

BETTER PLANTS 2022 PROGRESS UPDATE

Working with Industrial Partners to Advance Energy Efficiency & Decarbonization



Better Plants: Year in Review

In the last year, through **Better Buildings**, **Better Plants**, the U.S. Department of Energy (DOE) has worked with over 270 manufacturers and water and wastewater utilities—representing every U.S. state and territory—to accelerate the adoption of more energy efficient practices, highlight new and innovative technologies, and spur change at an organizational level. Through the program, DOE supports **3,600 facilities**, 14% of the US manufacturing footprint, to meet ambitious emissions, energy, waste, and water goals. Collectively, these partners have reported savings of **2.2 QTBU** of energy and **\$10.6 billion**.

In 2022, DOE announced a new opportunity for industrial organizations through the **Better Climate Challenge**. Focused on supporting industrial partners in achieving portfolio-wide decarbonization, more than 60 industrial partners and allies have now committed to reducing their operational greenhouse gas (GHG) emissions as a part of this program. As the program further focuses its efforts on developing decarbonization resources, DOE remains committed to supporting all partners in meeting their sustainability goals, whether they be emissions, energy, water, or waste.

Partner Achievements by the Numbers

Below: Equivalency statistics from the [U.S. Energy Information Administration](#) and the EPA [Greenhouse Gas Equivalencies Calculator](#).



2.2 QBTU
of energy saved



\$10.6 billion
saved



1.8%
average annual
energy intensity
improvement rate



131 million
metric tons of CO₂ saved



14%
of the U.S.
manufacturing footprint
are Better Plants
partners

Partners in Action

To help partners achieve their ambitious decarbonization, energy, water, and waste goals, DOE has:

Focused on Decarbonization

- The Better Climate Challenge was launched this year to work with partners to set and achieve portfolio-wide GHG reduction targets (pp. 6-7).
- Low Carbon Pilot participants continue to work with DOE to explore facility-level pathways for reducing emissions (pg. 8).

Highlighted Partners

- Partners were presented with Better Practice and Better Project Awards during the Better Buildings, Better Plants Summit (pg. 12) to recognize their leadership and innovation in adopting emissions-, energy-, water-, and waste-savings projects (pp. 10-11).

Developed Tools and Technical Expertise

- Software tools like MEASUR and VERIFI (pg. 13) and guidance documents like “Renewable Energy Guidance for Industry” (pg. 15) are helping partners track and meet their energy and GHG goals.
- Many partners also expanded their sustainability commitments by participating in the Waste Reduction Network (pg. 16) or the Water Savings Network (pg. 17).

Provided Technology Innovation

- Phase II of the Industrial Technology Validation Pilot has launched and will work with companies to validate emerging technologies that can cost-effectively advance decarbonization (pg. 18).
- DOE’s tour of Argonne National Lab in October 2022 is designed to educate partners about technologies under development and how to collaborate with national labs (pg. 19).

Offered Workforce Development Training

- Over 500 total participants have attended Virtual In-Plant Trainings on seven different topics in the past year, identifying more than \$400 million in cumulative energy cost savings opportunities (pg. 20).
- More than 70 attendees gathered at Oak Ridge National Lab for the inaugural “Energy Bootcamp,” a workshop created to educate attendees on the key aspects of energy efficiency and fundamentals of energy management (pg. 21).
- DOE’s In-Plant Trainings return in-person in late 2022 (pg. 21).

Leveraged Complementary Programs

- Nearly 30 Better Plants partner sites have completed the 50001 Ready Navigator through DOE’s 50001 Ready Program (pg. 22).
- DOE’s Industrial Assessment Centers (IACs) have conducted more than 20 no-cost energy assessments for Better Plants partner facilities in 2022 (pg. 23).
- The Combined Heat and Power (CHP) Deployment program helps manufacturers and wastewater treatment plants (WWTP) lower operating costs and reduce carbon emissions (pg. 24).



“Better Plants partners are international leaders of industrial sustainability—setting and achieving ambitious energy, water, waste, and emissions reduction goals. In the face of our planet’s climate crisis, our industrial partners are stepping up and achieving real progress. They are providing leadership for others across the U.S. economy by demonstrating what is possible and economically viable. Through Better Plants, leading manufacturing companies—ranging from single-facility, family-owned businesses to members of the Fortune 100—and water and wastewater utilities are developing and sharing innovative solutions, training workers, and field testing the technologies of the future.”

— Carolyn Snyder
Deputy Assistant Secretary for Energy Efficiency
Office of Energy Efficiency and Renewable Energy,
U.S. Department of Energy

New Program and Challenge Goal Achievers

Legrand North & Central America, Deschutes Brewery, Nestlé Health Science, and Intertape Polymer Group all met and exceeded their ambitious energy intensity reduction goals in the past year. Their experience and willingness to share solutions helps other partners achieve their goals as well.

To date, Better Plants partners have **met and exceeded nearly 80 energy and water goals**—saving money, improving competitiveness, and helping mitigate climate change by reducing GHG emissions. See the full list of Better Plants goal achievers on page 28 of this report.



Above: Acting Deputy Director of the Advanced Manufacturing Office (AMO) Diana Bauer presents a goal achiever award to Legrand's Vice President, Energy Efficiency, Sustainability & Public Policy Susan Rochford at the 2022 Better Buildings, Better Plants Summit.



Legrand North & Central America surpassed their goal of a 13% reduction in energy intensity in 5 years, achieving a 14.1% reduction. This was Legrand's third energy goal; they previously set and achieved energy intensity reduction goals of 20% and 25%.



Deschutes Brewery surpassed their goal of a 10% reduction in energy intensity in 10 years, achieving a 10.2% reduction in three years.



Nestlé Health Science surpassed their goal of a 20% reduction in energy intensity in 10 years, achieving a 24.1% reduction in three years.



Intertape Polymer Group surpassed their goal of a 25% reduction in energy intensity in 10 years, achieving a 38.5% reduction in seven years.

Follow Better Plants on social media for the latest on our partners' accomplishments:



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@BetterPlantsDOE



LinkedIn
Better Plants

How Did They Do It?

Legrand North & Central America has taken a wide range of measures to reduce energy consumption and increase energy efficiency across its operations, including leveraging new technologies such as fuel cells, improving processes, and engaging employees. The partner has famously conducted several "Energy Marathons:" 26.2-days of energy saving competitions across multiple sites that empower their employees to implement technology and process changes. At the end of Energy Marathon 3.0, Legrand saved more than **575,000 kWh** and almost **\$60,000 in energy costs**. Energy consumption at participating sites was collectively **reduced by 14%**.



Above: One of the participating facility teams in Legrand's Energy Marathon 3.0.

Other notable projects have included installing occupancy sensors, replacing fluorescent lighting with LED, replacing aging rooftop HVAC units with more efficient equipment, process cooling improvements in raceway and injection molding, and replacing aging hydraulic injection molding units with more energy efficient electric units.

New Better Climate Challenge Partners

Through the Better Climate Challenge, industrial organizations partner with DOE to reduce portfolio-wide **GHG emissions (scope 1 & 2) by at least 50% within 10 years**. To date, over **60 partners and allies** have joined the Better Climate Challenge from the industrial sector. Learn more about the program on pages 6 and 7.

List of All Industrial Better Climate Challenge Partners and Allies

Organizations with asterisk* are allies



New Challenge and Program Partners

DOE welcomed **18 new partners** in the last year that set ambitious U.S. portfolio-wide energy intensity reduction goals. Eleven partners joined at the program level, while seven partners joined at the Challenge level with the added commitment of publicly sharing their energy efficiency data and solutions to help inform the work of other industrial organizations. Through Better Plants, DOE now works with **more than 270 companies** and **water and wastewater treatment entities**, with organizations in **every U.S. state and territory**.

New Challenge Partners



ABB offers a broad range of solutions for process and hybrid industries.



BorgWarner manufactures mobility solutions for the vehicle market.



Brewery Vivant/Broad Leaf Brewery & Spirits is the world's first LEED-certified commercial microbrewery.



The Chemours Company delivers a wide range of industrial and specialty chemicals products.



Emerson provides a wide range of integrated solutions to manufacturers across the world.



Lear Corporation is a global technology corporation that specializes in Seating and E-Systems.



Trane Technologies manufactures HVAC systems and building management systems and controls.

New Program Partners



Acuity Brands, Inc. designs and manufactures products and services to solve problems in space and light.



Lopez-Dorada Foods supplies beef, pork, and poultry products to some of the largest global restaurant chains and retailers.



Brose North America is a family-owned automotive supplier.



Michael Foods is a manufacturer, processor, and distributor of foodservice, food ingredient, and retail offerings.



DENSO Corporation develops advanced technology and components for vehicles.



Nestlé is a multinational food and drink processing conglomerate. Three of Nestlé's six main businesses, Nestlé Health Science, Gerber Products Company, and Nestlé USA are Better Plants partners.



Entegris is a supplier of advanced materials and process solutions for semiconductors, life sciences, and other high-tech industries.



Phoenix Closures is a family-owned business that supplies closures and packaging.



The Hershey Company is a snack company known for its iconic brands.



Hollingsworth and Vose is a manufacturer of advanced materials used in filtration, battery, and industrial applications.



West Lafayette Water Resource Recovery Facility collects and treats wastewater for the City of West Lafayette, Indiana.

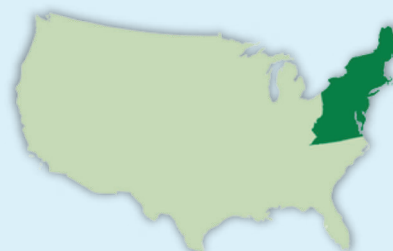
Focusing on Decarbonization: Better Climate Challenge

60 industrial organizations have joined DOE's [Better Climate Challenge](#). This new, national public-private partnership calls on organizations nationwide to set bold, portfolio-wide GHG emissions reduction targets and share their innovative solutions across industries.

Partners pledge to reduce **scope 1 and 2 GHG emissions** across their U.S. plant portfolio by **at least 50% (25% for energy intensive industries) over 10 years** without the use of offsets. DOE will drive progress towards these commitments by providing technical assistance and convening peer exchanges that support pathways to decarbonization while elevating energy efficiency and prioritizing clean energy solutions.

Partnership programs like the Better Climate Challenge are vital to reaching President Biden's goal of a **net-zero emissions economy by 2050** through an equitable clean energy transition.

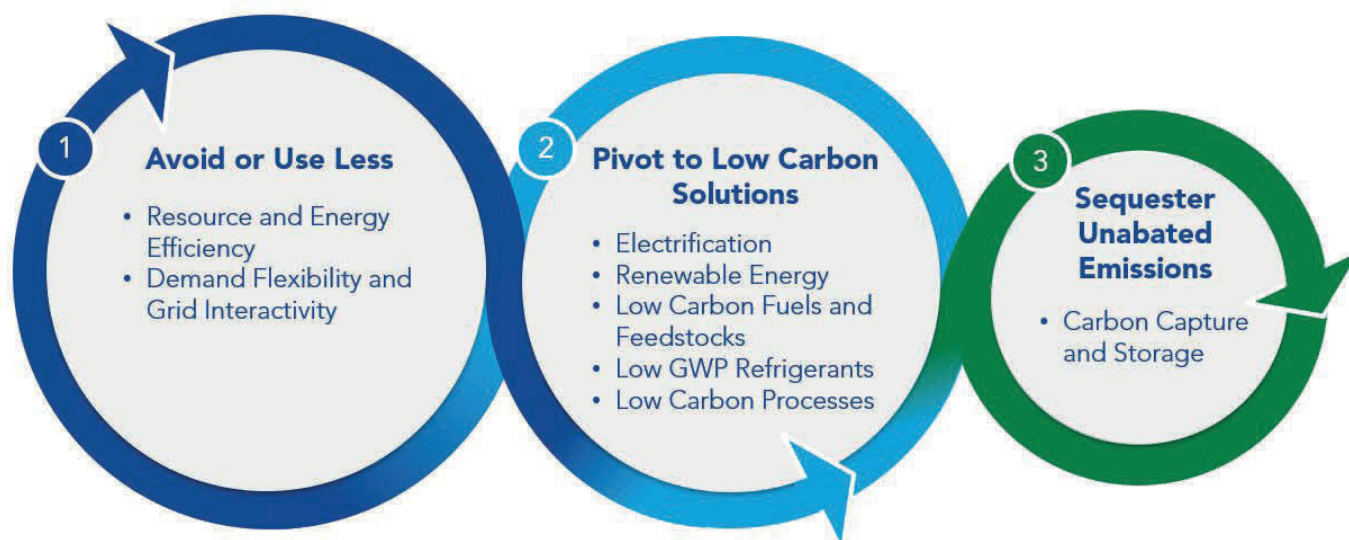
If all industrial organizations reduced their U.S. GHG emissions by **50%**, it would save nearly **970 million metric tons** of CO₂e annually¹, more than the combined annual energy-related emissions from all northeastern and mid-Atlantic states.



¹ U.S. Environmental Protection Agency, 2021. 2019 Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2019, Table ES-7. <https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2020>

Prioritizing GHG Mitigation Activities

DOE encourages partners to lead with energy efficiency when pursuing a decarbonization plan. Energy not used is energy saved, which makes the transition to clean, renewable energy infrastructure easier, saves money by reducing energy costs, and creates jobs.



Above: DOE's suggested prioritization of decarbonization activities, starting with reducing energy efficiency and consumption. Organizations should then address remaining emissions through solutions such as electrification, renewable energy technology, and low carbon processes. Finally, carbon capture and storage technologies can keep persisting emissions from entering the atmosphere.

DOE understands that every organization operates within a different context and has its own priorities and challenges. And so, Better Climate Challenge partners are encouraged to leverage all the tools available through the Better Plants program to develop a decarbonization roadmap that meets their needs. Partners can leverage a decade's worth of industrial energy efficiency solutions and tools developed by Better Plants partners and the DOE, with new **decarbonization-focused tools and resources** being developed and added regularly on the Solution Center's [Decarbonization Resource Hub](#) (see page 13 for more information on these resources).

Focusing on Decarbonization: Better Climate Challenge

Decarbonization Working Groups

Collaboration is a core component of the Better Plants program, as well as the Better Climate Challenge. New Better Climate Challenge partners are participating in working groups with their peers and technical experts to **discuss barriers** and **exchange best practices**. This focus on collaboration fosters a diverse network that benefits all participants. Initially, the DOE invited partners to participate in two industrial-focused working groups on the topics of **portfolio-level GHG emissions reduction** planning and **electrification**. These working groups kicked off in July and will take place every six weeks through May 2023.

These working groups aim to facilitate discussion among Better Climate Challenge partners and garner insights on assessing a portfolio, creating an emissions reduction plan, and implementing the plan, as well as strategies, lessons learned, and cost-benefit trade-offs of electrification. In addition, DOE experts will provide technical support to the working group participants, summarize discussions, and begin developing additional resources identified during these discussions.



Portfolio-Level GHG Emissions Reduction

This group will share insights about assessing a portfolio's emissions, creating a plan, and taking action. Experts will facilitate discussion among partners in a small group environment about the development of actionable plans for GHG emissions reductions of an entire portfolio of plants.



Electrification

This group will explore effective planning techniques and pathways to implement electrification strategies to scale from the plant and equipment-level to entire portfolios, as well as share lessons learned and cost-benefit trade-offs.

Volvo Group North America and DOE Jointly Develop Three Facility Decarbonization Roadmaps

Volvo Group North America, a Better Climate Challenge partner and Low Carbon Pilot participant, has committed to ambitious Science-Based Targets to reduce GHG emissions by **50% by 2030** and reach **net-zero GHG emissions by 2050**. To achieve these goals, the company drafted "Action Plans" for three U.S. facilities with a portfolio of different strategies for energy efficiency, low carbon fuel switching, electrification, and renewable energy purchases. Volvo Group then collaborated with the DOE Industrial Assessment Center at West Virginia University to conduct a detailed analysis of targeted opportunities to **evaluate** and **quantify potential GHG emissions reductions** and properly inform business decisions.



Focusing on Decarbonization: Low Carbon Pilot

Through the [Low Carbon Pilot](#), DOE is working with **30 industrial partners** to explore facility-level pathways for reducing emissions from manufacturing operations and share these approaches with the market. Throughout the past year, Low Carbon Pilot partners have shared the challenges they face in decarbonizing their facilities and the pathways they are leveraging to lower their emissions. Partners also helped DOE identify how to best direct research and development investments towards transformational technologies that will benefit the broader industrial sector.

The knowledge and information shared by Low Carbon Pilot partners were instrumental in the design and implementation of DOE's recently launched Better Climate Challenge, helping DOE establish working groups on portfolio-level emissions reduction planning and electrification. Throughout the following year, Low Carbon Pilot partners will work with DOE to share their knowledge and insights more broadly through the development of decarbonization case studies.

Highlights and Outcomes

- ▶ **30 Industrial Low Carbon Pilot partners** in **15 sectors**
- ▶ **63 facilities**
- ▶ **110+ calls** with Low Carbon Pilot partners to complete Action Plan Tools. During these calls, partners provided insights into challenges and pathways for industrial decarbonization
- ▶ **17 Action Plans** completed, **13** in progress
- ▶ The **Industrial Decarbonization Peer Exchange Series** was established to share expert insights and partner experiences on the most relevant decarbonization topics to industry; **13** hosted to date (pg. 9)
- ▶ **19 Low Carbon Pilot partners** have signed on to the Better Climate Challenge

Low Carbon Tools and Calculators

DOE and Oak Ridge National Lab have developed several tools to help jump-start organizations' journeys toward lower carbon emissions. Partners are encouraged to take advantage of these free tools and calculators to plan projects, calculate carbon emissions, and determine the impact of electrification.

Carbon Inventory Calculator



This calculator lets the user [determine carbon dioxide emissions](#) for given combustion fuel, biofuel refrigerant charge, purchased gases, purchased electricity from the grid. It also helps calculate the emissions from fuel used for transportations. [Click here to access.](#)

Electrification Impact Calculator



Use this calculator to [estimate potential cost and CO₂ emissions savings](#) resulting from changing from fuel-based equipment to electrical equipment (output rates determined by the EPA and Electronic Code of Federal Regulations). [Click here to access.](#)

Low Carbon Action Plan Tool



DOE has developed this Action Plan Tool, which can be used to [think through low carbon strategies and develop low carbon pathways](#) for plants, as well as account for carbon emissions from onsite fuel consumption and purchased energy. [Click here to access.](#)

Zebra Technologies Conducts Comprehensive Climate Scenario Analysis



Low Carbon Pilot partner Zebra Technologies [published the first Low Carbon Pilot solution](#). In collaboration with DOE's Argonne National Lab, Zebra conducted a climate scenario analysis in 2021 using guidance from the Intergovernmental Panel on Climate Change (IPCC) to determine climate risks under the best- and worst-case scenarios for its operations and value chain.

Focusing on Decarbonization: Peer-to-Peer Learning

Industrial Decarbonization Peer Exchange Series

Started under the Low Carbon Pilot, the Industrial Decarbonization Peer Exchange Series now includes Better Climate Challenge partners. Through these calls, industrial Low Carbon Pilot and Better Climate Challenge partners hear from their peers and industry experts on the most pressing and relevant topics to industrial decarbonization. Partner speakers have included representatives from Electrolux and Cummins, and expert speakers have included Amory Lovins and Saul Griffith.



“

Integrative design has immense potential. It probably adds up to at least five-fold for long run global energy productivity. And yet it's not normally recognized, taught, delivered, expected, or rewarded.

— Amory Lovins, Cofounder and Chairman Emeritus (Rocky Mountain Institute)
Industrial Energy Efficiency Peer Exchange, March 2022

To date, organizations and subject matter experts have hosted **13 peer exchanges**, covering the following topics:

- | | |
|--|--|
| <ul style="list-style-type: none"> ▶ Low Carbon Pilot Kick-Off
Thomas Wenning, Program Manager (ORNL) ▶ Carbon Accounting & Reporting
Andrew Cummings, Associate Director, Sustainable Supply Chains (CDP) ▶ Green Bonds
Gordon Smith, Global Sustainability & Reliability Director for Operations (Electrolux) ▶ Off-Site Renewables
James Critchfield, Program Manager, Green Power Partnership (EPA Green Power Partnership & Cummins) ▶ Renewable Natural Gas
Blaine Collison, Executive Director (Renewable Thermal Collaborative)
Tom Moffett, VP, Environmental Product (Element Markets) ▶ Hydrogen
Julio Friedmann, Senior Research Scholar (Center on Global Energy Policy at Columbia University SIPA) ▶ Industrial Electrification
Saul Griffith, Engineer and Inventor (Other Lab and Rewiring America) | <ul style="list-style-type: none"> ▶ CHP & Decarbonization
Bruce Hedman, Managing Director (Entropy Research, LLC) ▶ Industrial Energy Efficiency
Amory Lovins, Cofounder and Chairman Emeritus (Rocky Mountain Institute) ▶ Heat Pumps
Edward Rightor, Director of the Industrial Program (ACEEE)
Paul Scheihing, Principal (50001 Strategies) ▶ Greening of the Grid
Chris Namovicz, Team Leader for Electricity, Coal, and Renewable Modeling (Energy Information Administration)
Tara Narayanan, Senior Associate, North America Power (BloombergNEF) ▶ Carbon Capture and Sequestration
Noah Deich, Deputy Assistant Secretary (DOE, Office of Fossil Energy and Carbon Management) ▶ REC Purchases and Renewable Energy Accounting
Michael Leschke, Director, Certification Programs (Center for Resource Solutions)
Lisa Brunie-McDermott, Corporate Director of EHS and Sustainability (HNI Corporation) |
|--|--|

Highlighting Partners: 2022 Better Project and Practice Winners

The **Better Practice Award** recognizes partners for innovative and industry-leading accomplishments in implementing and promoting practices, principles, and procedures of energy management and for implementing emissions-, energy-, water-, and waste-savings projects.

Winners of both the Better Practice and Better Project (see next page) Awards are recognized at the annual Better Buildings, Better Plants Summit (pg. 12), where they are given an opportunity to present on their achievements to industry peers and stakeholders.



Above: 2022 Better Practice Award winners at this year's Better Buildings, Better Plants Summit.

Here are the 2022 Better Practice award winners:



For developing a corporate Energy Manual—Manual 81—that outlines minimum design requirements for new spaces, processes, and utility systems intended for use by 3M and its approved suppliers, with implemented projects delivering savings of 6,676,000 in MMBtu and 272,000 tons in CO₂.



For creating the Green Bond Framework to finance sustainability projects and improve product energy efficiency, and for the Long-term Incentive Program, which links employee compensation with sustainability and climate-related action.



For expanding an operational upgrade project at a bakery into a series of thirteen energy efficiency projects, resulting in total energy savings of 13,506 MMBtu, \$411,695 in utility incentives, and verified energy cost savings of \$231,103 per year.



For addressing fugitive emissions from the facility's use of refrigerants by replacing CFX heat exchangers with more efficient LCX units, resulting in 1,340 annual metric tons of CO₂ reduction in the first year of implementation.



For successfully incorporating demand response into its water operations and reducing pumping load during peak periods, resulting in an average demand reduction of 7.1 MW per event and 45 tons of CO₂ emissions avoided.



For incorporating training materials and tools from a DOE Steam System In-Plant Training throughout the company's capital project approval process, leading to process changes that resulted in natural gas savings of 132,000 MMBTU and over 7,000 metric tons of CO₂ emissions annually.



For adopting a new method to standardize compressed air leak detection using acoustical imaging technology, resulting in the identification of over 250 leaks, representing over \$600,000 in cost savings and 317 metric tons of CO₂ reduction.



For implementing the Excellent Plant Shutdown approach across five sites and using automated system controls to assist with shutdown/startup performance, improving plant shutdown performance by over 17 MW and 28%.

2022 Better Practice Honorable Mentions



For implementing multiple compressed air projects that address leaks and system-wide efficiency, resulting in 522,300 kWh and \$44,850 in annual savings at one plant.



For adapting the company's lean continuous improvement tools to develop Waste Value Stream Maps for energy and sustainability projects, empowering local teams to use existing continuous improvement tools to identify projects.

Highlighting Partners: 2022 Better Project and Practice Winners

The **Better Project Award** is presented to partners for outstanding accomplishments in implementing industrial decarbonization, energy, water, and waste projects at individual facilities. Better Project Award applications can focus on improvements to industrial systems, the use of new and innovative technology, or resilience and energy security.

Better Plants strives to highlight all Project and Practice applications, regardless of their award status, by converting them into case studies published on the [Better Buildings Solution Center](https://betterbuildingssolutioncenter.energy.gov/better-plants).



Above: 2022 Better Project Award winners at this year's Better Buildings, Better Plants Summit.

Here are the 2022 Better Project award winners:



For installing a solar photovoltaic system of more than 2,600 ground-mounted panels, producing 1.5 million kWh annually and saving 30% of site electricity use, and reducing the site's total carbon footprint by 19%.



For installing a sustainable scrap preheat system that reduced dust in the facility by 73%, annual electricity consumption by 2.25 million kWh, and annual GHG emissions by 14,000 tons.



For developing and implementing an optimization model that provides a facility's operators with real-time recommendations for powerhouse equipment, leading to energy savings of approximately 960,000 MMBtu a year.



For adopting an advanced refrigeration controls platform at a facility to maximize operational efficiency and reduce workload for onsite operators by enabling remote access, reducing annual energy usage by up to 20%.



For improving the efficiency of a facility's water filtration system and recovering, softening, and redistributing a reverse osmosis concentrate, reducing annual incoming water usage by approximately 30 million gallons, or 15%.



For piloting and installing a new recycling technology that grinds and then captures waste gypsum and paper for reuse, reducing annual landfill waste by 15,000 tons and annual costs by over \$384,000.



For utilizing reverse osmosis technology to improve a facility steam system, cutting annual natural gas, water, and chemical use by 3.7%, 11.1%, and 43.3%, respectively.



For replacing all of a site's 102 gasoline vehicles with an all-electric fleet of 84 vehicles, resulting in \$88,000 in annual gasoline savings and annual avoided CO₂ emissions of approximately 94 tons.



For upgrading and then optimizing a facility's compressed air system, increasing energy efficiency by 13.5% and reducing annual energy usage by 18,000 MMBtu and water usage by 13 million gallons of water.

2022 Better Project Honorable Mention



Container Technologies

For implementing a series of efficiency projects across the company, including a chiller upgrade project, compressed air leak audits at every plant, and monthly audits at all plants to ensure recycling of material resin and production floor waste.

Highlighting Partners: 2022 Better Buildings, Better Plants Summit

After two years of meeting virtually, partners, industry experts, and other stakeholders attended the [2022 Better Buildings, Better Plants Summit](#). **More than 670 attendees** came together to participate in insightful learning sessions, sector meetups, networking events, interactive workshops, and engaging panels—all of which aided in strengthening their respective organizations' paths toward carbon, energy, water, and waste reduction.

Keynote Summit Speakers

Jennifer M. Granholm, *Secretary, U.S. Department of Energy*

Gina McCarthy, *White House National Climate Advisor*

“**This Summit is one reason I’m optimistic . . . I see the power of the folks out there like you who are . . . not sitting on the sidelines, [but] getting into the game. I see real change happening.**

— Gina McCarthy
2022 Better Buildings, Better Plants Opening Plenary



Industrial organizations and partners were able to network, share, and learn from each other during these sessions:

▶ **Industrial Sector Meet-up**

Better Plants partners and stakeholders came together to discuss energy efficiency and decarbonization challenges and solutions, learn about new tools and resources, and highlight partner achievements.

▶ **Best of the Betters – 2022 Better Project and Better Practice Presentations**

2022 Better Project and Better Practice Award-winners (pp. 10-11) spoke about their exciting, innovative, and impactful practices and projects.

▶ **Choose Your Own Solution: Can You Decarbonize This Industrial Facility?**

Two teams competed against one another to reduce a manufacturing facility's scope 1 and 2 emissions, while staying within their budget during this interactive simulation.

▶ **Industrial Decarbonization Round Robin**

Attendees rotated through targeted focus groups highlighting various decarbonization solutions to identify opportunities to reduce emissions at their facilities.

▶ **Challenge the Champions: An Energy Management Face-Off**

In a Family Feud-style game show, experienced veterans of energy management went against upstart newcomers to answer questions in front of a “live studio audience.”



Top: Choose Your Own Solution session attendees working together to decarbonize a hypothetical industrial facility.

Bottom: Challenge the Champions participants competing in a Family Feud-style game.

Tools and Technical Expertise: Updated Software and Tools

The DOE Advanced Manufacturing Office (AMO) provides a wide variety of tools to increase efficiency at both the plant-level and within specific systems. Categories of tools and calculators focus on **energy management**, **energy systems analysis**, and **carbon, water, and waste management**.

These tools and more can be accessed by visiting the Solution Center's [Software Tools](#) and [Setting Carbon Goals and Tracking Progress](#) pages, and by clicking the links below.

Energy Management & Systems

- ▶ [MEASUR](#)
- ▶ [VERIFI](#)
- ▶ [Compressed Air Scoping Tool](#)
- ▶ [50001 Ready Navigator](#)
- ▶ [Energy Footprint Tool](#)
- ▶ [Implementation Guidance Toolkit](#)
- ▶ [Plant Energy Profiler](#)

Carbon, Water, & Waste

- ▶ [Carbon Emissions Calculator](#)
- ▶ [Electrification Impact Calculator](#)
- ▶ [Waste-to-Energy Calculator](#)
- ▶ [Plant Water Profiler](#)
- ▶ [Plant Carbon Footprint & Decarbonization Assessment Tool](#)

MEASUR - Manufacturing Energy Assessment Software for Utility Reduction



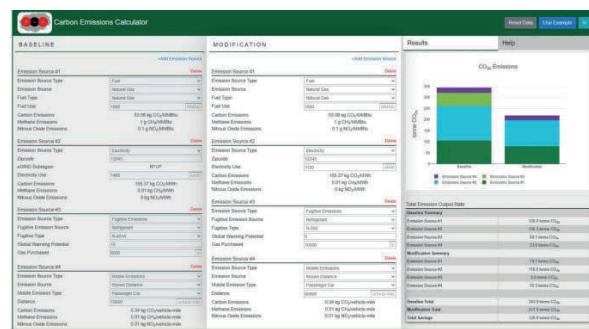
[MEASUR](#) is an open-source software suite to help users understand the energy use and potential savings opportunities for their industrial and commercial equipment. MEASUR includes **7 energy system assessment modules**, a Motor Inventory module, a Data Exploration module, as well as **72 standalone calculators** for quick estimates. MEASUR is designed for industrial plant managers, engineers, and personnel who are interested in improving system efficiency and measuring potential savings opportunities in dollars, energy savings, and GHG emissions.

VERIFI - Visualizing Energy Reporting Information and Financial Implications

The new [VERIFI tool](#) incorporates and expands on several existing DOE tools used for plant and corporate-level energy analysis, including EnPI, EnPI Lite, Energy Footprint Tool, Plant Energy Profiler, and Plant Water Profiler. The tool is currently being updated with new features and uses an **open-source framework** that is harmonized with the MEASUR tool suite. VERIFI is intended to be used by industrial energy coordinators, plant managers, engineers, and personnel who are interested in tracking and increasing their understanding of their energy and water use and carbon emissions (via regression, correlation, or savings analyses).

Carbon Emissions Calculator

The [Carbon Emissions Calculator](#) lets the user determine carbon dioxide (CO₂) emissions for given combustion fuel, biofuel, refrigerant charge, purchased gases, and purchased electricity from the grid. It also helps calculate the emissions associated with fuel used for transportation.



Tools and Technical Expertise: Diagnostic Equipment Program

Diagnostic Equipment Program

The Better Plants [Diagnostic Equipment Program](#) (DEP) continues to provide value to partners as a standalone program offering, as well as an opportunity to participate in industrial, system-specific technical assistance and training events. **23 different tools** can be used to collect energy data to help improve system performance in partner facilities and identify savings opportunities. Once energy-saving opportunities are identified and implemented, tools can be used again to confirm predicted savings and periodically check system operations.

PRESSURE TRANSDUCER

Converts pressure from compressed air and pumping systems into an analog electrical signal for recording, with the use of a data logger.

Why it matters:

Characterizing a compressed air system using pressure transducers and data loggers provides valuable insight into system performance over time. These instruments help identify imbalances between compressed air supply and demand, which enables users to identify and implement energy saving opportunities.

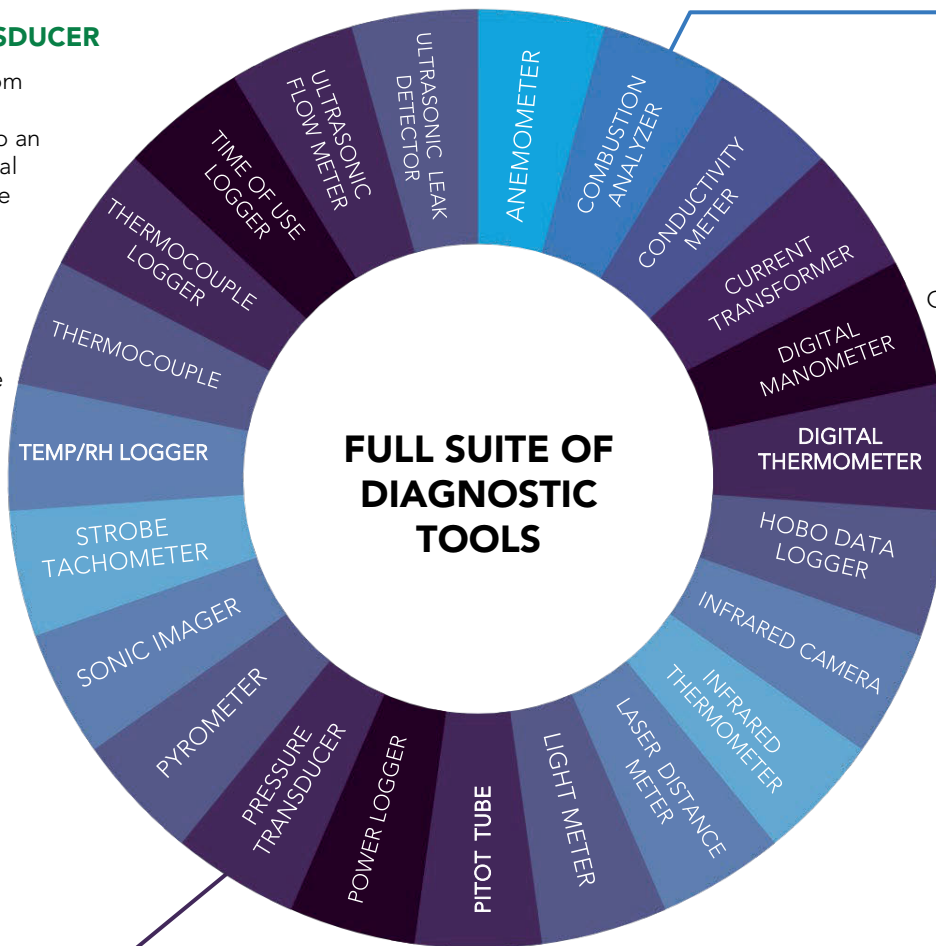


COMBUSTION ANALYZER

Quantifies excess oxygen in boiler/combustion process exhaust.

Why it matters:

When more air is present than is needed during boiler and combustion processes, heat is absorbed and exhausted. Quantifying excess oxygen helps reduce payment for heated air that is not being used.



DEP – Partner Success Story

OZINGA

Better Plants partner Ozinga Brothers, Inc. used data loggers available through DEP to monitor motor and air compressor utilization, run times, and compressed air demands, which allowed the facilities to collect data on how much time equipment ran in unloaded scenarios versus loaded scenarios. Ozinga started by establishing data logging procedures for their highest horsepower rated equipment and created a cost-per hour rating for each compressor. As a result of collecting and analyzing these data points, Ozinga is now able to better identify and quantify energy saving opportunities in their facilities. [More information on Ozinga's Data Logger Project can be accessed by clicking here.](#)

Tools and Technical Expertise: New Guidance Documents

Renewable Energy Guidance for Industry

The [Renewable Energy Guidance for Industry](#) is intended to help partners navigate the renewable energy market by providing background on specific technologies and the benefits and purchasing options available to organizations. This guidance provides helpful information on adopting renewables by highlighting tools and resources for evaluating renewable energy projects. It also provides information on how Better Plants reporting requirements account for renewable energy resources.



Demand Response in Industrial Facilities: Peak Electric Demand



Demand response (DR) is a consumer's ability to reduce their energy consumption when the wholesale cost of electricity in their area is high, or the reliability of the grid is at risk. This [Demand Response in Industrial Facilities: Peak Electric Demand](#) document summarizes the different types of time-varying rates utility companies offer their customers, how a DR management program can be set up in a typical manufacturing facility, and examples of how some Better Plant Partners are taking part in utility DR programs to save money on their utility bills.

Better Plants Implementation Guidance

To better assist companies with organizing and implementing their energy efficiency projects, DOE has developed a set of essential tools and materials, collectively known as the [Implementation Guidance Toolkit](#), to help manufacturers develop projects and communicate their successes. This toolkit provides corporate energy managers with the necessary tools to plan projects, track progress, and communicate their accomplishments once projects have been completed.

Business Information		Energy Conversion Factors	
Business	Product 1	1	MMBtu = 1,000,000 Btu
Locations	Plant 1, Plant 2, Plant 3	1	GI = 0.04786259 MMBtu
Annual Reduction Target	2.5 %	1	MMBtu = 1.055056 MJ
Energy Baseline Information		1	MMBtu = 1,000 MJ
Baseline Production (Unit)	35,000 Units	1	MMBtu = 1 decal Therm
Baseline Energy (Total)	70,000,000 MMBtu	1	MMBtu = 293.071 kWh
Baseline Energy Intensity	2,000.0 MMBtu/Units	1	MMBtu = 0.293071 MWh
Annual Energy Consumption (Site) Totals		1	MWh = 3.412 MMBtu
Electricity	10,000,000 kWh		
Natural Gas	46,000,000 MMBtu		
Coal	300,000 MMBtu		
Propane	0 MMBtu		
Fuel Oil	0 MMBtu		
Purchased Steam	3,665,870 MMBtu		
Totals	69,999,999.7 MMBtu		
Annual Energy Reduction (Site) Totals from Projects			
Electricity	250,000 kWh		
Natural Gas	1,650,000 MMBtu		
Coal	7,500 MMBtu		
Propane	0 MMBtu		
Fuel Oil	0 MMBtu		
Purchased Steam	91,647 MMBtu		
Totals	1,750,000.0 MMBtu		

Above: One of the tools of the Implementation Guidance Toolkit, the Gap Analysis Tool, identifies gaps in energy management actions, i.e., identified reduction targets and identified / implemented projects.

Tools and Technical Expertise: Waste Reduction Network

Following the success of the Waste Reduction Pilot, the new [Waste Reduction Network](#) is a permanent initiative open to Better Plants, Better Buildings, and Better Climate Challenge partners. Using the feedback collected during the pilot from almost 30 Better Plants partners, the Waste Reduction Network embarked on a programmatic and technical development strategy based on three key elements: **energy recovery**, **circularity**, and **knowledge-sharing**. This strategy involves growing the initiative with new participants and new resources that are related to these elements.

Partners can now join with whichever corporate waste reduction goals they have set for themselves, selecting at least one of the goal categories: Diversion, Absolute, Zero Waste, Intensity, Waste-to-Energy, or Circularity. DOE will provide **technical assistance**, **recognition**, and **access to innovation** in recycling and other waste remediation measures.



Above: Since the pilot was converted to an initiative, two Better Plants Challenge and one Better Climate Challenge partner, Celanese, and Bendix respectively, have joined the Waste Reduction Network.

Waste-to-Energy

Based on the link between waste and energy, a waste-to-energy [spreadsheet calculator](#) has been designed and is available for all partners to download. The tool evaluates the **potential for energy recovery** from applicable waste streams and the impact on site energy consumption, as well as evaluates on- and off-site GHG impacts of the energy recovered. Energy-related content and resources will continue to be developed in accordance with the Waste Reduction Network.

Circularity

Additionally, the pilot found that many companies want to include circularity, or using recyclable materials to make products that can be easily broken down and **reused at the end of life**, within their product lifecycles. Accordingly, DOE will work with various AMO Consortia such as the REMADE and RAPID institutes to identify innovative technologies, materials, and best practices that can facilitate implementation of circularity within corporate waste reduction goals.

Knowledge-Sharing

DOE is working to create **knowledge-sharing platforms** as part of the Waste Reduction Network. Quarterly interactive webinars—which highlight best practices from waste experts, organizations, and partners—featured during the Waste Reduction Pilot, will continue during the Waste Reduction Network. Additionally, the Waste Reduction Network will create working groups on various waste-related topics.

For more information, please visit the [Waste Reduction Network](#) page on the Better Buildings Solution Center or contact a [TAM](#).

Tools and Technical Expertise: Water Savings Network

Water resource management is a growing interest for manufacturers to reduce costs and environmental impact while managing risk. Manufacturing subsectors may face production-altering water shortages in the future as the population grows, demand for water increases, and climate change worsens droughts and alters watersheds. As manufacturers recognize that the nexus between energy and water is profound, more organizations are expanding their sustainability efforts to include water efficiency and conservation. Through the Better Buildings, Better Plants [Water Savings Network](#) (WSN), DOE brings organizations together to discuss and demonstrate successful approaches to conserving water in buildings, plants, and multifamily housing.

Plant Water Profiler

DOE's [Plant Water Profiler Tool](#) (PWPEX) breaks down total plant water intake, wastewater disposal, and quantifies the "true cost" of water by individual systems in the plant. It identifies systems that contribute the most toward source water intake versus true cost and enables efforts to prioritize water efficiency measures. Results can also be used to establish a baseline and track future water use.

Better Buildings, Better Plants Summit



Above: Session attendees break out and discuss water savings priorities, barriers, best practices, and offer technical guidance.

During the 2022 Better Buildings, Better Plants Summit, the session **"There Must Be Something in The Water: Lessons Learned from Water Savings Projects and Practices"** featured WSN and Better Plants partners. The interactive session included presentations from Boardman Foods, Erie Veterans Affairs Medical Center, CBRE, and The Water Research Foundation. Partners presented on their water success stories before breaking out into a poster session, where they discussed priorities, barriers, best practices, and technical guidance with presenters and their peers. Technical experts from ORNL were also available at the Better Buildings, Better Plants Summit to discuss specific partner challenges one-on-one regarding water efficiency during **"Ask an Expert"** sessions.

Peer Exchanges

The WSN also facilitated a peer exchange in April on the **Energy-Water Nexus**. Ron Burke, President and CEO of [The Alliance for Water Efficiency](#), presented on the call. As a stakeholder-based nonprofit organization dedicated to the efficient and sustainable use of water, the Alliance for Water Efficiency serves as an advocate for water-efficient programs and provides information and assistance on water conservation efforts. The peer exchange provided insights and real-world experiences in response to water-related challenges.



Technology Innovation: Industrial Technology Validation Pilot

As Better Plants partners across the country set ambitious GHG emissions, energy, water, and waste reduction goals, emerging technologies can be integral to achieving them. However, the risks involved in installing and objectively validating performance in high-stakes industrial environments can often impede adoption.

DOE and National Labs offer the [Industrial Technology Validation Pilot](#) (ITV), which validates performance in dynamic industrial environments, in order to overcome the risks inherent in adopting emerging technologies. The results will help Better Plants partners understand the viability of a solution while mitigating many of the risks associated with being the first to install an emerging technology.



“ As part of this ITV pilot, DOE provided an independent and unique perspective on our existing water treatment system. The technology being tested and the pilot program design encouraged us to think deeply about ways to improve our process flow and system operations.

— Katlyn Stepansky, Manager - Utilities and Energy Conservation
Cleveland-Cliffs Inc.

During **Phase I of the pilot**, the following selected DOE Better Plants partners evaluated innovative energy efficiency and water-treatment technologies in their facilities:

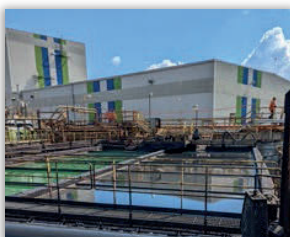


ITV Launches Phase II of Pilot

With applications currently under review, this second phase of the pilot will validate emerging technologies that can cost-effectively **advance decarbonization** of American industry and meet the following criteria:

- ▶ Reduce GHG emissions, energy use, water use, and/or waste creation
- ▶ Involve pre- or early-commercial technology or commercial technology in a new use case
- ▶ Have broad deployment applicability, but not widely used or accepted

For each technology, a team of experts led by DOE's Advanced Manufacturing Office and Lawrence Berkeley National Laboratory will develop a measurement and verification plan, conduct on-site data collection and testing, analyze performance, and draft a field-validation report. These **reports will be made publicly available** to help inform future initiatives in industrial decarbonization and energy, water, and waste conservation.



Left: Nissan Engineering and Operations team members after Side-Stream Precipitator and Water Enhancement device installation; **Center Photos:** Cleveland Cliffs Primary Tanks 121 and 122 Waste Water Treatment and Dynamic Water Technology's DSR Reactor to be installed; **Right:** The Via Separations team following the setup of the Black Liquor Concentration System at the Ahlstrom-Munksjo Mosinee mill.

Providing Technology Innovation: National Labs

The DOE's **17 National Laboratories** form a nationwide network that is working to solve some of the world's greatest scientific challenges. The National Labs conduct research and development that address DOE's core missions in **energy, science, national security, and environmental stewardship**. They address large scale, complex research and development challenges with a multidisciplinary approach that places an emphasis on translating basic science to innovation.

Manufacturers who partner with DOE through the Better Plants Program can leverage many of the tools and resources that DOE has to offer, whether through the annual Technology Days with the National Labs or their own private partnerships. Additionally, Technical Account Managers (TAMs) regularly facilitate meetings for Better Plants partners with lab experts to explore areas of collaboration.

Technology Days at Argonne National Lab



For more than 20 years, researchers at Argonne have led major research efforts and developed tools and methodologies to support local, state, and federal sponsors in enhancing the security and resilience of the nation's critical infrastructure in the face of natural and manmade disasters. This year, Argonne

is hosting [Technology Days](#), aiming to expose Better Plants partners to the various early-stage technologies best positioned to enable American industrial competitiveness and innovation. Some of the core capabilities at Argonne include Sustainable Transportation – Engines and Fuels; Powertrain Systems Modeling and Controls; Tribology, Anti-Wear Coatings and Lubricants; Materials and Systems Engineering Solutions; and Additive Manufacturing and Novel Processing.

At Technology Days, industrial energy and R&D staff have the unique opportunity to:

- ▶ **TOUR** state-of-the-art facilities at National Labs
- ▶ **VIEW** first-hand demonstrations of innovative technologies under development
- ▶ **HEAR** from experts from the Lab and industry
- ▶ **LEARN** how to easily leverage research and technologies through lab-industry partnerships
- ▶ **NETWORK** with lab technologists and other Better Plants partners and thought leaders from the industrial sector

National Lab Innovation Portal

Better Plants has created an online [National Lab Innovation Portal](#) on the Better Buildings Solution Center to make it easier to learn about the opportunities for public/private partnerships in research and testing, how to tour and use the labs, and set up a partnership.

These research centers tackle the most critical scientific challenges of our time and possess unique instruments and capabilities—many of which are found nowhere else in the world. Through the National Labs' user facilities, independent groups can also take advantage of specialized equipment and expertise to advance private projects.

Right: Photos from the last in-person Technology Day in 2019, hosted by Lawrence Livermore National Lab (LLNL) and Lawrence Berkeley National Lab (LBNL).



Workforce Development: Preparing Industrial Workers of the Future

Broadening the Impact of Virtual In-Plant Trainings

In the past year, manufacturers were trying to determine how to safely open and operate their manufacturing plants amidst a global pandemic. To address this challenge, Better Plants began conducting [Virtual In-Plant Trainings](#) (VINPLT) to enable remote workforce learning and development.

VINPLTs are multi-day workshops performed by industry-recognized experts. They **train attendees** to identify energy conservation opportunities, **quantify savings** from those opportunities, and **implement projects** to realize energy and cost savings. Since the last Better Plants progress update, VINPLT topics have included compressed air, industrial water efficiency, motor systems, process cooling, 50001 Ready energy management systems, and wastewater.



Above: A screenshot from an Industrial Water Efficiency VINPLT with the Plenco team.



“ I am sincerely grateful for the process knowledge you have offered in eight weeks of passionate, thorough training. I have a lot of learning to do on the fundamentals behind wastewater treatment and my organization’s plant processes, yet I am walking away from this training with a couple key things:

1. Contextualizing the mission of energy management within the broader perspective of a wastewater treatment plant’s (WWTP’s) objective.
2. More practice with back-of-the-envelope energy calculations for plant kWh/MG treated KPI and unit process
3. The control variables that actually matter and can impact energy efficiency in WWTP unit processes. Understanding there is a fundamental difference between response and control variables.
4. The science behind several key energy-consuming unit processes in WWTPs.

I will need some practice and a lot of repetition of this material to really gain a functional mastery of it and put it to work, but this was (in my eyes) time well spent engaging with you all. Thank you all for your time and talents!

— Nicholas Brandt, Energy Engineering Technician
City of Fort Wayne - City Utilities

VINPLTs by the Numbers*



7

VINPLTs



\$400 million+

energy cost savings
opportunities identified



500

trained workers

*since last Progress Report

Workforce Development: Preparing Industrial Workers of the Future

Returning to In-Plant Trainings, In-Person

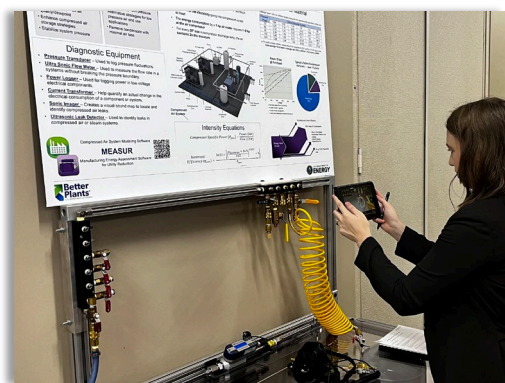
In July 2022, DOE released applications for physical, [in-person In-Plant Trainings](#) – the first cohort after a hiatus of more than two years. To ensure that the trainings have the broadest and most significant impact possible, applications will now factor whether they are held at partner sites located in historically disadvantaged communities. The scoring weight of information sharing, willingness to allow outside visitors, and willingness to perform an exchange with another company (in the case of the treasure hunts topic) have also all been increased to encourage more partners to share results with their industry peers.

Energy Bootcamp at Oak Ridge Laboratory

In August 2022, **over 70 attendees** gathered at Oak Ridge National Laboratory (ORNL) in Oak Ridge, Tennessee for the inaugural Better Plants Energy Bootcamp. The three-day workshop, with extensive hands-on activities, was created to educate attendees on the key aspects of energy efficiency and fundamentals of energy management. The course covered **energy management, process heating, steam, compressed air**, and other **motor-driven systems**, along with an introduction to **alternative energy options**. Finally, attendees learned how to use diagnostic equipment along with DOE's free software tools for identifying energy savings opportunities and quantifying cost savings. The bootcamp was designed to give participants immediate energy efficiency solutions to begin decarbonizing now. Specifically, participants learned:

- ▶ Fundamental principles and concepts of common industrial energy systems
- ▶ How to identify opportunities in major energy systems
- ▶ How energy impacts carbon and how to develop a decarbonization roadmap
- ▶ How to use diagnostic equipment to take energy measurements
- ▶ How to access and utilize DOE's free energy management/assessment software tools
- ▶ The components needed to establish a world-class energy management system

During an optional fourth day, participants had the opportunity to tour various ORNL facilities, including: ORNL's Supercomputer, the Graphite Reactor, and the Manufacturing Demonstration Facility, which houses some of world's premier 3D printing capabilities.



Above: Attendees of the inaugural Better Plants Energy Bootcamp partaking in hands-on equipment testing and learning sessions.

Complementary Programs: 50001 Ready and SEP

50001 Ready

DOE's [50001 Ready program](#) 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.

DOE has recognized over **29 Better Plants partner sites** this year and associated companies for completing the 25 steps of the 50001 Ready Navigator. Each site has implemented an energy management system aligned to the globally recognized ISO 50001 energy management system standard. An additional **57 non-Better Plants industrial sites and non-industrial partners** have also completed the steps necessary to become 50001 Ready.



34%



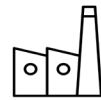
Growth of US users in FY22

31%



Growth of US projects in FY22

35



Better Plants partners engaged

Updates to the 50001 Ready Navigator

Decarbonization Management Guidance: The [50001 Ready Navigator](#) now offers tailored guidance designed to help organizations comprehensively manage energy-related GHG emissions through an energy management system, focusing on managing **scope 1 and 2** emissions:

- ▶ Align internal systems and processes
- ▶ Improve quality and rigor of data to be shared externally
- ▶ Create a culture for continual improvement of energy and GHG emissions performance
- ▶ Develop a data collection, analysis, and reporting process
- ▶ Establish a systematic approach to managing and reducing energy-related GHG emissions

Virtual Cohorts: The cohort program includes six to twelve months of support from ISO 50001 experts delivered via monthly cohort group training webinars, virtual one-on-one coaching sessions, on-demand guidance on the use of 50001 Ready tools and resources, and opportunities for peer-to-peer learning. Please send an email to the Help Desk, 50001Ready@lbl.gov to learn more about the technical assistance available and how to join.

SEP 50001

Facilities or organizations that achieve sustained excellence using their energy management systems (EnMS) may get certified to the **Superior Energy Performance 50001™** (SEP 50001™) program and achieve elevated levels of DOE recognition. Better Plants partners **3M, AstraZeneca, Cummins Inc., Nissan, Schneider Electric, and Volvo** were all recertified to the SEP 50001 program. 3M and Volvo each demonstrated leadership by achieving verified improvements in energy performance across multiple sites. **56 facilities** are currently certified, and **37 facilities** are recognized at elevated levels.



Complementary Programs: Industrial Assessment Centers

Industrial Assessment Centers

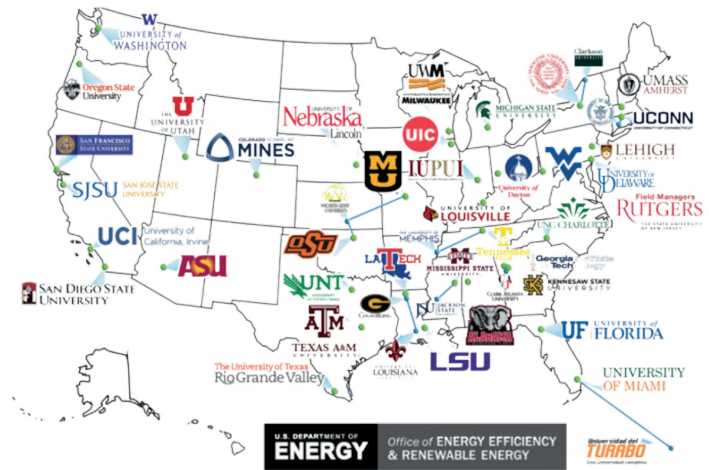
DOE [Industrial Assessment Centers](#) (IACs) help small and medium-sized U.S. manufacturers save energy, improve productivity, and reduce waste by providing no-cost energy assessments conducted by university-based teams of engineering students and faculty, **conducting more than 20 assessments** for Better Plants partner facilities in 2022. This year, funding from President Biden's **Bipartisan Infrastructure Law** added five new universities, creating the largest-ever cohort of **37 IACs**, each focused on improving productivity, enhancing cybersecurity, promoting decarbonization and resiliency planning, and providing training to manufacturers in underserved communities. The new IACs added in 2022 are Georgia Institute of Technology, San Jose State University, University of Delaware, University of North Texas, and San Diego State University.



The Bipartisan Infrastructure Law

The Bipartisan Infrastructure Law provides more than half a billion dollars in additional funding for the IAC program over the next five years to allow the program to:

- ▶ Establish Centers of Excellence to mentor, assist, and coordinate across the IAC network and with regional, state, local, tribal, and utility energy efficiency programs.
- ▶ Expand the IAC program at community colleges, technical schools, and union training programs.
- ▶ Create workforce training programs, including internships and apprenticeships, to train students and members of the manufacturing workforce through experiences with industries, manufacturers, energy service providers, and the IACs.
- ▶ Promote R&D for alternative energy sources in energy intensive industries.
- ▶ Institute a \$400 million grant program for manufacturers to implement projects recommended by IACs or other assessors.



Above: The map above highlights the 37 schools across the country that currently participate in the IAC Program.



The **Women for Energy Efficiency (WE²)** network is an initiative created to enhance the experience of women and non-binary students in the IAC program to increase and maintain gender diversity in the larger energy and engineering industry, for which the IAC program acts as workforce development.

As part of the IAC's WE² initiative, the University of Utah IAC created the first all-female assessment team, with six female students, one female alumna, one female professor, and one female professional from **multidisciplinary** and **diverse backgrounds**. Autoliv, an automotive safety company that designs and manufactures airbags, seatbelts, and electronic systems, requested an assessment of their location in Brigham City, Utah after a successful assessment of their Tremonton site. The assessment team identified six recommendations with four additional considerations resulting in an estimated **\$170,000** in electricity and natural gas savings with an average **payback period of less than 3 years**.



Left: Members of the University of Utah's IAC's Women for Energy Efficiency team.

Complementary Programs: Combined Heat and Power

CHP Deployment Program

Combined heat and power (CHP), also known as cogeneration, helps manufacturers and wastewater treatment plants (WWTP) lower operating costs and reduce carbon emissions while offering fuel flexibility, improved reliability, and energy resilience. CHP is an efficient technology that generates electricity and uses the thermal energy that is otherwise wasted as heat to provide steam or hot water, achieving overall efficiencies of **up to 80%**. Better Plants partners have access to a **range of no-cost CHP resources** provided by DOE's ten [CHP Technical Assistance Partnerships](#) as well as the [Better Buildings Solution Center](#).



Wastewater Treatment Plants

Both the ability to produce a renewable fuel onsite and their continuous demand for heat and power make wastewater treatment plants (WWTP) ideal candidates for CHP. The following Better Plants partners have harnessed CHP at WWTPs to move towards their energy goals.

St. Petersburg Southwest Water Reclamation Facility (SWWRF)



St. Petersburg Southwest Water Reclamation Facility (SWWRF) improved its energy intensity by 14% last year, using their CHP system installed in 2020. The system helps St. Petersburg progress towards its Better Plants energy intensity goal by significantly reducing source energy use and generating much of the electricity needed using biogas produced on-site. A digester project, installed in 2019 allows the site to consolidate solids from 2 other plants, boosting biogas production while using the CHP thermal energy. During an 8-month period in 2021, CHP reduced average plant electricity use by **65% reduction in grid electricity**. Planning is underway to sustain unit operation, to realize the long-term benefits that were envisioned when the system was approved.

City of Grand Rapids Water Resource Recovery (WWRF)



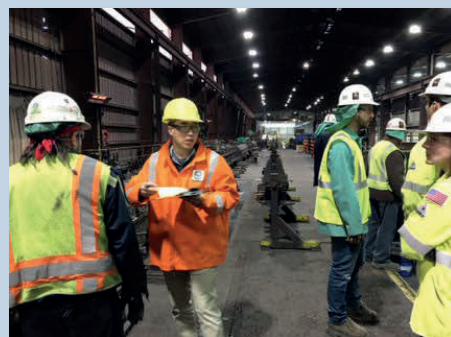
In 2021, Better Plants partner **City of Grand Rapids Water Resource Recovery Facility** completed installation of a CHP system including two 1.4 MW Jenbacher engines, heat recovery equipment, and a gas treatment system. The Grand Rapids team identified a growing need to process highly concentrated food waste, finding that using a digester to process the waste was the most effective option. The CHP system heats the digester, and the biogas from the digester is cleaned to make renewable natural gas which is sold to the gas utility. Natural gas is used to produce electricity in the CHP system as well as provide recovered heat for the digesters. The CHP system provides about **two thirds of facility electricity use**, as well as enhances resiliency as it can operate in island mode during grid outages.

Other CHP and WWTP Resources

- ▶ [CHP Installation Database](#) identifies over 4,700 sites including 227 WWTPs that have CHP systems.
- ▶ [CHP Market Sector: Wastewater Treatment Plants Fact Sheet](#) explains the relationship between CHP and WWTPs.
- ▶ [CHP Project Profiles Database](#) is a searchable database of more than 200 CHP Project Profiles.
- ▶ [CHP eCatalog](#) is an open source, web-based system that is designed to increase the deployment of CHP by providing tools for users to learn about, select, and compare packaged CHP systems.

Looking Ahead

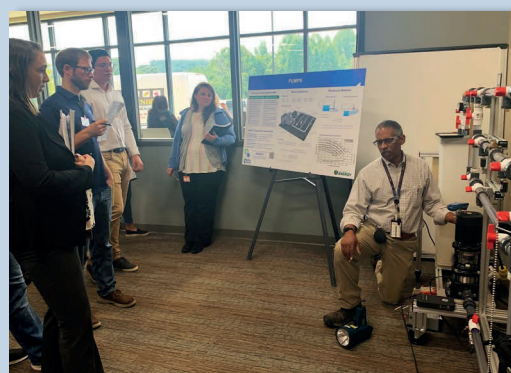
Over the past year, Better Plants partners continued to lead their peers in reducing energy, emissions, water, and waste in their facilities. With the continual publication of [Showcase Projects](#) and [Implementation Models](#) on the Solution Center—covering topics like data-driven approaches, streamlining operations, and energy performance contracting—partners are not just striving for sustainability in their own organizations, they are freely sharing solutions that move the needle across the industrial sector. Their leadership is indispensable as the U.S. faces the challenges of decarbonizing the industrial sector and developing the manufacturing workforce of the future.



DOE and its partners recognize the urgency of the climate crisis, which is already negatively affecting partners' operations. The newly launched **Better Climate Challenge** is an opportunity to support organizations' ambitious commitments to reducing their GHG emissions through technical assistance, collaborative learning, and recognition. As the program grows and partners publicly share their successes and barriers through rich peer exchange and technical support, their experiences will also help to inform research and development opportunities, which will translate to replicable solutions and contribute to a **net-zero emissions economy by 2050**.

Even as DOE expands its focus on decarbonization via the Better Climate Challenge, it will continue prioritizing **energy efficiency and clean energy solutions** through Better Plants, as they remain some of the most effective ways to reduce emissions. DOE intends to expand the reach of its programs into sectors that have previously been underrepresented in Better Plants, including energy-intensive industries and small-medium manufacturers, to ensure all facets of U.S. manufacturing are collectively progressing towards a clean energy future.

A crucial element of the clean energy transition is developing a **skilled workforce** to support manufacturers as they retool their processes to eliminate emissions—and as they build the components to facilitate decarbonization in other sectors of the economy. In this effort, DOE intends to expand on existing Better Plants workforce development opportunities, including onsite technical support in the form of In-Plant Trainings, multi-day “bootcamps” focused on energy and emissions reduction, and an expanded slate of virtual trainings.



Through these initiatives and more, DOE will continue to collaborate with and support **over 270 industrial partners** as they work towards an energy efficient, resilient, economically competitive, and low-carbon manufacturing sector.

Partners as of September 2022

3M*	Celanese Corporation*	DureX, Inc.	Graphic Packaging*
ABB	Chapco, Inc.	E&L Construction Group	HARBEC*
AbbVie Inc.	Charleston Water System	EARTH ₂ O	<u>Harley-Davidson Motor Company</u>
Acuity Brands, Inc.	Charter Steel*	East Penn Manufacturing Company	Harrison Steel Castings Co.
Agropur	The Chemours Company	<u>Eastman Chemical Company</u>	The Harva Company
Ahlstrom-Munksjo	Chippewa Valley Ethanol Company	Eaton Corporation*	Haynes International
Alcoa Corporation	Citrus World, Inc.	Eck Industries	The Hershey Company
Alexandria Renew Enterprises	City of Fort Wayne – City Utilities	Electrolux	<u>Hewlett Packard Enterprise</u>
Alumalloy Metalcasting Company*	City of Grand Rapids Water Resource Recovery Facility	Emerson	<u>HNI Corporation</u>
Amcort Rigid Plastics	City of Phoenix Water Services Department	Encina Wastewater Authority*	Holcim (US), Inc.*
American MITSUBA Corp.	City of Roseville, Environmental Utilities Department	EnerSys	Hollingsworth and Vose
Archer Daniels Midland	Clearwater Engineering, Inc.	Entegris	Honda North America
Armstrong Flooring	<u>Cleveland-Cliffs Inc.</u>	The Estée Lauder Companies	<u>Honeywell</u>
Asama Coldwater Manufacturing	Co-Operative Industries Aerospace and Defense	Flambeau River Papers	Huntsman Corporation
<u>AstraZeneca*</u>	Coca-Cola Consolidated	FLEXCO Corporation	IAC Group
AT&T*	Coilplus, Inc.	Flowers Foods, Inc.	Imerys Carbonates North America
Autodie, LLC	<u>Colgate-Palmolive</u>	FMC Corporation	Ingersoll Rand*
Autoliv, Inc.	Comau*	Ford Motor Company*	Ingevity*
Avon Lake Regional Water	Commercial Metals Company	GB Manufacturing	Intel
Ball Corporation	Commercial Vehicle Group, Inc.	<u>Genentech Inc.</u>	<u>International Paper</u>
BD	Connector Castings, Inc.	General Aluminum Manufacturing Company	Intertape Polymer Group Inc.*
<u>Bendix Commercial Vehicle Systems</u>	Cooper Standard	General Dynamics Ordnance and Tactical Systems Scranton Operation*	Intralox
Bentley Mills*	Cummins Inc.*~	General Electric	Isringhausen, Inc (ISRI)
Boardman Foods	Custom Glass Solutions	General Mills*	Ithaca Area Wastewater Treatment Facility
<u>BorgWarner Inc.</u>	Daikin Applied Americas*	General Motors*~	J.R. Simplot Company*
Bosch Rexroth Corporation	Danaher Corporation	General Stamping and Metal Working, Inc.	JBT Corporation*
BPM Inc.*	Delta Diablo	<u>Gerber Products Company</u>	Jedco, Inc.
Bradken*	Denison Industries	Gibraltar Industries	Johnson & Johnson*
Brewery Vivant/Broad Leaf Brewery & Spirits	DENSO Corporation	GKN Aerospace	Johnson Controls*
Bridgestone Americas, Inc.	Des Moines Water Works	Golden Renewable Energy, LLC	Johnson Matthey Emission Control Technologies Division
Briggs & Stratton, LLC	<u>Deschutes Brewery*</u>	Goodyear Tire and Rubber Company, U.S. Plants	Kent County Department of Public Works
Bristol-Meyers Squibb	Detroit Diesel Corp.	Graham Packaging Company	Kenworth Truck Company
Brose North America	Didion Milling		<u>Kingspan Insulated Panels, Inc.*</u>
Bucks County Water and Sewer Authority*	Dixline Corporation		
C. F. Martin & Co., Inc.*	Donsco Inc.		
CalPortland Company*	The Dow Chemical Company		
Campbell Soup Company	<u>DSM North America</u>		
Cardington Yutaka Technologies, Inc.*	Dura-Line Corporation		
Carlton Forge Works	Durable Products		
Cascade Engineering Technologies, Inc.			

KEY

Bold – Better Plants Challenge Partner
Underline – Better Climate Challenge Partner
 Asterisk* – Energy Goal Achiever
 Tilde~ – Water Goal Achiever

Partners as of September 2022

Krage Manufacturing	Neenah Foundry	Saint-Gobain Corporation	Toyota Motor North America*
<u>KYB Americas Corporation</u>	<u>Nestlé Health Science*</u>	Saputo Dairy Foods USA, LLC	TPC Group LLC
Land O' Lakes	<u>Nestlé</u>	Savage Precision Fabrication	Trane Technologies
Lear Corporation	Newman Technology, Inc.	Schneider Electric*	Tri-State Plastics, Inc.
Leggett & Platt	NEW Water (Green Bay Metropolitan Sewerage District)*	Sears Seating	TRAM Group
Legrand North & Central America*	Nissan North America, Inc.*	Selmet, Inc.	Tyson Foods
Lennox International*	Novati Technologies, Inc.	Shape Corporation	<u>United Mechanical and Metal Fabricators, Inc.</u>
Lineage Logistics	Novelis, Inc.	Shaw Industries Group, Inc.*	Valmont Industries
Lockheed Martin	NSK Americas	Sheboygan Regional Wastewater Treatment Facility	Valvoline
<u>Lopez-Dorada Foods</u>	NY DEP – Bureau of Wastewater Treatment	<u>The Sherwin-Williams Company*</u>	Vanguard Space Technologies
Los Angeles Bureau of Sanitation	O'Fallon Casting	<u>Siemens</u>	Vermeer Corporation
Los Angeles Department of Water & Power	Occidental Chemical Corporation	Silgan Closures	Verso Paper Corporation*
Lynam Industries, Inc.	OFD Foods, LLC	Silgan Containers	Victor Valley Wastewater Reclamation Authority*
L'Oréal USA	Orange Water and Sewer Authority*	Silgan Plastic Food Containers	Vitro Architectural Glass
<u>Lundberg Family Farms</u>	Oshkosh Corporation*	SL Tennessee, LLC	Volvo Group North America*
Magnetic Metals Corp.	OSRAM SYLVANIA*	Solberg Manufacturing Inc.	<u>Waupaca Foundry, Inc.</u>
MAHLE Engine Components USA, Inc.	Owens Corning*	Southwest Cheese	Weber Metals, Inc.
Manitowoc Grey Iron Foundry	Ozinga Brothers, Inc.	Spirax Sarco, Inc.	West Lafayette Water Resource Recovery Facility
Mannington Mills	Pactiv	St. Petersburg Water Resources Department	Western Lake Superior Sanitary District
Marquis Energy, LLC	PaperWorks Industries	<u>Stanley Black & Decker</u>	WestRock
Marquis Energy Wisconsin	Parker Hannifin	Stanley Spring & Stamping Corporation	Weyerhaeuser*
Massachusetts Water Resources Authority	Patrick Cudahy, LLC*	<u>Steelcase Inc.*</u>	<u>W. L. Gore & Associates</u>
MB Aerospace East Granby	PepsiCo	<u>Stellantis</u>	<u>Whirlpool Corporation</u>
McCain Foods USA, Inc.	Perrone Aerospace	<u>Stryker</u>	Xerox
McWane, Inc	Pharmavite	Sugar Creek Packing Company	Zebra Technologies Corp.
MEKRA Lang North America	Philadelphia Water Department	SunOpta, Inc.	Zimmer Biomet
Metal Industries, Inc.*	Phoenix Closures	<u>Synthomer</u>	
<u>Metal Technologies, Inc.</u>	Pima County Wastewater Reclamation Department	<u>Tarkett USA Inc.</u>	
<u>Miami-Dade Water and Sewer Department</u>	Plastics Engineering Company (Plenco)	TE Connectivity*	
Michael Foods	PPC Broadband, Inc.	Tenaris	
Michels Corporation	PPG Industries	Texas Instruments, Inc.*	
<u>Mitsubishi Electric Automotive America</u>	Procter & Gamble*	Texas Nameplate Company	
Mohawk Industries	Quad/Graphics, Inc.	Textron, Inc.	
Mulgrew Aircraft Components, Inc.	Raytheon Technologies	ThyssenKrupp Elevator*	
Narragansett Bay Commission	Research Electro-Optics	TitanX Engine Cooling, Inc.	
Navistar, Inc*	Richmond Industries, Inc.		
ND Paper, LLC	RING Container Technologies		
	Roche Diagnostic*		
	Rowley Spring and Stamping		

KEY

Bold – Better Plants Challenge Partner
Underline – Better Climate Challenge Partner
 Asterisk* – Energy Goal Achiever
 Tilde~ – Water Goal Achiever



GOALS ACHIEVED

