CLEAN ENERGY & ENERGY MANAGEMENT WEBINAR SERIES

# Sustainable Wastewater Infrastructure and Energy Savings with SWIFt

# Have a question?

Use the "Questions" function
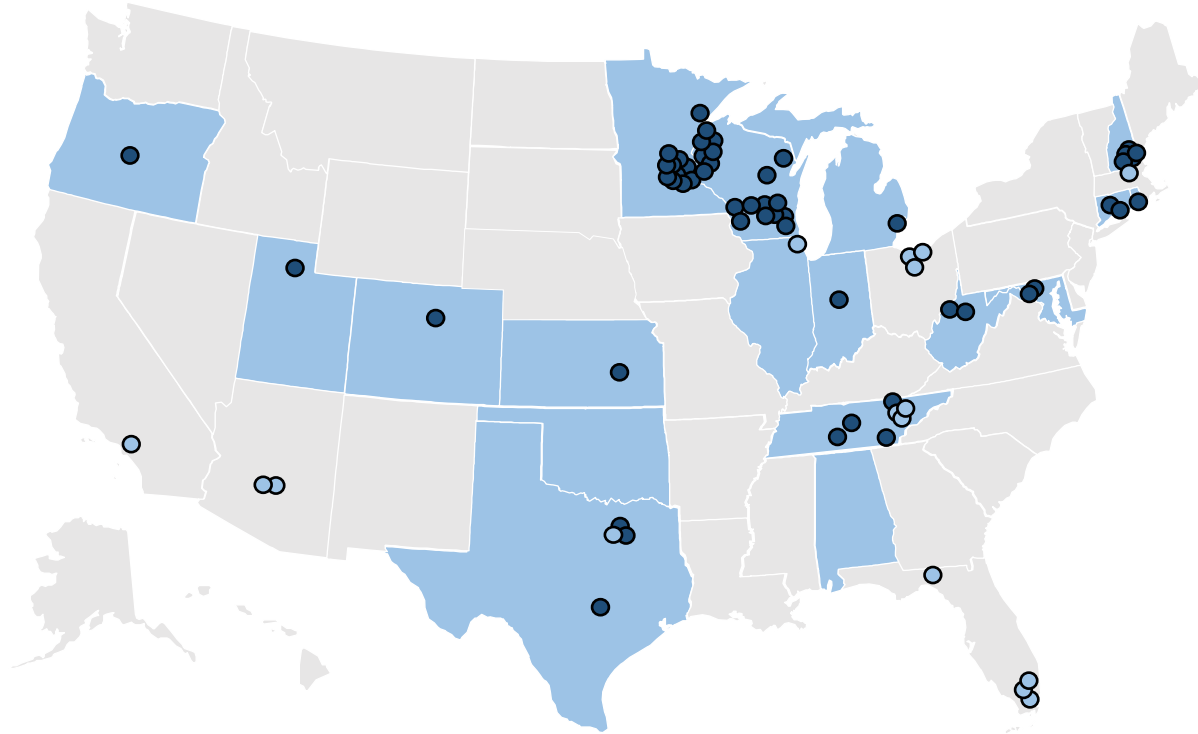to pose questions throughout
the webinar

EGLE

# Today's Speakers

- **Shannon Zaret** - Energy Technology Program Specialist, US DOE

- **Chelsea Mervenne** - ORISE Fellow, Weatherization & Intergovernmental Programs Office, US DOE

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# Sustainable Wastewater Infrastructure of the Future Initiative

# SWIFt Phase 1



- **4 billion gallons of wastewater** – treated daily by SWIFt Facility Partners (~12% of wastewater treated by publicly owned wastewater treatment facilities)
- **25 million people** – served by SWIFt Facility Partners (8% of nation's population)

- SWIFt 1.0 was a three-year partnership (2016-2019) that engaged 70 wastewater treatment facilities to accelerate the adoption of innovative and best-practice approaches in data management, technologies, and financing for infrastructure improvement.

- SWIFt Partners sought to improve the energy efficiency of their participating wastewater treatment facilities by at **least 30%** and integrate at least one resource recovery measure.

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# SWIFt 1.0 Results

**1,987 kWh/MG**
Average energy intensity for all reporting facilities

**2.5%**
Average energy intensity (kWh/MG) reduction over baseline by all reporting facilities

**130,446,219**
Cumulative kWh saved by all reporting facilities

**6.9%**
Total energy reduction over baseline by all reporting facilities

*Based on SWIFt partner data 2016-2019*

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# Wastewater Energy Management Toolkit



- The **Wastewater Energy Management Toolkit** is a collection of resources that will enable water resource recovery facilities to learn and benefit from SWIFt's work.

- Toolkit resources support best practices and innovative approaches successfully used by wastewater facilities to establish and implement energy management and planning.

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# Wastewater Energy Management Toolkit

## Data Management

The **Energy Data Management Manual** provides clear, step-by-step guidance to track energy performance and compares publicly available energy data management tools.

## Measure Planning

The **Measures Checklist** includes no-and low-cost energy savings options and identifies 23 high impact innovative energy conservation and resource recovery measures.
The **Measure Planning Workbook** is an automated tool that can help facilities decide whether and how to implement one of the 23 measures.

## Project Financing

The **Financing Matrix** highlights available financing and funding programs and mechanisms for the wastewater sector.
The **Energy Savings Performance Contracting Guide** helps decision makers consider this option for wastewater infrastructure improvements.

## Plan Development

The **Infrastructure Improvement Plan Template** outlines topics a facility may consider including in their own plan. Several example plans are also available.

# Low and No-Cost Measures List

## Low- and No-Cost Measures List

- A comprehensive checklist of low- and no-cost energy conservation measures recommended by U.S. DOE Industrial Assessment Centers

- Cost-effective, quick impact measures to achieve short-term savings goals (measures show 5-7% energy savings and average ≤ 2 year payback)

### Installation

- ☐ Install timers on light switches and occupancy sensors in little-used areas and adjust for scheduled operations as needed.
- ☐ Install programmable thermostats and use night set-back/setup settings.
- ☐ Turn off unnecessary lighting and install occupancy sensors.
- ☐ Identify and use energy-efficient belts compatible with your facility's equipment.
- ☐ Change aeration blower intake filters regularly to minimize air intake resistance. [1]
- ☐ Use automatic controls when available to optimize equipment, process monitoring, and operations.

### Assessment

- ☐ Review and assess ventilation requirements to optimize efficiency, reduce space conditioning during non-working hours, and manage space conditioning energy use during non-occupancy times.
- ☐ Assess the potential to remove organics prior to entering the secondary treatment system. Assess the capability for high strength organic dischargers to feed directly to an anaerobic digester.
- ☐ Review operations to identify any pumps or blowers that are being throttled and assess them to determine if they can be adjusted to operate more efficiently.
- ☐ Assess air and water piping systems in need of insulation (exposed piping).
- ☐ Identify equipment speeds and resheave blowers where needed.
- ☐ Consult your energy utility account manager to evaluate rate schedules and determine the most efficient rate for your facility.

### Operation

- ☐ Test, calibrate, and maintain dissolved oxygen level/sensors in aeration tank(s). [2]
- ☐ Shift to smaller HP pumps/blowers during nightly low-flow periods or seasonal low-flow periods, if applicable. [3]
- ☐ Reduce blower pressure to the minimum required through proper maintenance of aeration diffusers and distribution system to minimize head loss. Control the set point in the aeration blower control strategy. Also, identify, assess and repair aeration system air main leaks - (replace gasket, repair corrosion, underground maintenance) and lower aeration tank levels to reduce air header static pressure, if applicable. (May need sensing O2 level).
- ☐ Turn off equipment when not in use (e.g., turn off aerobic digester blower periodically or operate intermittently).
- ☐ Adjust system operations when there is a change in wastewater load.
- ☐ Raise wet well levels to reduce static head in the pump system. Coordinate all control points (low-level alarm, pump start/stop, high-level alarm) to adjust the wet well level upward. Consider hydraulic profile of the facility when doing so.
- ☐ Eliminate leaks in inert gas and compressed air lines/valves.
- ☐ Operate select aeration tanks as needed while also establishing operating protocols to enable the plant to bring tanks back on line efficiently.
- ☐ Routinely clean UV lamp sleeves to enhance transfer efficiency and decrease the number of UV lamps where/when possible while still meeting disinfection needs.
- ☐ Idle aeration basins/zones, if not needed (periodic maintenance may still be needed).
- ☐ Reschedule plant operations or reduce load to avoid on-peak hours (e.g., operate dewatering equipment during off-peak, load digesters during off-peak, repair equipment, and shift recycling of supernatant to off-peak).

# High Impact Measures List with Median Energy Savings

## Technologies

- Blower Technologies + Optimization
- Dissolved Oxygen (DO) Control
- Emerging Diffuser Technologies
- Membrane Bioreactors (MBR)
- Pumping System Technologies + Optimization
- Pure Oxygen (Pure Ox) Systems
- Solar Photovoltaic (PV)
- Ultraviolet (UV) Disinfection Systems

## Management Approaches

- Energy Assessment
- Energy Conservation Programs
- Energy Management Systems
- Infiltration/Inflow (I/I) Studies
- Rate Structure Management
- Real-time Monitoring & Control

## Process Improvements

- Ammonia-based Aeration Control (ABAC)
- Blower Optimization (w/ Technologies)
- Chemically-Enhanced Primary Treatment (CEPT)
- Dissolved Oxygen (DO) Control (w/ Technologies)
- Modifying System Operations Seasonally
- Pumping System Optimization (w/ Technologies)

## Resource Recovery

- Anaerobic Digestion
- Biosolids Energy Recovery
- Combined Heat & Power (CHP)
- Heat Recovery
- Inline Hydropower
- Onsite Water Reuse

# Measure Planning Workbook

- Once the user has completed the applicable number of **Evaluation Matrix** sheets, the **Dashboard** sheet will display:
  - Names
  - Weighted scores and
  - Total scores of each proposal evaluation (uploaded automatically)

- User are able to view a side-by-side comparison of each proposal based on its criteria performance.

| Evaluation Matrix: | | 1 | 2 |
|---|---|---|---|
| Name: | | ABAC[1] | CEPT[2] |
| Total Score: | | 69 | 47 |
| | | | |
| What is the potential environmental/permit impact? | 13% | 0.4 | 0.4 |
| What will be the payback period? | 13% | 0.4 | 0.3 |
| What level of effort is needed to operate and leverage an ammonia-based aeration control system?^ | 13% | 0.3 | 0.1 |
| What facility-wide energy savings are expected? | 13% | 0.3 | 0.4 |
| What level of system will be installed? | 13% | 0.5 | 0.1 |
| What is the purchase price of ammonia-based aeration control system equipment? | 13% | 0.3 | 0.3 |
| What staff training is needed to operate and leverage an ammonia-based aeration control system? | 13% | 0.4 | 0.3 |
| What are ongoing operations and maintenance needs for an ammonia-based aeration control system? | 13% | 0.4 | 0.1 |

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# SWIFt Partner Infrastructure Improvement Plans

## Low- and No-Cost

The Low- and No-Cost Measures List as part of the SWIFt workbooks includes many other opportunities at MDWASD Wastewater Treatment Plants. Any of these measures not already detailed in previous sections are listed:

Installation

- Timers and occupancy sensors for lights
- Programmable thermostats
- Energy-efficient belts

Assessment

- Optimize ventilation based on requirements
- Evaluate electric utility rate structure

Operation

- Optimize pump/blower HP sizing
- Turn off equipment when not in use
- Adjust system operations when there is a change in wastewater load
- Eliminate leaks in inert gas and compressed air lines/valves

It is estimated that Low- No-Cost measures can save MDWASD approximately 1% off total energy consumption: Savings are calculated as:

$$= 202{,}689{,}040 \frac{kWh}{yr} \times 0.01 \ energy \ efficiency \ gain$$

$$= 2{,}026{,}890 \frac{kWh}{yr}$$

Associated cost savings are calculated as:

$$= 2{,}026{,}890 \frac{kWh}{yr} \times 0.06 \frac{\$}{kWh}$$

$$= 121{,}613 \frac{\$}{yr}$$

## MDWASD BASELINE RECORDING AND CONSUMPTION TRACKING

Facility Name: MDWASD
Facility State: FL
Current Reporting Years: 2017-2018
Base Year: 2016

| Primary Energy Consumed (kWh): | Baseline Year | 2017 | 2018 |
|---|---|---|---|
| Electricity | 137,886,800 | 131,904,356 | 129,338,079 |
| Natural gas | 22,765,387 | 9,830,217 | 4,385,464 |
| Distillate or Light Fuel Oil (#1, 2, & 4) | 8,228,634 | 29,308,741 | 25,177,753 |
| Residual or Heavy Fuel Oil (# 5, 6, Navy Special & Bunker C) | | | |
| Coal | | | |
| Coke | | | |
| Blast Furnace Gas | | | |
| Wood Waste | | | |
| Biogas | 33,807,916 | 25,718,786 | 26,108,986 |
| Other Liquid (please specify) | | | |
| Other Solid (please specify) | | | |
| Flow | 303 | 312 | 288 |
| Total Primary Energy Consumed, (kWh): | 202,689,040 | 196,762,100 | 185,010,570 |
| Weather/Production/Other Normalizing related Adjustment for Baseline Primary Energy, (+/- kWh): | | | |
| Adjusted Baseline of Primary Energy (kWh): | 202,689,040 | | |
| Total Energy Savings since Baseline Year (kWh) (intensity): | | 11,679,830 | 7,911,935 |
| Total Energy Savings since Baseline Year (%) (intensity): | | 5.60% | 4.10% |
| Total Energy Cost Savings since Baseline Year ($) (intensity): | | $ 700,790 | $ 474,716 |

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# Better Buildings Solution Center



**More than 2,500 solutions are available publicly in the Better Buildings Solution Center**

**Showcase Projects:**
- Large and small buildings
- All sectors
- Specific building types such as schools, hospitals, hotels, grocery stores, universities, civic centers, libraries, offices and labs

**Implementation Models (Playbooks):**
- Overcome barriers: finance, data, energy management, staff training, community and customer outreach, partnering with utilities, and more
- Multi-faceted and applicable across sectors

**Additional Resources, Toolkits, Case Studies**

# Next Steps - SWIFt 2.0

- SWIFt 1.0 partners achieved robust results using DOE-developed energy management decision-making tools and how-to resources. SWIFt 2.0 will continue this momentum by helping facilities beyond the Accelerator leverage these proven energy management tools and resources.

## Goals

- Phase 2 (SWIFt 2.0) will engage 100 facilities in a voluntarily partnership to achieve 5% short-term and 25% long-term facility-wide energy savings, and will also work with 25 facilities to implement at least one next-generation technology (e.g., renewable energy, resource recovery, and advanced data management).

# SWIFt 2.0 - Track Breakdown

## SWIFt Toolkit Training

- For facilities interested in prioritizing energy savings and introducing the building blocks of energy management into their operations

- Designed to provide a deep dive into the resources that support best practices and innovative approaches successfully used by wastewater facilities to establish and implement energy management and planning

- Partner facilities voluntarily commit to achieving 5% short-term, 25% long-term cumulative energy savings

## SWIFt Energy Recovery Accelerator (SWIFter)

- Facilities that are ready to adopt more advanced energy technologies can join the SWIFt Energy Recovery (SWIFter) Accelerator

- Designed to provide customized technical assistance on energy and related data management, energy efficiency improvements, advanced technology integration, and project financing

- Partner facilities voluntarily commit to issuing a Request for Proposals to implement at least one next generation infrastructure improvement project

# SWIFt Toolkit Training

## Data Management

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# SWIFt Energy Recovery Accelerator (SWIFter)

SWIFter partner facilities will choose and focus on one of four advanced technology tracks. Partners have the option of observing the other track sessions, but any customization will be reserved for their chosen track.
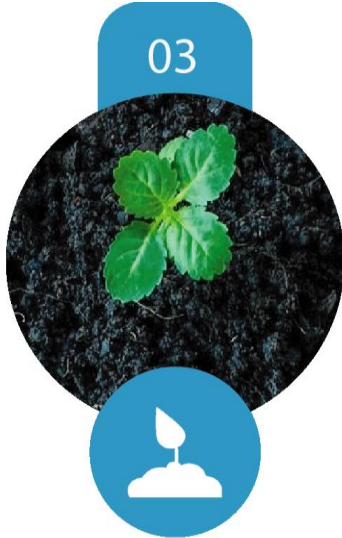
## 01 Energy Capture

Resiliency, onsite generation, and renewable energy integration (e.g., combined heat and power, solar photovoltaic, biogas, heat recovery, and energy storage)

## 02 Energy Efficiency

Advanced energy efficiency technologies (e.g., ammonia based aeration control, optimized pumping system technologies, and membrane bioreactors)

## 03 Resource Recovery

Biosolids recovery for land application as fertilizer and water recovery

## 04 Advanced Data Management

Advanced data management, sensing and control for optimized energy performance (e.g., Supervisory Control and Data Aquisition (SCADA) systems and Artificial Intelligence (AI) techniques)

# Energy Data Analysis and Energy Data Management Planning

First crack at the new wastewater tailored 50001 Ready Navigator, which allows facilities to create a comprehensive energy management roadmap. This tool pairs with DOE's Energy Performance Indicator Tool which can be used to calculate corporate level improvements and savings, determine $CO_2$ avoided emissions data, forecast and back cast data, and perform regression analysis.



## Corporate Roll-up

| | FY1 | FY2 | FY3 | FY4 |
|---|---|---|---|---|
| **Hastings** | | | | |
| Purchased electricity(MMBTU) | 4,073 | 4,306 | 4,334 | 4,033 |
| LPG(MMBTU) | 7,213 | 6,963 | 6,677 | 6,714 |
| TOTAL Primary Energy Consumed (MMBtu/year) | 11,286 | 11,269 | 11,012 | 10,748 |
| TOTAL MODELED Primary Energy Consumed (MMBtu/year) | 11,286 | 11,269 | 11,012 | 10,748 |
| Annual Improvement (%) | 0.0% | 3.6% | 2.0% | 2.5% |
| Total Improvement (%) | 0.0% | 3.6% | 5.6% | 8.1% |
| New Energy Savings for Current Year (MMBtu/year) | 0 | 17 | 258 | 264 |
| Total Energy Savings since Baseline Year (MMBtu/year) | 0 | 17 | 275 | 539 |
| **McLean** | | | | |
| Electricity (MMBTU) | 302,219 | 252,204 | 274,129 | 267,194 |
| Natural Gas (MMBtu) | 136,359 | 113,943 | 130,994 | 132,601 |
| TOTAL Primary Energy Consumed (MMBtu/year) | 438,578 | 366,147 | 405,123 | 399,795 |
| TOTAL MODELED Primary Energy Consumed (MMBtu/year) | 438,578 | 420,488 | 440,605 | 408,602 |
| Annual Improvement (%) | 0.0% | 12.9% | -4.9% | -5.9% |
| Total Improvement (%) | 0.0% | 12.9% | 8.1% | 2.2% |
| New Energy Savings for Current Year (MMBtu/year) | 0 | 54,341 | -18,859 | -26,675 |
| Total Energy Savings since Baseline Year (MMBtu/year) | 0 | 54,341 | 35,482 | 8,807 |
| **Reston** | | | | |
| Electricity (MMBTU) | 1,797,595 | 1,574,253 | 1,120,188 | 1,254,039 |
| Natural gas (MMBTU) | 968,488 | 938,708 | 677,467 | 743,413 |
| TOTAL Primary Energy Consumed (MMBtu/year) | 2,766,083 | 2,512,960 | 1,797,655 | 1,997,452 |
| TOTAL MODELED Primary Energy Consumed (MMBtu/year) | 2,499,635 | 2,327,169 | 1,797,655 | 1,996,835 |
| Annual Improvement (%) | 0.0% | 2.2% | 7.4% | 0.0% |
| Total Improvement (%) | 0.0% | 2.2% | 9.6% | 9.6% |
| New Energy Savings for Current Year (MMBtu/year) | 0 | 80,657 | 185,791 | -267,065 |

# Scenario Modeling with DOE's MEASUR Suite



MEASUR is designed to help facilities measure the impact of proposed infrastructure upgrades.

# TIME LINE

The SWIFter Accelerator is designed to be flexible to accomodate participants' scheduling needs and includes individual scoping meetings, tailored workshops, training on energy savings resources and data analysis tools, one-on-one consultations, and peer-to-peer exchanges. SWIFter will facilitate streamlined scheduling and communications throughout the Accelerator.

## Initial Partner Conversations

**Spring 2021**

Once partner facilities sign the SWIFter Partnership Agreement, DOE will conduct an initial phone conversation to discuss the facilities' current progress on efficiency measures as well as advanced technology interest areas.

## Track-Specific Peer-Exchanges

**Summer 2021**

After partner facilities have chosen their technology track of interest, DOE will schedule track specific peer exchange sessions to discuss technical assistance requests. DOE's network of national laboratories will design and develop tailored technical assistance workshops based on the feedback recieved during these sessions.

## Introductory and Technical Workshop Sessions

**Fall 2021-22**

All partner facilites will recieve a 2-hour introductory training on DOE energy management resources (e.g., SWIFt Toolkit, 50001 Ready Navigator, and Better Plants). These resources will help facilities meet their short-and long-term voluntary energy savings goals. Following this, facilities will break into their chosen technology tracks and attend customized technical assistance workshops.

## Baseline Data Collection and Annual Reporting

**Fall 2021-23**

DOE will work with partner facilities to collect suggested data points related to the facilities' energy use in order to get a baseline metric for the energy savings achieved throughout the program. The baseline data will be collected within six months from the date of signing the partnership agreement. These same data points will be collected annually for three years. Data submission is voluntary. All data and information will be kept confidential and shared only in the aggregate.

## Financial Planning Workshops

**Fall 2022-23**

Partner facilities will attend financial planning workshops customized to their needs. Topics will include financial planning resources and RFP drafting tips. Facilities will also have the opportunity for peer exchanges with facilities who have successfully funded infastructure upgrades.

## Customized Technical Assistance

**Spring 2023**

Each partner facility will recieve an additional ten hours of customized technical assistance on their chosen topic.

## Issuing RFPs and Information Sharing

**SUMMER 2023**

Within 12-18 months following the conclusion of the program, facilities will put plans in place to achieve long term energy savings and issue RFPs to implement one next generation measure. The SWIFt Team will also work with the facilities to draft partner case studies and share lessons learned so that other facilities can benefit from the SWIFter Accelerator.

# Partnership Agreement – Voluntary Commitments

**A SWIFt Toolkit Training Partner Agrees to:**

- **Work towards** issuing a Request for Proposals (RFP) to initiate an infrastructure improvement that includes one next-generation advanced technology

- **Adopt** a facility-wide goal to reduce energy intensity by 25% over a 10-year period

- **Participate** in peer exchange and technical assistance forums about tools, approaches, technologies, and options

- **Establish** an energy use and energy intensity baseline

- **Report** energy intensity, energy use data, and achievements annually to DOE for three years following the initial training

- **Develop** an infrastructure improvement plan that includes best-practice energy performance tracking, a package of cutting-edge technologies, and a concrete financing model within 12-18 months following the conclusion of the training program

- **Demonstrate** at least a 5% cumulative energy consumption, as measured by overall energy intensity, by applying the SWIFt Toolkit's low- or no-cost energy conservation measures within 3 years

- **Share** results and lessons learned with DOE and other SWIFt Initiative partners

**The Department of Energy Agrees to:**

- **Appoint** a point of contact

- **Provide technical assistance** and training on energy data management, energy savings measures, project financing, and project implementation plan development

- **Develop** additional technical tools and/or assistance necessary to meet the goals of the SWIFt Initiative

- **Create and facilitate** networking and technical peer exchange opportunities with stakeholder organizations and other partners to develop best practices and share innovative solutions

- **Leverage** full set of tools and resources developed by stakeholder organizations and compile best practices and approaches for striving toward sustainable infrastructure

- **Provide national recognition** to SWIFt Initiative partners and participating facilities for achieving milestones and for their leadership in working toward a sustainable wastewater infrastructure

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# Advanced Manufacturing Office, Better Plants Program

- **SWIFt** partners will also have the opportunity to continue their progress through the **Better Plants program**

- **Better Plants** is a **voluntary**, public-private partnership program for **manufacturers** and industrial organizations

- Through Better Plants Partners:
  - Set **long-term efficiency goals**
  - Receive **technical assistance, networking platforms** and **national recognitions**
  - Learn how to conduct assessments, use DOE tools, and implement projects through **in-plant trainings**

- Partners are assigned **Technical Account Managers** to help them **achieve their energy performance goal**
  - Help **establish or improve data collection and analysis methods**; assist in annual reporting
  - Provide **assistance on** AMO's suite of industrial system software platforms
  - Relay information regarding **program developments, upcoming events, new resources, and other announcements**
  - Connect partners to one another for **peer-to-peer learning**
  - Help with energy baselines and data tracking/reporting (e.g., EnPI tool)

https://betterbuildingsinitiative.energy.gov/better-plants

# Frequently Asked Questions

## What is the time commitment involved?

The SWIFter Accelerator covers a three-year time period. The sessions will be spaced out through-out the year, coordinated with the facilities schedules, and no more than two hours on average. The individual technical assistance can be scheduled with the technical account manager at the facilities' discretion.

## What if I am already involved in a state-run program or working with a consultant?

Our program is meant to be additive and create synergies between programs. Many consultants work with our tools and would have the opportunity to get a first crack at the new tailored resources. It also provides a good opportunity to have another eye review the facilities' 10-year plan and allows facilities to network with other facilities who have successfully implemented projects across the U.S.

# Frequently Asked Questions

**Will you cover regulatory barriers to implementation?**
Yes, this is a common theme among our stakeholders and raises a key feature of our program. SWIFter is meant to be responsive to the facility. If there is an issue that you want our team to address, we will cover it. We will also take stock of the program regularly to ensure the facilities are satisfied with the program content.

**What do you do with our data?**
Sharing energy-savings data with DOE is encouraged but optional. DOE keeps facility and utility data confidential. Data are only used in the aggregate to assess the efficacy of the initiative or highlight partner success stories. It is up to the facility if they would like to receive national recognition.

**Can our operators receive continuing education credit?**
If you are interested in CE credit, we will submit our workshops to the state so that your operators can receive credit for attending our technical workshops.

# Additional Questions?

## Please Contact Us

Follow us on Twitter
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Better Buildings Solution Center
https://betterbuildingssolutioncenter.energy.gov/

General Inquiries
stateandlocal@ee.doe.gov

Program Support
ksanderson@retechadvisors.com

SWIFt Phase 2 kicked off in summer 2020 and is currently welcoming interested state, regional, and local agency and facility partners.

For more information, contact:

Shannon Zaret
U.S. Department of Energy
shannon.zaret@ee.doe.gov

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Upcoming in Sept.     Experiences with Michigan Community Solar

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