DE-FOA-0002830: Request for Information on Barriers and Pathways to Integrating Onsite Clean Energy Technologies in the Industrial Sector

ISSUE DATE: August 17, 2022
RESPONSES DUE: September 23, 2022
SUBJECT: Request for Information (RFI)

Description

The Advanced Manufacturing Office (AMO) is seeking information to better understand the barriers to deploying onsite clean energy and storage technologies at industrial facilities and pathways for accelerated adoption. These technologies include, but are not limited to, solar photovoltaic (PV), solar thermal, wind power, renewable fuels, geothermal, bioenergy, battery storage, and thermal storage technologies. This request for information (RFI) is focused on understanding the current state of knowledge and uptake of these technologies by industrial energy users, opportunities and barriers for technology integration at industrial facilities, existing technical assistance and resources available for technology evaluation and deployment, and pathways to accelerate the adoption of onsite clean energy technologies.

Background

AMO is a technology office within the Department of Energy's (DOE) Office of Energy Efficiency & Renewable Energy (EERE). The AMO mission is to catalyze research, development, and adoption of energy-related advanced manufacturing technologies and practices to drive U.S. economic competitiveness and energy productivity. To achieve its mission, AMO partners with private and public stakeholders and invests in research, development, and demonstration (RD&D) of innovative, next generation manufacturing processes and production technologies that will improve efficiency and reduce emissions, improve manufacturing competitiveness, reduce industrial waste, and reduce the life-cycle energy consumption of manufactured products.

In order to limit global temperature rise by 1.5°C and mitigate the worst impacts of climate change, the U.S. is targeting net-zero greenhouse gas (GHG) emissions economy-wide by 2050.[1] The industrial sector is responsible for nearly one-third of the nation's primary energy use and

[1] Executive Order 14008, "Tackling the Climate Crisis at Home and Abroad," January 27, 2021. https://www.federalregister.gov/documents/2021/02/01/2021-02177/tackling-the-climate-crisis-at-home-and-abroad

almost 30% of energy-related GHG emissions.[2] Further, energy use in the industrial sector is projected to increase by 31% over the next 25 years.[3] While many manufacturing companies have implemented energy efficiency technologies and practices to reduce their energy use and associated GHG emissions, industrial energy efficiency improvements alone will not be sufficient to meet our nation's carbon reduction goals.

Onsite clean energy technologies, including solar photovoltaic (PV), solar thermal, wind power, renewable fuels, and geothermal, can be practical and cost-effective alternatives to generating heat and electricity from fossil fuel sources at manufacturing facilities. In addition to reducing environmental impacts and supporting decarbonization goals, implementation of onsite clean energy technologies presents a range of benefits for the industrial sector and broader society. For example, investing in renewable technologies can lead to increased business profits by reducing energy costs and enabling excess energy to be sold back to the grid.[4] It also enables a company to distinguish itself as a leader in renewable energy, which can improve stakeholder trust, attract a talented workforce, and create new market growth opportunities, which may also lead to increased profits. Further, onsite clean energy technologies enhance energy resilience by reducing reliance on the grid. Societal benefits include supporting the creation of American clean energy jobs, as investing in solar and wind powered technologies create 50% and 20% more jobs, respectively, relative to the same investment in fossil fuels.[5] Clean energy also leads to health benefits by reducing hazardous air pollutants that are known to cause cancer or other serious health effects.[4]

Industrial heat demand accounts for approximately two-thirds of global industrial energy demand and includes a broad range of process heating and cooling applications such as drying, heating, steam production, and refrigeration.[6] The remaining share of industrial energy demand is for electrical end-uses, which include electric furnaces, machines, lighting, and facility cooling. Some onsite clean energy technologies, including solar thermal, bioenergy, and geothermal,

[2] Exact percentages can vary from year to year based on weather and economic factors; in particular 2020 may not be representative due to impacts from the COVID pandemic. For additional information: Energy Use in Industry. U.S. Energy Information Administration. 2021. https://www.eia.gov/energyexplained/use-of-energy/industry.php; including feedstocks – fossil inputs into materials (chemicals and plastics).

[3] What You Need to Know About Energy: How We Use Energy. The National Academy of Sciences, Engineering, and Medicine. 2022. http://needtoknow.nas.edu/energy/energy-use/industry/.

[4] Quantifying the Multiple Benefits of Energy Efficiency and Renewable Energy: A Guide for State and Local Governments, Part One: The Multiple Benefits of Energy Efficiency and Renewable Energy. U.S. Environmental Protection Agency. 2018. https://www.epa.gov/statelocalenergy/quantifying-multiple-benefits-energy-efficiency-and-renewable-energy-guide-state.

[5] Jaeger, J., Walls, G., Clarke, E., Altamirano, J.C., Harsono, A., Mountford, H., Burrow, S., Smith, S. and Tate, A., 2021. The Green Jobs Advantage: How Climate-friendly Investments Are Better Job Creators.

[6] World Energy Outlook 2017. International Energy Agency. https://iea.blob.core.windows.net/assets/4a50d774-5e8c-457e-bcc9-513357f9b2fb/World_Energy_Outlook_2017.pdf

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can be leveraged for direct generation of process heat for applications under 400°C, which accounts for approximately half of today's industrial heat demand[6]. For high-temperature requirements, clean energy technologies can be used to pre-heat a conventional heating process, which can lead to substantial reductions in a facility's GHG emissions while also reducing cost. Further, some forms of bioenergy sources can be used for high-temperature applications above 500°C, with some studies finding that using biomass for high-temperature heat applications will be the most cost-effective way to meet industrial emissions reduction targets.[7]

Other onsite clean energy technologies, such as solar PV and wind power, can be used to directly produce electricity for industrial applications. These onsite technologies will play an increasingly important role in industrial decarbonization as facilities electrify process heat to reduce GHG emissions. Solar PV and wind power have transformed the energy market in recent years, accounting for 55% of global investments in new power capacity in 2020.[8] This is due in part to the rapidly falling costs of PV and wind, which have decreased by 70% and 40%, respectively, since 2010, and have resulted in solar and wind becoming increasingly cost competitive with natural gas.[9] These trends are projected to continue, as the share of renewables in the nation's electricity mix is forecasted to increase from 21% in 2020 to 42% in 2050, with solar and wind generation being the primary contributors to that growth.[10]

As industry shifts from fossil fuel to intermittent clean energy resources, energy storage systems will play a pivotal role in enabling reliance and resilience.[11] In addition, energy storage systems offer an opportunity for manufacturers to reduce costs by load shifting from peak hours to off-peak hours. Demand for batteries is anticipated to increase as more solar projects are implemented to maximize renewable energy use and reduce costs.[12] Implementation of large-scale battery storage projects planned for 2021 to 2025 could increase the proportion of the nation's battery storage projects co-located with solar from 24% to 50%.[13] In addition to

[7] Lenz, V., Szarka, N., Jordan, M. and Thrän, D., 2020. Status and Perspectives of Biomass Use for Industrial Process Heat for Industrialized Countries. Chemical Engineering & Technology, 43(8), pp.1469-1484.
[8] Estimation by BloombergNEF.
[9] Bolinger, M. 2021. Utility-scale Wind and Solar in the U.S.: Comparative Trends in Deployment, Cost, Performance, Pricing, and Market Value, Electricity Markets & Policy, p. 21.
[10] Annual Energy Outlook 2022. U.S. Energy Information Administration. https://www.eia.gov/outlooks/aeo/.
[11] Balducci, P., Mongird, K. and Weimar, M., 2021. Understanding the Value of Energy Storage for Power System Reliability and Resilience Applications. Current Sustainable/Renewable Energy Reports, 8(3), pp.131-137.
[12] 2022 Renewable Energy Industry Outlook. Deloitte. 2022. https://www2.deloitte.com/us/en/pages/energy-and-resources/articles/renewable-energy-outlook.html.
[13] Battery Storage in the United States: An Update on Market Trends. U.S. Energy Information Administration. 2021. https://www.eia.gov/analysis/studies/electricity/batterystorage/pdf/battery_storage_2021.pdf.

battery storage, thermal energy storage presents an opportunity for long-duration storage for thermal-to-thermal cycles, in addition to load shifting to reduce cost.[14]

Purpose

The purpose of this RFI is to solicit feedback from industry, academia, research laboratories, government agencies, utilities, and other stakeholders on issues related to the deployment of onsite clean energy and storage technologies, including solar, solar thermal, wind power, renewable fuels, geothermal, battery storage, and thermal storage, at industrial facilities. EERE is specifically interested in information on the key barriers that manufacturers are encountering during technology evaluation and implementation of clean energy projects. EERE is also interested in the current state of knowledge and uptake of onsite clean energy technologies, existing technical assistance and resources for project evaluation and deployment, and potential pathways for accelerating the integration of clean energy technologies in the industrial sector. 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.

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 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.

[14] Energy Storage Grand Challenge: Energy Storage Market Report. 2020. Energy Storage Grand Challenge Energy Storage Market Report

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 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. 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.

Request for Information Categories and Questions

Category 1: **Current state of uptake by industrial energy users of onsite clean energy technologies (e.g., PV, solar thermal, wind power, bioenergy, geothermal, battery storage, and thermal storage)**

C1.1 What level of interest is there from industrial energy users in installing onsite clean energy technologies, and what is driving that interest?
C1.2 What types of onsite clean energy technologies do industrial energy users feel comfortable deploying, and why? Which technologies do industrial energy users not feel comfortable deploying, and why?
C1.3 What primary factors are driving decisions about whether a clean energy technology is implemented at a manufacturing facility?
C1.4 How are manufacturers incorporating onsite clean energy technologies into their *short-term* planning for a future decarbonized economy?
C1.5 How are manufacturers incorporating onsite clean energy technologies into their *long-term* planning for a future decarbonized economy?
C1.6 Provide any additional information relevant to the current state of uptake of onsite clean energy technologies by industry that does not fit in the previous sections in this category.

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Category 2: Opportunities and barriers for onsite clean energy generation and storage technology integration at industrial facilities

C2.1 How do industrial facilities expect their patterns of electricity and thermal energy use to change in coming years due to carbon reduction and renewable energy goals?
C2.2 What aspects of manufacturing processes or facility operations face the greatest challenges or barriers to using onsite clean energy technologies?
C2.3 What industrial subsectors have the greatest opportunity for integrating the following onsite clean energy technologies? What are the barriers to integrating the following technologies?

- Solar PV
- Solar thermal
- Wind power
- Bioenergy
- Geothermal
- Battery storage
- Thermal storage

C2.4 What are the greatest challenges or barriers to broadly deploying clean energy technologies across the U.S. industrial sector?
C2.5 Provide any additional information relevant to how the energy needs of industry are evolving and the opportunities that presents for onsite clean energy resources that does not fit in the previous questions in this category.

Category 3: **Existing technical assistance and resources available to industrial energy users interested in implementing onsite clean energy generation and storage technologies**

C3.1 Which types of facilities are more likely to have the resources required to implement onsite clean energy projects?
C3.2 What resources, such as cost/benefit analysis tools, vendors, consultants, education and training institutions, and technical assistance programs, are available to assist industrial energy users in *evaluating* different onsite clean energy technology options? What are their strengths and weaknesses?
C3.3 What resources, such as tools, vendors, consultants, education and training institutions, and technical assistance programs, are available to assist industrial energy users in *implementing* onsite clean energy generation and storage technology projects? What are their strengths and weaknesses?
C3.4 Of the resources described in the previous two responses, which are the most utilized by industrial energy users?
C3.5 Provide any additional information relevant to existing technical assistance and resources available to industrial energy users that does not fit in the previous sections in this category.

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Category 4: **Accelerating the adoption of onsite clean energy generation and storage technologies**

C4.1 What educational and training resources do industrial energy users need to accelerate the adoption of onsite clean energy technologies?
C4.2 What software and analysis tools do industrial energy users need to accelerate the adoption of onsite clean energy technologies?
C4.3 What other forms of technical assistance may industrial energy users need to accelerate the adoption of onsite clean energy technologies?
C4.4 What types of stakeholder engagement efforts may help to accelerate the adoption of onsite clean energy technologies?
C4.5 Provide any additional information relevant to accelerating the adoption of onsite clean energy generation and storage technologies that does not fit in the previous sections in this category.

Category 5: **Workforce development opportunities and equity considerations for deploying onsite clean energy technologies**

C6.1 In what ways will widespread deployment of onsite clean energy resources impact the industrial workforce?
C6.2 What workforce development opportunities would facilitate the industrial sector's ability to adapt to increased reliance on onsite clean energy resources?
C6.3 What equity and environmental and energy justice considerations should DOE incorporate into onsite clean energy resource deployment activities?
C6.4 Provide any additional information relevant to workforce and equity considerations that do not fit in the previous questions in this category.

Request for Information Response Guidelines

Responses to this RFI must be submitted electronically to onsiteenergy@ee.doe.gov no later than 5:00pm (ET) on September 23, 2022. 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 10 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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