Comments of the American Council for an Energy-Efficient Economy (ACEEE) on

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

Dr. Ed Rightor and Dr. Neal Elliott, ACEEE

August 20, 2021

About ACEEE

The American Council for an Energy-Efficient Economy (ACEEE), a nonprofit research organization, develops transformative policies to reduce energy waste and combat climate change. With our independent analysis, we aim to build a vibrant and equitable economy – one that uses energy more productively, reduces costs, protects the environment, and promotes the health, safety, and well-being of everyone.

ACEEE has been a leader for three decades in industrial energy policy, programs, and technologies and has been actively engaged in the development promotion of smart manufacturing and strategic energy management (SEM).

Introductory remarks

ACEEE's research indicates that smart manufacturing and SEM represent important, complementary opportunities to improve energy efficiency and reduce industrial greenhouse gas emissions while reducing waste, improving productivity, and enhancing competitiveness in U.S. industrial facilities and supply chains. These measures can also provide a foundation for the technology and market transformations needed to address a changing climate and evolving global markets.

The past four decades have seen important improvements in energy and resource productivity through the application of improved technologies such as electric motors, boilers, and furnaces. More recently, we have seen the relative importance of component efficiency being superseded by optimization of systems, both processes and supply chains that also convey many other economic and environmental benefits. Smart manufacturing and SEM both enable such a systems approach within plants and companies and across supply chains, and together they offer synergistic improvements.

Smart manufacturing and SEM have been linked since their inceptions as they both seek to turn data into knowledge that firms can act on to continually improve production quality,

productivity, and performance. Recently, these parallel paths of information technology and operations technology have converged, bringing together plant operations and corporate management systems.

The revolutions in sensors, communication, and computational capabilities over the past three decades have enabled the rapid evolution of these practices, increasing the impacts and creating the potential for democratizing the benefits of information and communication technology for small and medium-sized manufacturers (SMM) by making the benefits of smart manufacturing accessible to these firms if the appropriate tools are deployed to enable them to focus on the application of these practices to their operations. Achieving this benefit will require a buildout of high-speed broadband across the country, as is envisioned by the infrastructure legislation that recently passed the U.S. Senate, and building the deployment infrastructure to support manufacturers in conceptualizing and implementing these systems.

Building the capacity for knowledge-based systems in the SMMs will also benefit larger manufacturers by enabling insights into their supply chains, which are dominated by SMMs, and allowing supply chain optimization that offers the potential for waste reduction and can enable shortening of these supply chains through onshoring. This capacity can help reduce operational risks, improve productivity and competitiveness, and reduce the carbon footprint of the many consumer products produced by the manufacturing sector.

These approaches also offer the potential for greater precision and performance in supply chains, allowing manufacturing to achieve maximum production from available assets while enabling the operational precision to make the right products at the right time and deliver them to the right place. Enabling greater control of these systems can eliminate waste, reduce rework, and minimize disruptions. Smart manufacturing and SEM represent building blocks that enhance global competitiveness and market share that grows the U.S. economy and workforce while producing new products such as manufacturing-as-services and chain-of-custody-service that provide visibility into and control of complex manufacturing supply chains that can help minimize risk and empower a new knowledge-driven workforce that ensures the global competitiveness of U.S. manufacturing.

Smart manufacturing and SEM systems also offer the promise to improve and expedite the carbon tracking and tracing needed for supply chain embodied carbon reporting as part of corporate commitments to science-based targets and corporate environmental, social, and governance practices. Currently, investors, consumers, and governments are pressuring companies to make commitments to transparency and reporting of embodied carbon in their products, but many large corporations have been unwilling to make upstream scope-3

commitments because they lack visibility into their supply chains. Broad deployment of smart manufacturing and SEM could enable companies to make these commitments.

Responses to questions

Responding to four of the five questions.

CATEGORY 1: CURRENT STATE OF UPTAKE BY MANUFACTURERS OF SMART MANUFACTURING TECHNOLOGIES AND ENERGY MANAGEMENT SYSTEMS

Uptake of both smart manufacturing and SEM have been greater among large organizations that have the human infrastructure necessary to implement the systems and technology and to track and report the benefits of the systems to management. Many small and medium-sized manufacturers lack the workforce to implement these complex administrative systems, and often have limited access to the broadband service needed to enable them. These smaller companies need tools that allow them to deploy these systems easily and inexpensively, without the need for hiring new technical staff or retraining existing staff. In addition, technical assistance will need to be available for walking them through the implementation process. Current program engagements, such as utilities, manufacturing extension partnership centers, and industrial assessment centers (IAC), tend to be episodic, not providing the ongoing hand-holding that many firms will need. The private sector may be able to meet this need in the future, but until that capacity emerges, it will fall to the public sector to make this support available.

CATEGORY 3: FUTURE USE OF SMART TECHNOLOGIES AND ENERGY MANAGEMENT SYSTEMS NEEDED TO BE NATIONALLY AND INTERNATIONALLY COMPETITIVE

Access to broadband communication capacity will be vital to enable the broader adoption of smart manufacturing and SEM because many areas of the country do not currently have access to affordable, reliable high-speed digital communication. Communication infrastructure unlocks access to high-performance computing though cloud supercomputing capability and allows timely communication and sharing of data in near real time, which enables factories to access remote expertise and services, such as condition-based monitoring and continuous cross-facility optimization.

Smart manufacturing requires the development of process simulations that allow for the management and optimization of operations. The skills to develop such simulations may be beyond the capabilities of many SMM. It does not make financial sense for these firms to develop this capability themselves, so it will be important to develop platforms and

resources that manufacturers can use to access this expertise. A promising idea is the development of tools that can make this expertise accessible to plants without extensive staff training or development. Because many of these capabilities enable more-effective collaboration with customers, such as assembly manufacturers, partnering with these companies to build capacity among their suppliers should be considered.

While a trained workforce will be important to advancing U.S. manufacturing, the training should focus on fundamental skills rather than specific software or hardware platforms, because these are likely to vary from plant to plant. It will be important to identify the skills needed to enable smart manufacturing and SEM. This skills development should be incorporated into curricula of university, community college, trade school, and union training programs. Combining formal training programs with internships and apprenticeships can provide the practical foundations that a next-generation manufacturing workforce will need. In addition, it is important to ensure the diversity of this knowledge-driven workforce, so we encourage the Department of Energy (DOE) to work with historically Black-, Hispanic-, and Native-serving institutions to develop programs that address the skills needed for smart manufacturing implementation.

As noted in our introductory remarks, smart manufacturing and SEM are converging as operations and corporate management see the benefits of integration and optimization. With market pressure growing for tracking and reporting of embodied carbon by investors and customers, facilitating this integration will position U.S. manufacturing to be responsive to growing domestic and global market pressure.

CATEGORY 4: ACCELERATING THE UPTAKE AND INTEGRATION OF SMART MANUFACTURING AND ENERGY MANAGEMENT SYSTEMS BY MANUFACTURERS

Smart manufacturing and SEM are not usually perceived as core activities by most manufacturers. It will be important to make information about these initiatives easily available and accessible to companies, particularly for SMM. Developing programs and policies at the local, state, and regional levels will be vital to accelerating the uptake of these practices, as discussed below.

See comments above for discussion of technical and training needs and roles for educational institutions.

CATEGORY 5: ACCELERATING THE ADOPTION OF STATE OR UTILITY PROGRAMS FOR SMART MANUFACTURING AND ENERGY MANAGEMENT SYSTEMS

Building programs and capacity at the local and regional levels will be necessary for meeting the needs of companies to accelerate the adoption of smart manufacturing and SEM. This approach supports the development of relationships and partnerships that can reflect the mix of industry and create communities of practice, which is particularly important for SMM with limited capacity to seek resources at the national level. As with supporting firms in implementing smart manufacturing and SEM, it will be important to develop materials and tools for the program implementers so they can tap into national level resources to support their programs, rather than having to develop expertise within their own programs. Creating program and policy templates that leverage this capability is a proven approach for deployment, as seen with past programs such as IACs and Manufacturing Extension Partnerships.

Collaboration is an important element of successful programs. We recommend that DOE undertake efforts at the state or regional level to identify opportunities for smart manufacturing and SEM, including identifying clusters of similar manufacturers and key supply chains, potential resources and program partners including educational institutions, government efforts, trade associations, and other key stakeholders in the program area.

To get many of these policies and programs off the ground, DOE should provide planning and capacity-building grants that will help program administrators create a foundation for a successful effort. ACEEE research has shown that industrial programs can take three to five years to become established. It will be important to plan for this time commitment if efforts are to be successful.

ACEEE research has shown that many industrial programs are delivered by national implementation contractors. We recommend that DOE engage these firms in the development of tools and training and program templates, which will allow them work with their clients to incorporate the development of unique expertise required into their programs. Using these implementation contractors allows program administrators to access national-level expertise without the cost of developing expertise within an individual program. The implementation firms frequently assist the implementation contractor in planning programs, so their engagement early in the process will make them a valuable part of the adoption effort.

Most program administrators require authorization from a regulatory or oversight entity such as a utility commission or governmental entity to initiate new efforts. Developing

materials that can be used to support the initiation of a new program can ease the process of getting approval from these bodies. To the extent feasible, these materials should be regionally specific, as they have greater sway if they come from within the region.

ACEEE appreciates the opportunity to provide comments to the Office as it considers future programmatic directions in smart manufacturing and energy management. We stand ready to assist the Office. Please do not hesitate to contact Dr. Ed Rightor (erightor@aceee.org), industrial program director, or Dr. Neal Elliott (rnelliott@aceee.org), director emeritus, should you have any questions.