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Manufacturing and Energy: Advancing Productivity, Prosperity, and the Environment

An Overview of Industrial Technical Assistance for State and Territory Energy Offices

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Overview

A resurgence in U.S. manufacturing is in the offing, propelled by private investment and reinforced through public policies and incentives. Manufacturing makes large contributions to incomes, employment, and tax bases at national, state, and local community levels. Domestic manufacturing is crucial to economic competitiveness and to the resilience and security of supply chains for critical products and materials. However, manufacturing also consumes large amounts of energy and can contribute to adverse environmental impacts, including pollution and climate-altering emissions.

There are significant opportunities, many readily available, to improve manufacturing energy and environmental performance while enhancing productivity and competitiveness. State and Territory Energy Offices[1] can play important roles to support such improvements and advance state economic, energy, and environmental goals, including, among others, raising awareness, uptake, and coordination of industrial technical assistance programs; supporting technology advancement; and including manufacturing considerations in state energy policies and planning. This brief, developed under the aegis of the National Association of State Energy Officials State Industrial Working Group, provides an overview of the importance of manufacturing and relevant State Energy Office interests, a summary of various programs and resources for industrial and manufacturing technical assistance, and a few highlighted cases of states that are advancing manufacturing energy and environmental management.[2]

1 The term State Energy Office is meant to include the Energy Offices of U.S. Territories and the District of Columbia.

2 The NASEO State Industrial Working Group (https://www.naseo.org/naseo-state-industrial-working-group), in partnership with the U.S. Department of Energy's Industrial Efficiency and Decarbonization Office, is working with State Energy Offices to identify, develop, and enhance resources to help manufacturing industries meet their goals and state objectives for economic development and competitiveness, emissions reduction and environmental protection, and energy reliability, resilience, and security.

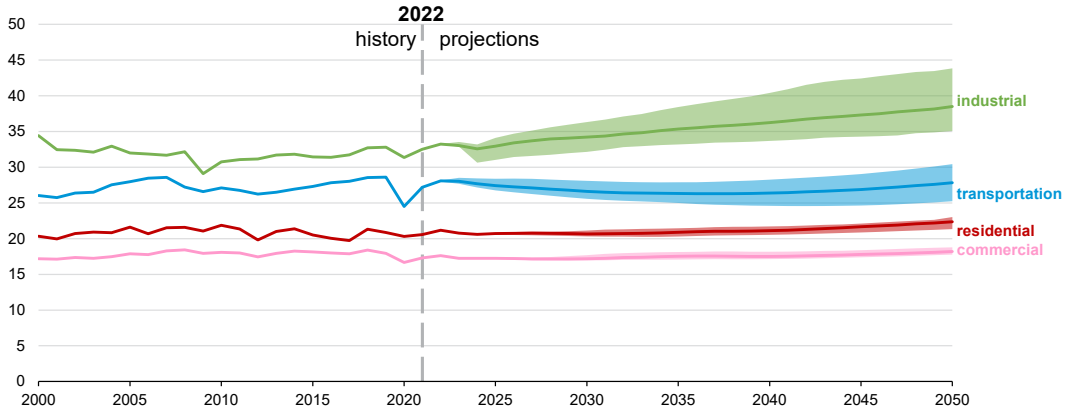
Why Manufacturing Matters

The U.S. Department of Commerce Bureau of Economic Analysis reports that American manufacturers contributed $2.6 trillion of value-added, about 10.3 percent, to U.S. gross domestic product (GDP) in 2022.[3] The U.S. Census Bureau estimates that manufacturing shipments (sales) amounted to $6.1 trillion in 2021, including $849 billion in exports, representing nearly 55 percent of U.S. exports.[4] The National Association of Manufacturers, however, reports almost $1.4 trillion in 2021 manufactured good exports.[5]

For that year, U.S. manufacturers employed 11.7 million people with a total annual payroll of $785.2 billion, averaging $67,051 per employee, which is about four percent higher than the average across all sectors.[6] The National Association of Manufacturers reports that 243,687 manufacturing firms employed about 8.4 percent of the U.S. workforce, representing about 12.5 million people, in December 2021, with average annual total compensation of $95,990 (18 percent greater than average non-farm compensation).[7] Irrespective of specific figures and statistical methodologies, a healthy manufacturing sector is critically important to incomes, employment, and economic well-being across the nation.

The industrial sector consumes about 33 quadrillion British thermal units (Btu) or quads, or about one-third of national energy use, which is significantly more than transportation, residential, or commercial use (see Figure 1).[8] Manufacturing accounts for about 25 quads or 76 percent of industrial energy use. These figures include both energy and non-fuel feedstock inputs (material inputs such as oil and gas used in chemical and fertilizer manufacture, coking coal for iron and steel, asphalt, and lubricating oils and greases), and include electrical system losses from power provided to industry.

Figure 1. Total Energy Consumption by End-use Sector (quadrillion Btu)



Source: U.S. Energy Information Administration, Annual Energy Outlook 2023

Note: Total consumption by end-use sectors includes purchased electricity and electricity-related losses. AEO 2023 Reference case projections. Shaded regions represent maximum and minimum values for each projection year across AEO 2023 Reference and side cases.

3 U.S. Bureau of Economic Analysis (2023), Interactive Data, GDP by Industry, Underlying Detail Tables, Annual, 2017–2022, Value Added by Industry, via https://www.bea.gov/itable/gdp-by-industry.

4 U.S. Census Bureau (2023), Manufacturing in America, https://www.census.gov/content/dam/Census/library/visualizations/2023/econ/manufacturing-in-america.pdf.

5 National Association of Manufacturers, 2022 United States Manufacturing Facts, https://nam.org/state-manufacturing-data/2022-united-states-manufacturing-facts/.

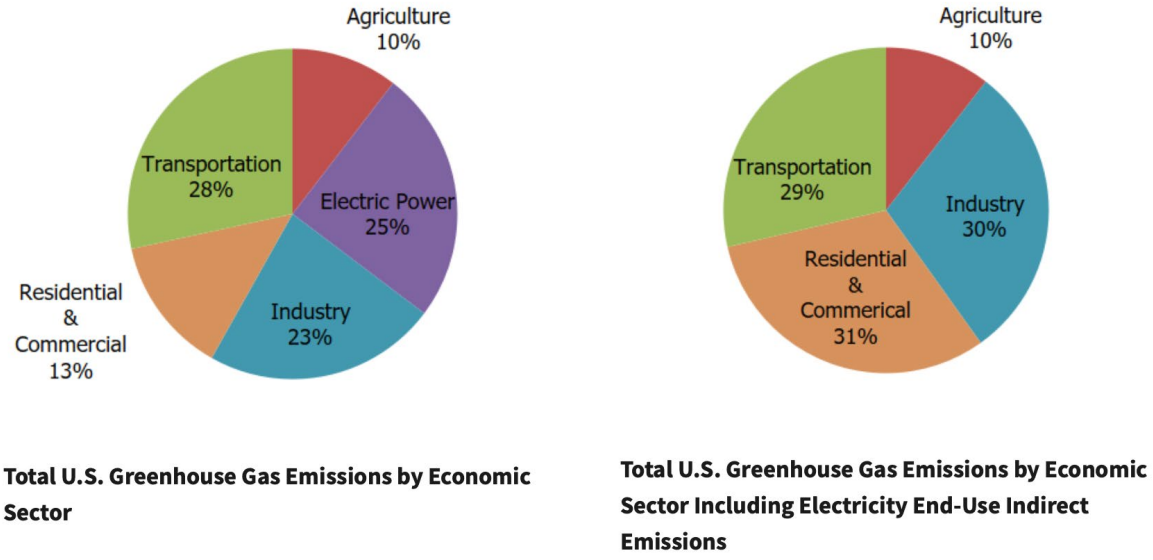
6 U.S. Census Bureau, op. cit.

7 National Association of Manufacturers, op. cit.

8 The U.S. Energy Information Administration defines industrial as including manufacturing (NAICS codes 31-33); agriculture, forestry, fishing and hunting (NAICS code 11); mining, including oil and gas extraction (NAICS code 21); and construction (NAICS code 23). For 2022, manufacturing accounted for 76 percent of industrial consumption; mining, construction, and agriculture accounted for, respectively, 12 percent, 7 percent, and 4 percent. U.S. Energy Information Administration, Use of Energy Explained: Energy Use in Industry, https://www.eia.gov/energyexplained/use-of-energy/industry.php.

According to the U.S. Environmental Protection Agency (EPA), industry's share of U.S. primary energy consumption correlates with its emissions of greenhouse gases, accounting for about 30 percent of emissions when its electricity use is included, or about 1.9 billion metric tons CO_2-equivalent (CO_2e) out of total net emissions of 6.34 billion metric tons CO_2e in 2021.[9] About 78 percent of industrial greenhouse gas emissions was direct (from burning fossil fuels, leakage from equipment and processes, and from chemical processes used to make products), while 22 percent was indirect (from generation of purchased electricity). This has implications for the quantity and location of non-greenhouse gas pollution emissions, such as particulate matter, nitrogen oxides, and hazardous air pollutants, and their health and environmental impacts.

Figure 2. Total U.S. Greenhouse Gas Emissions by Economic Sector in 2021



Total U.S. Greenhouse Gas Emissions by Economic Sector

Total U.S. Greenhouse Gas Emissions by Economic Sector Including Electricity End-Use Indirect Emissions

Source: U.S. Environmental Protection Agency, Sources of Greenhouse Gas Emissions, https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions

Greater electrification of industrial processes along with moves to electrify transportation and building thermal systems will increase demand for electricity. This is important for electricity system planning, investment, and operations and, thus, for State Energy Offices, Public Utility Commissions, unregulated consumer-owned utilities, and others seeking to achieve state and local energy affordability, economic, reliability and resilience, and environmental goals. Enhancing industrial energy efficiency, demand management practices, and onsite or distributed power generation and energy storage can help meet these objectives. Industrial energy management is also important to the economics and reliability of natural gas and petroleum systems. Also, for some industrial sectors, hydrogen and carbon capture, utilization, and storage (CCUS) may play growing roles and will be salient to the work of State Energy Offices.[10]

9 U.S. Environmental Protection Agency, Sources of Greenhouse Gas Emissions, https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions, based Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2021. Note that EPA omits agriculture from its definition of industry.

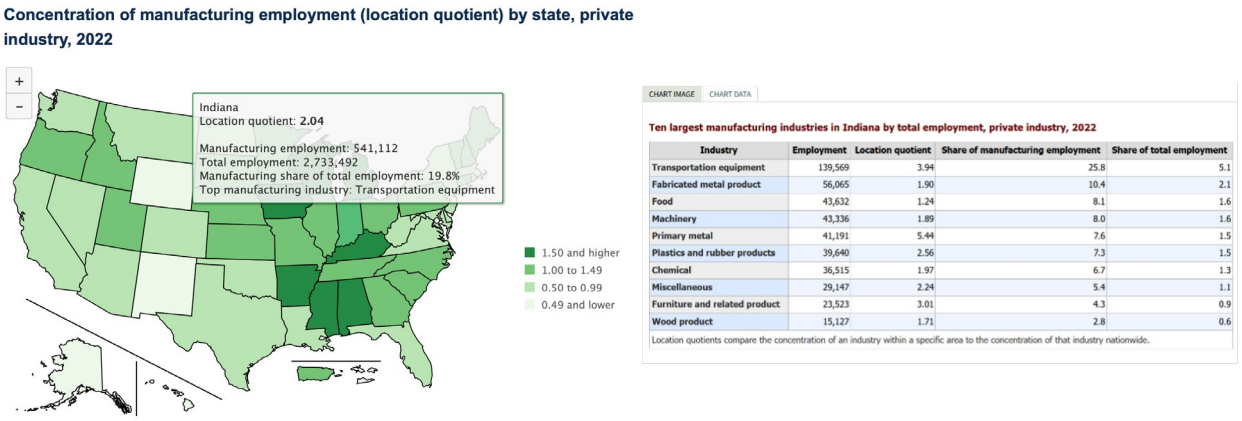
10 NASEO offers state-oriented overviews, resource links, and learning and exchange opportunities concerning hydrogen (https://www.naseo.org/issues/energy-environment-climate/hydrogen) and CCUS/carbon management (https://www.naseo.org/issues/energy-environment-climate/ccus).

Box 1. State Manufacturing Data

The National Association of Manufacturers offers easy-to-access fact sheets on manufacturing in the United States and each of the 50 states and District of Columbia, providing numbers of firms, manufacturing output, top-ten manufacturing sectors, employment, compensation, and export data. See https://nam.org/state-manufacturing-data/.

Various detailed official data are available from the U.S. Bureau of Economic Analysis, Census Bureau, Bureau of Labor Statistics, and the Federal Reserve (including from individual Federal Reserve Banks). The Census Bureau offers a visualization tool based on its 2021 Annual Survey of Manufacturers that provides, by state or by sector, data on manufacturing shipments, employment, and payroll.* The Bureau of Labor Statistics offers summary and detailed state-level information on manufacturing employment and wages by industry subsector.**

State Manufacturing Employment Data Visualization screenshot



Source: U.S. Bureau of Labor Statistics, https://www.bls.gov/opub/ted/2023/a-look-at-manufacturing-jobs-on-national-manufacturing-day.htm

State Energy Officials may consult with state Departments of Commerce (some of which include the State Energy Office), and of Labor, or similar agencies; economic development authorities; and state Chambers of Commerce, manufacturers associations, and similar bodies for more details on the manufacturing sectors in their states.

State environmental agencies (which in some states include the State Energy Office) may provide data on manufacturing-related emissions, effluents, and wastes; permits and regulatory requirements; and other environmental aspects. As noted below, in discussion of technical assistance programs, these agencies may house or work with pollution prevention and small business environmental assistance programs to provide technical assistance to businesses.

* U.S. Department of Commerce, Census Bureau, https://www.census.gov/library/visualizations/interactive/2021-asm.html.

** U.S. Department of Labor Bureau of Labor Statistics, *The Economics Daily*, "A look at manufacturing jobs on National Manufacturing Day," https://www.bls.gov/opub/ted/2023/a-look-at-manufacturing-jobs-on-national-manufacturing-day.htm (visited *February 23, 2024*). Data are from the Quarterly Census of Employment and Wages, available at North American Industry Classification System (NAICS) 2-digit sector and 3-digit subsector levels. For more data on employment and wages, see QCEW Data Viewer, charts and maps on the latest QCEW data release, and QCEW Location Quotient Details.

Box 2. Clean Manufacturing and Clean Energy Manufacturing

Much recent policy emphasis, including through various provisions of the federal Infrastructure Investment and Jobs Act (also referred to as the Bipartisan Infrastructure Law) and the Inflation Reduction Act, aims to boost U.S. production and deployment of "clean energy" products and technologies, meaning those specific to "decarbonizing" (i.e., reducing or eliminating greenhouse gas emissions from) our energy systems. Examples include renewable power generation equipment (solar, wind, etc.), electric vehicles (EVs) and related charging equipment, EV and stationary batteries, electrolyzers for making hydrogen, heat pumps, insulation, and high-efficiency motors. It can include technologies and equipment associated with nuclear power; carbon capture, utilization, and storage; sustainable fuels; and bio-based products. It may also include production of associated materials and components ranging from critical mineral mining and processing to electrical transformers, power electronics, computer chips, sensors, and controls.

While these are critically important for a sustainable energy transition, great opportunities for energy savings, improved productivity and competitiveness, and reduced adverse environmental impacts lie with "clean manufacturing" of all kinds of products across all manufacturing sectors; colloquially, from potato chips to computer chips. These sectors include energy- and emission-intensive industries like chemicals, petroleum refining, iron and steel, aluminum, cement, pulp and paper, and glass. They also encompass the breadth of production, from lumber, apparel, printing, housewares, and plastic parts to automobiles, aircraft, pharmaceuticals, electronics, and medical devices, and everything in between. The emphasis in this brief and of the NASEO State Industrial Working Group is on the wider manufacturing realm.

State Energy Office Interests and Roles

While the nation's State Energy Offices are diverse in their contexts, including their locations within state government, size and resources, and particular responsibilities and authorities, they generally share interests and roles concerning state energy planning; supporting energy-related economic development and employment; energy reliability, resilience, and security; and responsible environmental stewardship. They develop and implement plans, policies, and programs. They advise governors and legislatures and sometimes are directly or indirectly involved in regulatory processes. Importantly, State Energy Offices can be fulcrums for working across agencies, levels of government, and the range of private, public, and nongovernmental stakeholders. This places them in a good position to help advance manufacturing and its energy and environmental performance in their states.

While this brief focuses on manufacturing technical assistance programs and resources, State Energy Offices can play multiple supportive roles, some of which are noted in Table 1. These roles interact. For example, State Energy Office policy advice and planning activities can incite or strengthen policies affecting the technology innovation continuum from research and development through commercialization and deployment. In support of state policy objectives, some State Energy Offices directly operate or oversee grant, loan, and credit enhancement programs that industrial firms can access, including State Energy Revolving Loan Funds. Other State Energy Offices collaborate with Green Banks, economic development authorities, and other agencies and institutions to access, coordinate with, and leverage federal, state, and private capital that may be used to advance clean manufacturing projects.[11] State Energy Offices can be well-positioned to work across state government; with federal partners, Tribes, localities, and other public bodies; and with private and nongovernmental firms, organizations, and other stakeholders to advance state objectives.

11 For example, various State Energy Offices are developing Revolving Loan Funds under the federal Energy Efficiency Revolving Loan Fund Capitalization Grant Program, authorized under the Infrastructure and Investment Act (IIJA), https://www.energy.gov/scep/energy-efficiency-revolving-loan-fund-capitalization-grant-program). Some are also working to qualify existing and new state entities as State Energy Financing Institutions to enable access to DOE Loan Program Office loan guarantees for qualifying projects (also authorized under the IIJA), https://www.energy.gov/lpo/articles/lpo-outlines-state-energy-financing-institution-sefi-opportunities-and-how-state.

Table 1. Roles State Energy Offices Can Play to Support Manufacturing

State planning and strategy development	• Include manufacturing in State Energy Plans. • Collaborate and contribute to other relevant plans, strategies, and roadmaps (e.g., economic development, climate, sustainability, and manufacturing or industry-specific).
Policy development and support	• Advise Governor, Legislature, and other agencies and authorities. • Convene state agencies and/or wider stakeholders for input on manufacturing/industrial energy issues.
Financial support	• Administer or support and coordinate with agencies that administer relevant state grants, rebates, loan funds, credit enhancements, tax incentives, etc. • Identify, inform, and support applications for federal grants, loans, credit, credit enhancements, tax incentives, etc. • Provide or help identify sources for matching or cost-share resources for federal or other funding. • Support or facilitate partnerships applying for financial resources.
Technical and business assistance	• Provide manufacturing/industrial technical and business assistance. • Help fund technical and business assistance by other organizations and programs. • Raise awareness of, collaborate with, and help coordinate varied technical and business assistance programs.

Source: NASEO

A particularly important role that State Energy Offices can take is to make or reinforce connections among industrial and manufacturing technical and business assistance programs so they can make cross-referrals, complement each other's capabilities and expertise, cooperate, and coordinate their services to better help manufacturers and support state economic, energy, and environmental objectives. Simple awareness of program offerings can help State Energy Offices and others make appropriate referrals and suggestions to businesses. Deeper awareness and collaboration can tap synergies, enhance the quality of assistance, and contribute to policy and program development to strengthen the efficacy and uptake of programs. Several state case studies below offer vignettes of state agencies and programs, including State Energy Offices, working together to strengthen industry while improving energy and environmental performance.

Technical Assistance Programs and Resources

The diversity of manufacturing technical assistance offerings across the nation is both a strength and a challenge. Federal and state governments, sometimes along with Tribes, localities, utilities, and nongovernmental organizations, support varied industrial and manufacturing assistance programs. In some states, these programs cooperate well, providing cross-referrals, consultations, and collaboration. In other states, cross-program awareness and cooperation is not robust, meaning that companies may miss out on technical assistance offerings, and states may miss out on economic, environmental, and energy benefits that otherwise would accrue to them.

This section outlines some major industrial/manufacturing technical assistance programs supported by the U.S. Department of Energy and others. It is not comprehensive, nor does it reflect the range and diversity of programs and institutions that offer various services to manufacturers and related industries. State officials, businesses, and others should explore their states' resources in context.

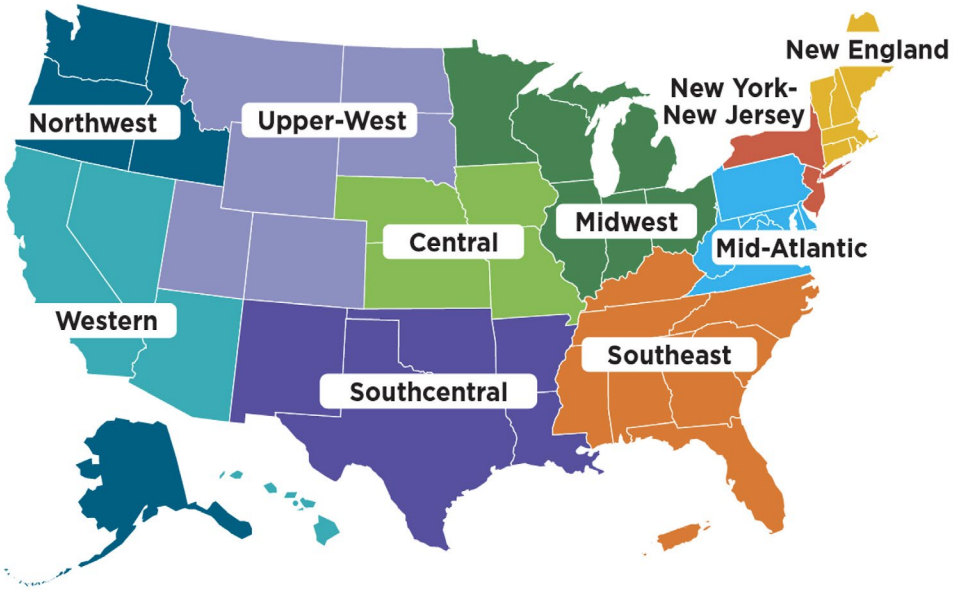
The emphasis here is on energy and related technical assistance pertinent to industrial processes and operations, such as energy and environmental assessments, analyses and advice on technology and process options, technology demonstrations, operator and other workforce training, and energy and environmental management system training and advice. There can be interactions with occupational safety and health technical assistance, too. Organizations providing these types of technical assistance often, but not always, differ from those providing other types of business assistance, such as for finance, business management, marketing, human resources, industrial siting/location, and start-up incubation. There can be overlap among these services and, importantly, there are opportunities for collaboration across programs offering varied services to help industrial clients and to further state policy objectives.

The following are among major industrial technical assistance programs and resources available across the United States:[12]

12 The program descriptions that follow draw extensively from their online descriptions at the NASEO State Industrial Working Group webpage at https://www.naseo.org/naseo-state-industrial-working-group.

Onsite Energy Technical Assistance Partnerships

Formerly known as Combined Heat and Power Technical Assistance Partnerships, Onsite Energy Technical Assistance Partnerships help industrial facilities and other large energy users through 10 multistate regional partnerships that also include the District of Columbia, Puerto Rico, and U.S. Virgin Islands. They bring specialized, regional knowledge to advise on economic, environmental, regulatory, and other issues impacting the adoption of onsite clean energy technologies. DOE-supported Onsite Energy TAPs have expertise to advise on a variety of distributed energy technologies suitable for the industrial sector and are backed by support from DOE's national laboratories. They also develop tools and resources, share best practices, and work in partnerships across U.S. industry.



Source: U.S. Department of Energy, https://betterbuildingssolutioncenter.energy.gov/onsite-energy/taps

Better Climate Challenge/Better Plants

DOE's Better Climate Challenge and Better Plants programs (part of the Better Buildings Initiative) work with leading U.S. manufacturers and wastewater treatment agencies to set and achieve ambitious greenhouse gas, energy, water, and waste reduction goals. In the case of the Better Climate Challenge program, partners commit to reducing Scope 1 and 2 greenhouse gas emissions by 50 percent over a 10-year period across all U.S. operations. In the case of the Better Plants program, partners commit to reducing energy intensity by 25 percent over a 10-year period across all U.S. operations. DOE provides direct technical assistance to partners and showcases market leadership to encourage manufacturers to adopt the technologies and best practices that will enable them to achieve their goals. By partnering with industry thru Better Plants, DOE aims to help manufacturers boost efficiency, increase resilience, strengthen economic competitiveness, and reduce their carbon footprint through improvements in energy efficiency.

Energy Management Programs

DOE offers two energy management programs, 50001 Ready and Superior Energy Performance 50001 (SEP 50001), to help companies create and implement Energy Management Systems in their enterprises. 50001 Ready recognizes facilities and organizations that attest to the implementation of an ISO 50001-based energy management system. 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.

Industrial Training and Assessment Centers[13]

Small and medium-sized manufacturers may be eligible to receive a no-cost assessment provided by more than 50 DOE-supported Industrial Training and Assessment Centers (ITACs) located across the lower 48 states and Puerto Rico. Engineering faculty and upper-class and graduate students at participating universities conduct energy assessments to identify opportunities to improve productivity and competitiveness, reduce waste, and save energy. In-depth evaluations provide detailed process analyses and recommendations with estimates of costs, performance, and payback times. Companies can also query a database of recommendations from past plant assessments.

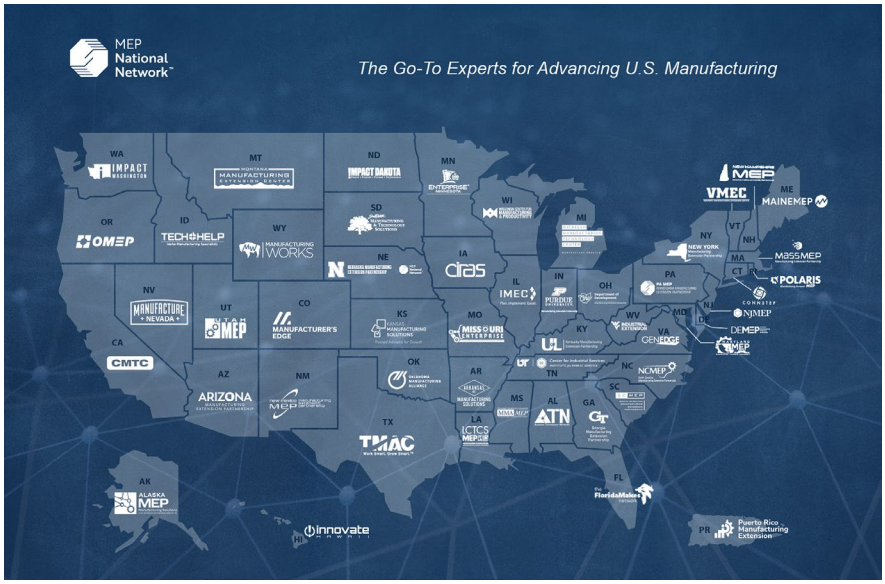
Newly available are ITAC implementation grants of up to $300,000 per manufacturer on a 50 percent cost-shared basis to implement recommendations from ITAC, Onsite Energy/Combined Heat and Power (CHP) Technical Assistance Partnership, or recognized "ITAC-equivalent" third-party assessments. New Regional Centers of Excellence and 17 Industrial Training and Assessment Centers at community colleges, trade schools, and union training programs enhance ITAC workforce training capabilities. Contact the closest Industrial Assessment Center (IAC) location about receiving ITAC services.

Source: U.S. Department of Energy, https://www.energy.gov/mesc/locations-industrial-assessment-centers

13 At the time of this writing DOE is in the process of rebranding the IAC program as the Industrial Training and Assessment Center (ITAC) program. Thus, both terms and abbreviations are commonly used.

Manufacturing Extension Partnership (MEP)

Under the purview of the U.S. Department of Commerce, National Institute for Standards and Technology (NIST), MEP is a public-private partnership with Centers in all 50 states and Puerto Rico dedicated to serving small and medium-sized manufacturers. MEP Centers provide a wide range of technical and business assistance to help manufacturers grow, improve, and mitigate their risks, including helping enhance energy and sustainability performance. In Fiscal Year 2023, the MEP National Network helped manufacturers create or retain over 107,100 jobs, save $2.9 billion, make $16.2 billion in new and retained sales, and stimulate $4.8 billion in new client investments.[14]



Source: National Institute for Standards and Technology, https://www.nist.gov/mep/mep-national-network

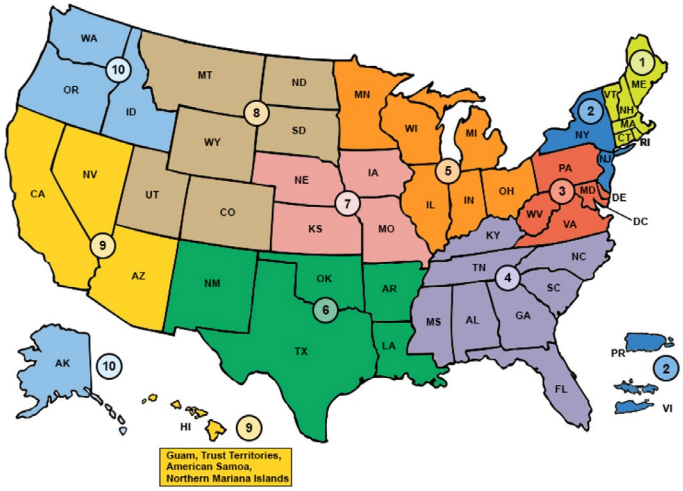
ENERGY STAR Program for Industry

Supported by the EPA, ENERGY STAR's industrial program works with manufacturers large and small, and new and well-established, to enhance energy and cost savings, strategic energy management, and emissions reduction. The program offers a multitude of resources, from general to industry specific, including industrial energy management tools and guides. ENERGY STAR and its voluntary industrial partners offer peer exchange opportunities, case studies, and advice. Its industrial challenges, energy efficiency "treasure hunts," and plant certifications and recognitions incite adoption of economically and environmentally rewarding practices. The program launched an Industrial Assistance Network to help small and medium-sized manufacturers access local energy management support and expertise, earn ENERGY STAR recognition, and receive training and lessons from experienced industrial energy managers.

14 National Institute for Standards and Technology, MEP National Network, https://www.nist.gov/system/files/documents/2024/02/13/FY23%20MEPNN%20Overview%20w%20IMPACTS%20012624.pdf.

National Small Business Environmental Assistance Program (SBEAP)

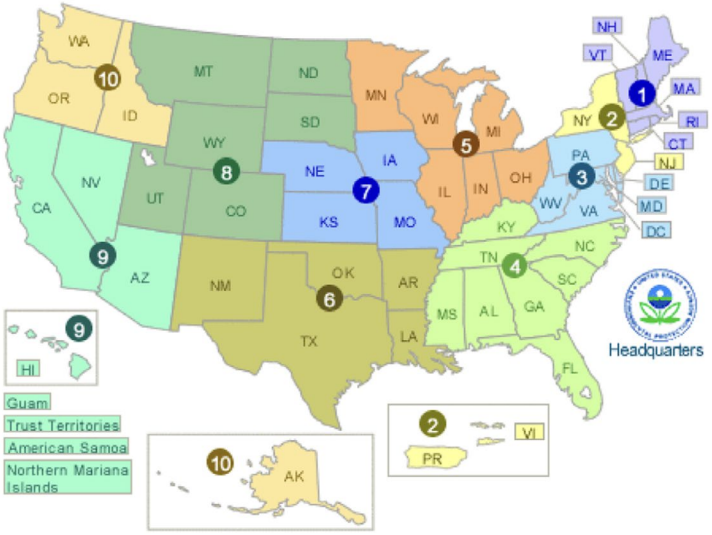
Most states host an SBEAP to help small businesses comply with environmental requirements. While these programs focus on regulatory compliance, their assistance helps companies save energy and reduce emissions directly as well via conservation of chemicals and materials that would otherwise become waste and pollution. The website contains resources for both small businesses and the SBEAPs that serve them.

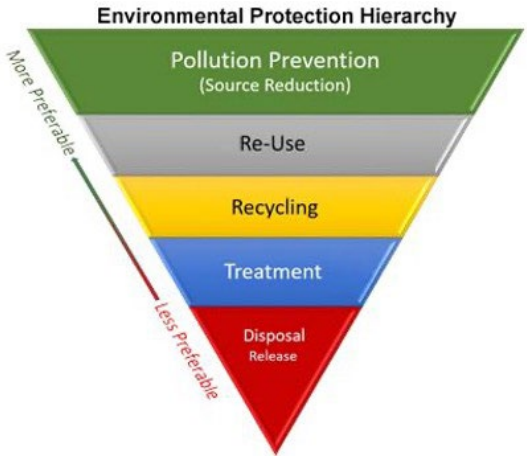


Source: National Small Business Environmental Assistance Program, https://nationalsbeap.org/states

Pollution Prevention Technical Assistance Resources

A website hosted by the EPA provides links to regional, state, and local pollution prevention technical assistance resources. These include public agencies, universities, Small Business Development Centers, MEP centers, nongovernmental organizations, and other programs and resources. These varied programs focus on pollution prevention and waste reduction, advancing both direct reductions in energy use and emissions and indirect reductions through avoided releases and disposal of chemicals, materials, and products.





Source: U.S. Environmental Protection Agency, https://www.epa.gov/p2/p2-technical-assistance-providers

Small Business Development Centers (SBDC)

SBDCs deliver professional, individualized advice and technical assistance to existing small businesses and pre-venture entrepreneurs. SBDCs provide problem-solving assistance to help small businesses access capital, develop and exchange new technologies, and improve business planning, strategy, operations, financial management, personnel administration, marketing, export assistance, sales and other aspects key to growth and expansion, management improvement, increased productivity, and innovation.

State Examples

The following vignettes from several diverse states demonstrate just a few ways that states, including State Energy Offices often working across programs and agencies, can support their manufacturing sectors through technical and business assistance and technology advancement while simultaneously furthering state energy management and environmental objectives.

California: Advancing Industrial Energy Innovation

Like many other states, California provides a suite of industrial technical assistance resources. Among these are offerings from four Industrial Assessment Centers (at San Diego, San Jose, and San Francisco State Universities and the University of California-Irvine); California's Manufacturing Network (25 partners led by Manufacturing Technology Consulting, the NIST MEP partner); and the Western Onsite Energy TAP (operated by Optony).

Industries also benefit from robust support in California for research, development, demonstration, and deployment (RDD&D) of energy efficient and lower-emitting technologies. Much of this is led by the California Energy Commission (CEC, the State Energy Office) in pursuit of the state's ambitious goal to achieve economy-wide carbon neutrality by 2045 while supporting economic growth and addressing electric grid reliability, air quality, water supply, and other challenges.

Second to transportation's 39 percent share, California's industrial sector accounts for 22 percent of the state's direct greenhouse gas emissions plus a share of the 16 percent attributable to electricity generation (both in-state and imported).[15] Electrification of industrial processes, as well as buildings and transportation, is fundamental to the state's decarbonization strategy along with decarbonizing the electricity sector, which has so far increased reliance on variable renewable solar and wind generation. This is leading to a strong emphasis on improving electricity grid management and using demand flexibility to reduce peak loads, better use renewable generation, and improve energy reliability and resilience. The state has a load shift target of 7 gigawatts by 2030 to be facilitated by CEC and California Public Utility Commission policies, regulations, and programs.

In addition to performing its regulatory roles, the CEC is bringing to bear existing and new programs to invest in and foster greater industrial energy efficiency and demand flexibility. This includes the utility customer-funded Electric Program Investment Charge (EPIC) and Gas Research and Development Programs that support demonstration and early deployment of various industrial technologies, including industrial heat storage, cold storage load flexibility, and smart pumping in the water sector.

Another existing CEC program is the Food Production Investment Program (FPIP) that supports energy efficiency and cost savings in the state's large food production industry, including grid-supportive technologies such as for peak load reduction. The Commission is launching its Industrial Decarbonization and Improvement of Grid Operations (INDIGO) program, intending to fund about $40 million of decarbonization technology deployment that mutually benefits industries and electricity grid reliability. FPIP and INDIGO resources will also provide cost-share for pertinent federal funding opportunities.[16]

15 This and subsequent paragraphs draw extensively from "Industrial Energy Innovation in California" (https://www.naseo.org/Data/Sites/1/documents/tk-news/cec-jun-11-2024-naseo-forum.pdf), presented to the June 11, 2024 NASEO-NARUC Grid-interactive Efficient Buildings (GEB) and NASEO Industrial Working Groups Joint Forum: Industrial Demand Flexibility.

16 California Energy Commission, GFO-22-902 - Cost Share for Federal Funding Opportunities Industrial Decarbonization and Improvement of Grid Operations (INDIGO) Program and Food Production Investment Program (FPIP), https://www.energy.ca.gov/solicitations/2023-03/gfo-22-902-cost-share-federal-funding-opportunities-industrial.

The CEC will also fund an Industrial, Agricultural, and Water Demand Flexibility Research and Deployment Hub (IAW FlexHub) with an estimated $17 million. The Hub will work to advance flexible demand management technologies, inform future policies, and enhance the ability of industry to respond to emission and price signals to improve grid reliability while reducing costs and emissions.

California's technical assistance, complementary policies, and industrial RDD&D portfolio will help meet the state's multiple economic, energy, and emission goals while yielding nationally beneficial advancement of industrial technologies.

Connecticut: Chief Manufacturing Officer — Concierge to Manufacturers and Driver of Collaboration

Connecticut is the only state with a Chief Manufacturing Officer (CMO). The CMO leads the Office of Manufacturing in the Department of Economic and Community Development (DECD). The CMO serves as a "a concierge to Connecticut's manufacturers, and as their voice to the governor and legislature" and drives collaborations across the state's manufacturing ecosystem.[17]

The state's Manufacturing Strategic Plan centers on innovation and three pillars: (1) growing and developing the workforce; (2) enhancing supply chain resiliency; and (3) expanding the industrial base.[18] The plan highlights various programs run not only by DECD but also, collaboratively, with other agencies and organizations and through public-private partnerships to support these pillars' objectives. Such programs include the Manufacturing Innovation Fund, a Manufacturing Voucher Program supporting small business manufacturers, the CONNEX platform for enhancing supply chains, and apprenticeship and training support, among others.

The CMO and DECD collaborate extensively with the State Energy Office in the Department of Energy and Environmental Protection to improve energy efficiency, reduce costs, and improve environmental performance of Connecticut's manufacturers, as well as grow opportunities for clean energy manufacturing, including for energy storage and distribution, offshore wind, electric vehicles, sustainable aviation fuels, and hydrogen. In the technical assistance realm, the CMO serves on the University of Connecticut's Industrial Training and Assessment Center Board and works with CONNStep, operator of the state's NIST MEP center, further supporting cooperation, collaboration, and complementarity across the state's manufacturing ecosystem.

Connecticut's approach with the catalytic role of Chief Manufacturing Officer exemplifies collaboration across agencies, organizations, and programs to support new and well-established manufacturing firms with workforce development, technical assistance, and finance across the breadth of manufacturing sectors.

17 State of Connecticut, Office of Manufacturing, About Us, Who We Are, https://manufacturing.ct.gov/About-Us?language=en_US.

18 State of Connecticut, "2023 Connecticut's Manufacturing Strategic Plan," https://portal.ct.gov/-/media/manufacturing/pdf/2023-ct-mfg-strategic-plan---final---hr.pdf.

Maine: Industrial Innovation Task Force

As recommended in the state's four-year climate action plan, "Maine Won't Wait,"[19] an Industrial Innovation Task Force was established to help the state's industrial sector keep industrial greenhouse gas emissions flat through 2030 and reduce them through 2050 while encouraging economic growth in the sector.[20]

The Task Force is co-chaired by the Commissioner of the state Department of Environmental Protection and Executive Director of the Efficiency Maine Trust, the quasi-state agency that operates the state's energy efficiency program. Members of the Industrial Innovation Task Force include company representatives within the industrial sector in Maine, nonprofit advocacy organizations, members of the Maine Climate Council, the University of Maine, the Maine Public Utilities Commission, and the Maine Governor's Energy Office (the State Energy Office). The Task Force provides a forum for learning, engagement, and exploring technical and funding opportunities for innovation and pilot projects to reduce emissions in the industrial sector.

Maine will build on existing programs, such as Efficiency Maine Trust's commercial and industrial assistance and incentives for heat recovery, combined heat and power, variable-frequency drives, compressed air system optimization, vacuum pumps, refrigeration and process cooling, boilers and heating systems, and lighting systems. The Industrial Innovation Task Force is cited as a priority measure in Maine's Priority Climate Action Plan submitted under the EPA Climate Pollution Reduction Grant program.[21]

Pennsylvania: Pennsylvania Technical Assistance Program

The Commonwealth of Pennsylvania hosts a rich industrial technical assistance ecosystem with a mix of state, federal, nonprofit, independent, and university organizations and partnerships. Support of innovative emerging manufacturing technologies is provided by Ben Franklin Partners, while a broader engagement network provides robust technical assistance to existing industry participants.[22] The Pennsylvania Manufacturing Extension Partnership manages NIST MEP federal funding and program outcomes through collaboration with a network of seven Industrial Resource Centers.[23] The Keystone State hosts the Mid-Atlantic Onsite Energy TAP at Pennsylvania State University (Penn State) and an ITAC at Lehigh University. Its small and medium-sized manufacturers are also served by several ITACs in neighboring states.[24] The Department of Community and Economic Development supports the Manufacturing PA Innovation Program that imbeds college and university students with Pennsylvania manufacturers to help them advance their processes and technologies.[25]

In 2024, the Commonwealth buttressed its support of industry by creating the Reducing Industrial Sector Emissions in Pennsylvania (RISE PA) Grant Program. Overseen by the Pennsylvania Department of Environmental Protection (DEP) with $396 million of EPA Climate Pollution Reduction Grant funding, the program will support industrial projects that create jobs, reduce emissions, and protect air quality.[26]

19 Maine Climate Council (2020), "Maine Won't Wait: A Four-Year Plan for Climate Action," https://www.maine.gov/future/sites/maine.gov.future/files/inline-files/MaineWontWait_December2020.pdf.
20 State of Maine, Governor's Office of Policy Innovation and the Future, Industrial Innovation Task Force, https://www.maine.gov/future/initiatives/climate/climate-council/industrial-task-force.
21 State of Maine Priority Climate Action Plan, https://www.epa.gov/system/files/documents/2024-03/maine-pcap.pdf.
22 Ben Franklin Technology Partners, https://benfranklin.org/
23 Pennsylvania Manufacturing Extension Partnership, https://pamep.org/, and Pennsylvania Industrial Resource Center Network, https://pamade.org.
24 Such as IACs at Case Western Reserve, University of Delaware, and West Virginia University.
25 Manufacturing PA Innovation Program, https://manufacturingpa.org/index.html.
26 Pennsylvania Department of Environmental Protection, Reducing Industrial Sector Emissions in Pennsylvania (RISE PA), https://www.dep.pa.gov/Business/Energy/OfficeofPollutionPrevention/Pages/RISE_PA.aspx

A key provider, especially for energy and environmental management, is the Pennsylvania Technical Assistance Program (PennTAP).[27] PennTAP receives support from the Office of Energy Programs (the State Energy Office) in DEP, DOE, EPA, U.S. Department of Agriculture (USDA), and other sources to provide industry with various forms of technical assistance, such as conducting energy and environmental audits and assessments, supporting the establishment of energy management systems via DOE's 50001 Ready and Superior Energy Performance programs, matching Penn State student interns and research capabilities with industrial firms, and educational webinars and workshops.

PennTAP also helps its clients access funding from state and federal sources, including the state DEP's Small Business Advantage Grants, USDA's Rural Energy for America Program, and utility rebates as well as DOE sources. Having been certified as providing "IAC-equivalent" (or "ITAC-equivalent") energy assessments, PennTAP's clients can apply for DOE ITAC implementation grants that can provide up to $300,000 to cover up to 50 percent of the cost of implementing PennTAP recommendations. In addition, PennTAP will administer the Small-scale Award Track of RISE PA for small and medium-sized manufacturers.

A case that illustrates multi-program collaboration to help small manufacturers is Custom Container Solutions (CCS) of Milton, Pennsylvania, a manufacturer of steel containers used in multiple industries.[28] CCS engaged with the Innovative Manufacturers' Center (a Pennsylvania MEP center) that helped the company with process improvements while also making a referral to PennTAP to conduct an EPA-funded Economy, Energy, and Environment (E3) assessment. The assessment identified process and equipment improvement opportunities, leading to a Penn State student design project to enhance CCS's plasma cutter dust collection system design and maintenance. The project also stimulated research supported by the Penn State Center for the Application of Artificial Intelligence and Machine Learning to Industry on welding quality as well as a Manufacturing PA Innovation Program grant to enhance weld operator training and improve defect detection and quality control. The E3 assessment allowed the company to increase production by 30 to 35 percent while reducing electricity and propane consumption, with concomitant cost savings and greenhouse gas reductions. The student design project led to improved plant air quality to the benefit of workers' health.

The project illustrates the benefits of cross-referrals and cooperation across programs and organizations to provide technical assistance and facilitate funding to improve productivity, save money and energy, reduce emissions, and protect workers' health. Coordinated technical and business assistance across multiple organizations and programs was critical to this industrial success story.

27 PennTAP, https://penntap.psu.edu/.
28 PennTAP, 2023, "PennTAP helps metal manufacturer increase production by 30-35%," https://penntap.psu.edu/about/our-stories/penntap-helps-metal-manufacturer-increase-production-by-30-35-percent/.

Texas: Texas Industrial Energy Efficiency Program and Network

The Lone Star State has a strong industrial technical assistance network, with a big focus on energy performance. The State Energy Conservation Office (the State Energy Office) is a key supporter of the network. It sponsors the University of Houston-coordinated Texas Industrial Energy Efficiency Program (TIEEP) and the Texas Industrial Energy Efficiency Network (TIEEN).[29]

Both the program and the network focus on education and awareness. TIEEP offers forums and other outreach that often feature industry case studies to inform, educate, and facilitate discussion on advancing industrial energy and water management, efficiency, and decarbonization. The forums are typically short (two-hour) events with invited speakers who present on emerging technologies and share case studies with audiences of engineers and managers, most of whom are from the chemicals and oil refining sectors. TIEEP periodically organizes more in-depth training in specific areas of interest.

TIEEN also provides outreach through its webinars and case studies, but its audience includes a much wider range of industries. TIEEN consists of multiple industrial assistance programs and providers. These include TIEEP; the Houston Advanced Research Center (which hosts the DOE-supported Southcentral Onsite Energy Technical Assistance Partnership); the Texas A&M Industrial Assessment Center; the Texas PACE Authority (which facilitates property assessed clean energy financing); the South-central Partnership for Energy Efficiency as a Resource; and the Texas Manufacturing Assistance Center (TMAC, the state's MEP affiliate).

TMAC is itself a network of eight Texas universities and research institutions that provide technical and business assistance to manufacturers across the state. The following TMAC case, employing the Economy, Energy, and Environment assessment approach, illustrates how Texas is helping manufacturing industry save energy, reduce pollution and waste, and improve companies' bottom lines.

For Metro Custom Plastics, a plastic injection molding specialist in Tarrant County, TMAC's E3 Assessment and trainings, including in-depth "Value Stream Mapping" of the facility's operations, identified 23 areas where energy, environmental, and process time improvements could be made, allowing the company to enact changes that will save $238,000, avoid 16 tons of plastic wastes, avoid 5.7 metric tons of CO_2e, and save 10,500 kilowatt-hours of electricity. The E3 training enables the company to continue evaluating and improving its operations.[30]

The State Energy Office-supported Texas Industrial Energy Efficiency Network, through its partner institutions with their varied capabilities and resources, is helping Texas manufacturers be more competitive and profitable while saving energy and being better environmental stewards.

29 University of Houston, Industrial Energy Efficiency, https://uh.edu/uh-energy-innovation/uh-energy/educational-programs/industrial-energy/.

30 University of Houston, Division of Energy and Innovation, Metro Custom Plastics Success Story, https://uh.edu/uh-energy/educational-programs/tieep/content/metro-custom-plastics-success-story.pdf.

Utah: Industrial Assessment Center-State Energy Office Partnership[31]

The Intermountain Industrial Assessment Center (IIAC) at the University of Utah has partnered with the Utah Office of Energy Development to identify and explore many case studies for intelligent industrial energy management throughout the state. In one such case study, the IIAC identified an opportunity for a minerals processing facility to pump its slurry product to another processing facility during off-peak hours, rather than pumping continuously. This smart pumping automation strategy leverages existing product storage tanks on each end, with each set capable of storing over two days' worth of product. This significant storage capacity, coupled with large pumps equipped with variable frequency drives, gives the processing facility the flexibility to respond to signals from the grid, which can enhance reliability and better enable more renewable generation on the grid. By adding intelligence, potentially including machine learning models to predict future facility, grid, and market conditions, the facility can become a significant grid asset. It could act essentially as a battery for the grid, while giving the facility the opportunity to benefit financially from structured utility rate programs. Using the facility's existing time-of-use and peak demand pricing structure, the IIAC identified a savings opportunity of $180,000 annually by employing this intelligent pumping scheme. The economics can be further enhanced by enrolling in a newly established real-time curtailment program.

There are many opportunities like this for manufacturers to leverage existing infrastructure by coupling it more closely with real-time grid management and leveraging new computational and algorithmic developments from the artificial intelligence boom. These require careful design of automation applications that leave the processes unharmed, while allowing them to contribute to grid operations and benefit from the incentive programs. The IIAC and the State of Utah are committed to continually identifying these opportunities to help manufacturers and, ultimately, help enhance grid resilience by better leveraging flexibility of the industrial sector.

31 Case provided by Kody Powell, Director, Intermountain Industrial Assessment Center, University of Utah, April 8, 2024.

Conclusion

This brief summarizes the importance of manufacturing to national, state, and local communities' economies, highlights roles that State Energy Offices can play to support manufacturing, and focuses on technical assistance as a key tool for strengthening manufacturing while advancing important state economic, energy, and environmental policy objectives. There are various technical and business assistance programs — some major ones summarized in this brief — supported by federal, state, and other funding and expertise that can help industry. The number and diversity of programs, including their variations across states, can be strengths, offering specialized expertise and resources tuned to state and local contexts. However, the number and variety of programs can also lead to modest awareness and uptake of offerings, low rates of cross-referrals and cooperation across programs, and, thus, reduced efficacy and lost opportunities to simultaneously help manufacturers and meet policy goals. This brief seeks to illustrate and stimulate opportunities to strengthen awareness, cooperation, and collaboration among State Energy Offices; economic development, environmental, and other agencies and institutions; technical and business assistance providers; and others to advance cleaner and more prosperous American manufacturing.

Image: istockphoto/Sean Anthony Eddy

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