likely to have necessary resources to implement an EnMS or SM technologies?
4. What external resources, such as vendors, consultants, education and training institutions, and technical assistance programs, currently exist to help manufacturers implement energy management systems? What are their strengths and weaknesses?
5. What external resources currently exist to help manufacturers integrate smart manufacturing technologies into their operations? What are their strengths and weaknesses?
6. Where are these two types of resources available?

Category 3: **Future use of smart technologies and energy management systems needed to be nationally and internationally competitive**

1. What information and communication technology infrastructure (hardware and software) must a facility have in place before it should consider investing in smart manufacturing technologies?
2. What worker training and skills are required to enable a facility to effectively use an EMIS and other smart technologies to manage its energy?
3. What smart manufacturing technologies are most valuable and currently in use by SMMs? Why?
4. How important will it be to integrate smart technologies with energy management and other business management systems?

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5. What challenges will manufacturers face integrating smart technology and energy management systems?
6. How can they overcome these challenges?

Category 4: Accelerating the uptake and integration of smart manufacturing and energy management systems by manufacturers.

1. What resources, especially with respect to worker education and training, do manufacturers need internally or externally to accelerate their adoption of smart technologies, energy management systems, and integrating them to optimize energy use?
2. What technical and workforce training and development resources do programs serving the industrial sector need to provide to increase the uptake of EnMS and smart manufacturing?
3. How can community colleges and universities help existing workers gain the skills and knowledge to become effective implementers of smart manufacturing and energy management systems?

Category 5: Accelerating the adoption of state or utility programs for smart manufacturing and energy management systems.

1. Describe program designs currently available that help organizations implement smart manufacturing and energy management system programs.
2. Where are there program implementation companies available to assist in running smart manufacturing and energy management system programs?
3. What are the challenges states and utilities face when trying to justify smart manufacturing and energy management system programs?

Request for Information Response Guidelines

Responses to this RFI must be submitted electronically to RIIAMP@ee.doe.gov no later than 5:00pm (ET) on **August 20, 2021**. Responses must be provided as attachments to an email. It is recommended that attachments with file sizes exceeding 25MB be compressed (i.e., zipped) to ensure message delivery. Responses must be provided as a Microsoft Word (.docx) attachment to the email, and no more than **7 pages** in length, 12 point font, 1 inch margins. Only electronic responses will be accepted.

Please identify your answers by responding to a specific question or topic if applicable. Respondents may answer as many or as few questions as they wish.

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EERE will not respond to individual submissions or publish publicly a compendium of responses. A response to this RFI will not be viewed as a binding commitment to develop or pursue the project or ideas discussed.

Respondents are requested to provide the following information at the start of their response to this RFI:

- Company / institution name;
- Company / institution contact;
- Contact's address, phone number, and e-mail address.

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