Energy Efficiency as a Pathway Towards Sustainable Wastewater Infrastructure

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The Presenters

Nina Wuerch is an ORISE Fellow in DOE's Office of State and Community Energy Programs.

Her cross-cutting work focuses on technical assistance for the public sector. Beyond supporting energy efficiency at wastewater facilities through the SWIFt initiative, Nina also works on technical assistance offerings for states, local governments, and K-12 school districts.

This work involves the Better Buildings Initiative, a resource and funding hub known as the State and Local Solution Center, and two data tools – SLOPE and LEAD.

Naushita Sharma is a Postdoctoral Research Associate at the Oak Ridge National Laboratory.

Her research focuses on *understanding the occurrence and treatment of emerging water contaminants; Water-Energy Nexus; Big Data Modeling and Analysis; Climate Sustainability & Resiliency Planning.*

Her work in the diverse areas has resulted in over 15 peer-reviewed journal articles, with wide interaction with municipal water and wastewater utilities.

She also engages with mentoring and teaching undergraduate and K-12 students.

AGENDA

- Energy Efficiency in WWTPs
- SWIFt Initiative
- Energy Management Systems
- Low- to No- cost Energy Efficiency Measures
- Median energy saving opportunities for WRRFs
- Available Tools from DOE
- Resources
- Future Opportunities
- Concluding Remarks
- Questions & Discussion

“Sustainability” in Wastewater Industry

SUSTAINABILITY???

WW production expected to rise 1.5×

2030

- **Climate vulnerability**
- **Setting ESG goals**
- **Metrics to quantify sustainability and resiliency**
- **Reduce Energy & Costs**

2022

- **32.4 TWh electricity**
- **$5.2 billion Annual Electric Costs**

- End-of-life Infrastructure
- Under or Over Capacity
- Rising Costs

Why Energy Efficiency?

1% of US Energy Consumption

30-40% of Municipal Energy Consumption

Energy

- Largest Controllable Costs
- Top 3 O&M Costs

Energy Efficiency?

Operating Costs
Energy Costs
Labor Costs

Process Efficiency

Controlled Customer Rates

Reference: US EPA – Energy Efficiency for Water Utilities

SWIFt: The Sustainable Wastewater Infrastructure of the Future Initiative

U.S. DEPARTMENT OF ENERGY

DOE's Sustainable Wastewater Infrastructure of the Future (SWIFt)

SWIFt is engaging with facilities in a voluntarily partnership to achieve 5% short-term and 25% long-term facility-wide energy savings by implementing next-generation technologies across 4 technology pillars

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)

Session Recordings: https://bptraining.ornl.gov/swift/

Overview of SWIFt

Training in data management, EE improvements, advanced technology integration, and project financing

Average utility energy savings between 5-25%

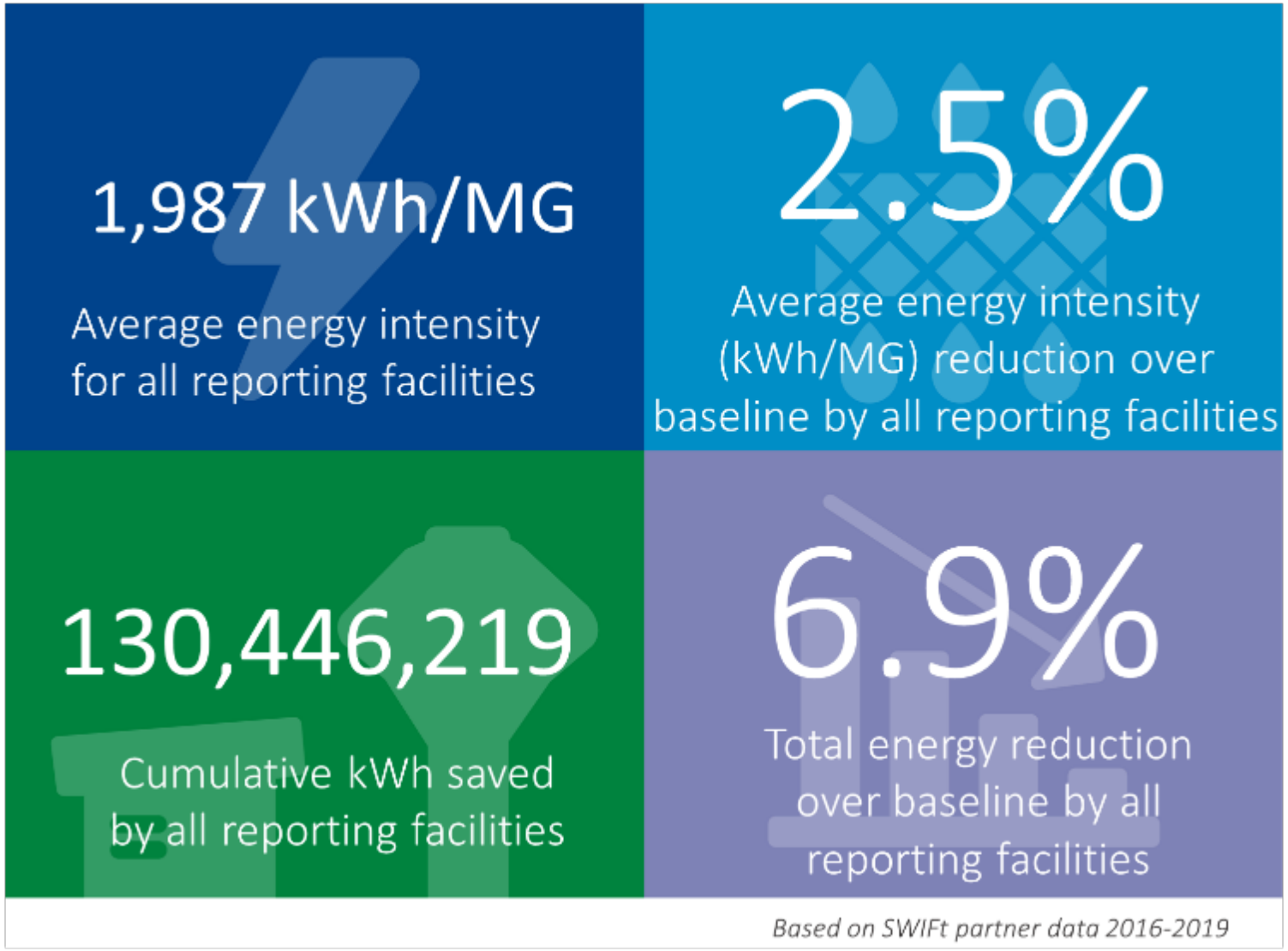
154 signatory partners representing over 328 facilities across 43 states

Participating in the virtual training is free and open to all staff at the utilities

Results So Far: Energy Savings

Based on results from 2016-2019.

Data from 2020-2023 forthcoming.



Summer 2023 Virtual Training Sessions

01
Energy Management Tools

02
Process Energy Conservation and W3

03
Energy Map, BOD, and Pumping

04
Headworks and Blower Energy

05
Aeration Process Requirements

06
Sludge Quality, SRT, and Fans

07
Secondary Clarifier Optimization

08
Dewatering, Digestion, & Decarbonization

09
Renewable Energy & Financing

10
Nutrient Recovery & Emerging Contaminants

Zoom Poll
Who is in the Room?

Energy Management Systems

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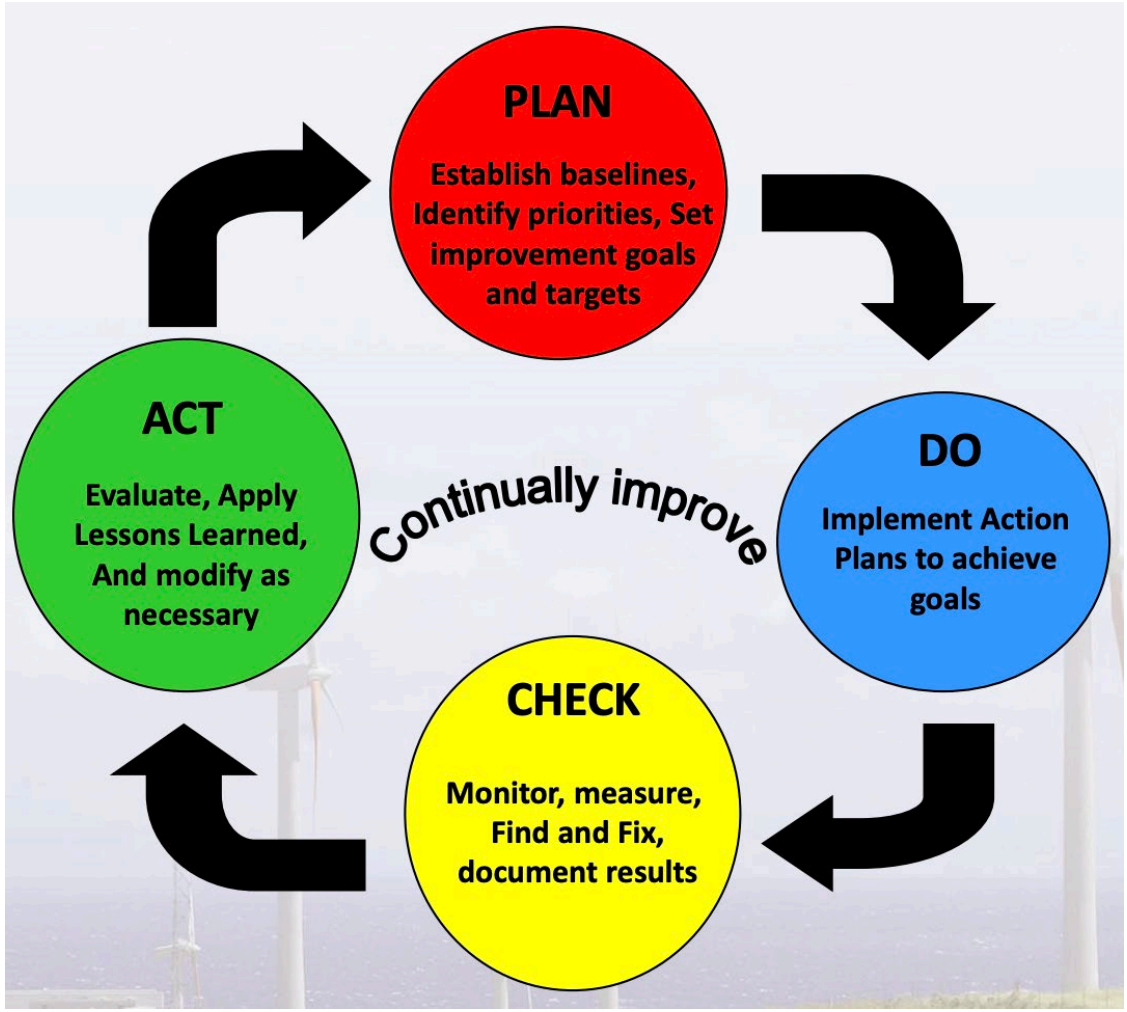
What is an energy management system?

- An energy management system helps organizations better manage their energy use, thus improving productivity.
- It involves developing and implementing an energy policy, setting achievable targets for energy use, and designing action plans to reach them and measure progress.
- This might include implementing new energy-efficient technologies, reducing energy waste or improving current processes to cut energy costs.

Energy Management Systems and Programs



50001 Ready
U.S. DEPARTMENT OF ENERGY

Superior Energy Performance 50001™
U.S. DEPARTMENT OF ENERGY

Industrial Assessment Center
U.S. DEPARTMENT OF ENERGY

Onsite Energy
Technical Assistance Partnerships
U.S. DEPARTMENT OF ENERGY

Reference: 50001 Energy Management Systems

What is ISO 50001?

Overview

- Develop a *policy* for more efficient use of energy
- Fix *targets and objectives* in line with that policy
- Use *data* to make informed decisions about energy use
- *Measure the results* to identify areas of energy efficiency improvements
- *Review the policy's effectiveness* and results of improvements
- *Continually improve* energy management practices

ISO 50001 provides organizations with an internationally recognized framework for implementing an energy management system (EnMS).

DOE's 50001 Ready program recognizes facilities that attest to the implementation of an ISO 50001-based EnMS.

Benefits

- A Tried and Tested Framework to Manage Energy.
- Greater Visibility of How Energy is Being Used and Where Performance can be Improved.
- Reducing Energy and Costs
- Carbon Reduction
- Organizational Engagement
- Continuous Improvement System
- Staff turnover is eased by having written practice in place

The program is a self-paced, no-cost way for facilities to build a culture of structured energy improvement that leads to deeper and sustained savings.

Better Plants U.S. DEPARTMENT OF ENERGY

***Voluntary* standard for establishing an energy management system**

U.S. DEPARTMENT OF ENERGY

How 50001 Ready Works

1. Implement ISO 50001 principles

Complete 25 Tasks in US DOE's 50001 Ready Navigator free, self-guided online tool

2. Present energy performance

Submit energy performance data. May use 50001 Ready Nav's Consumption Tracker, EPA's Portfolio Manager, DOE's EnPI Lite

3. Self-attest to 50001 Ready

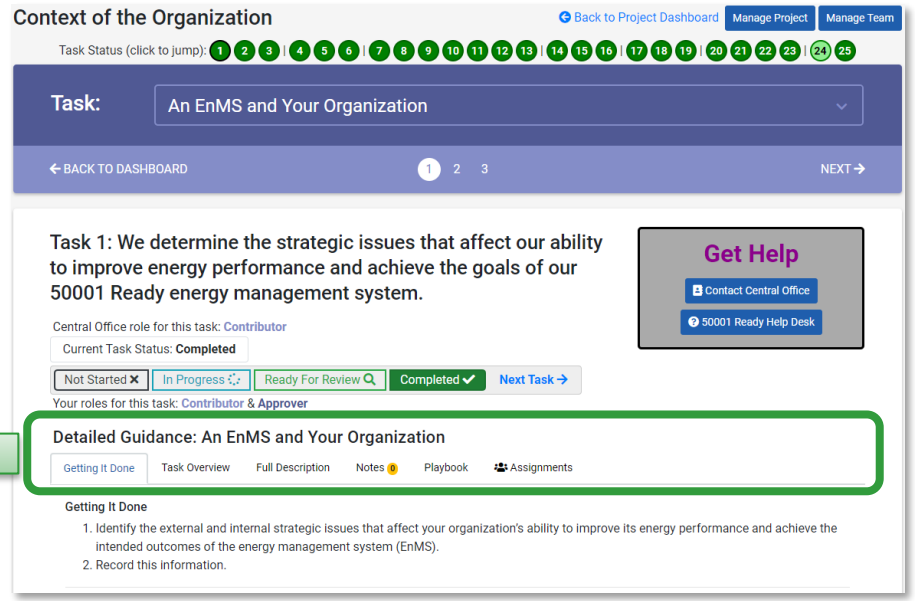
Sign-off by management of 50001 Ready implementation and commitment

energy.gov/50001Ready

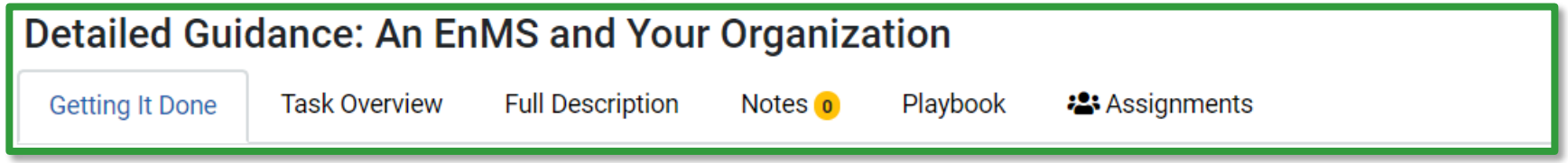
DOE and others recognize 50001 Ready achievement

50001 Ready Navigator - Overview

- Free online 'Turbo Tax-like' tool, with step-by-step approach to ISO 50001 implementation
- Guidance broken into straight forward sections, including:
  - Getting It Done – what specifically needs to be accomplished
  - Task Overview – how does this task connect with ISO50001
  - Full Guidance – comprehensive guidance about the task
  - Transition Tips – from other management systems or ENERGY STAR
- Form teams, assign tasks, setup multiple projects
  - **Great project management tool**
- Downloadable guidance
- **URL: navigator.lbl.gov**

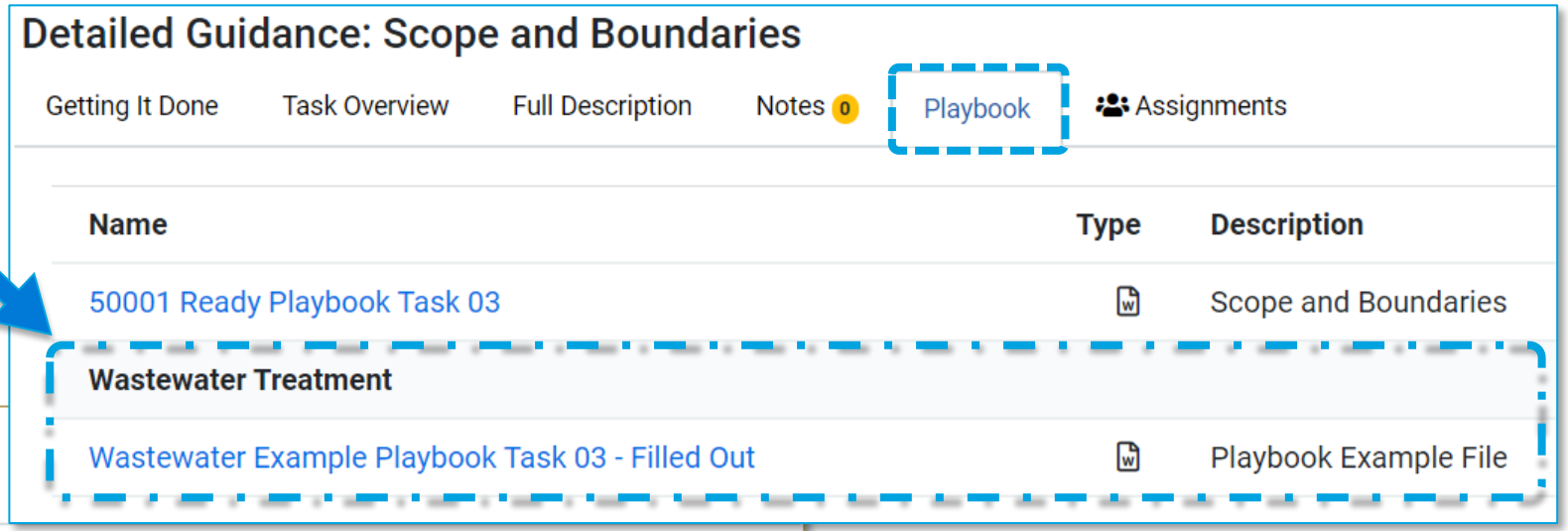


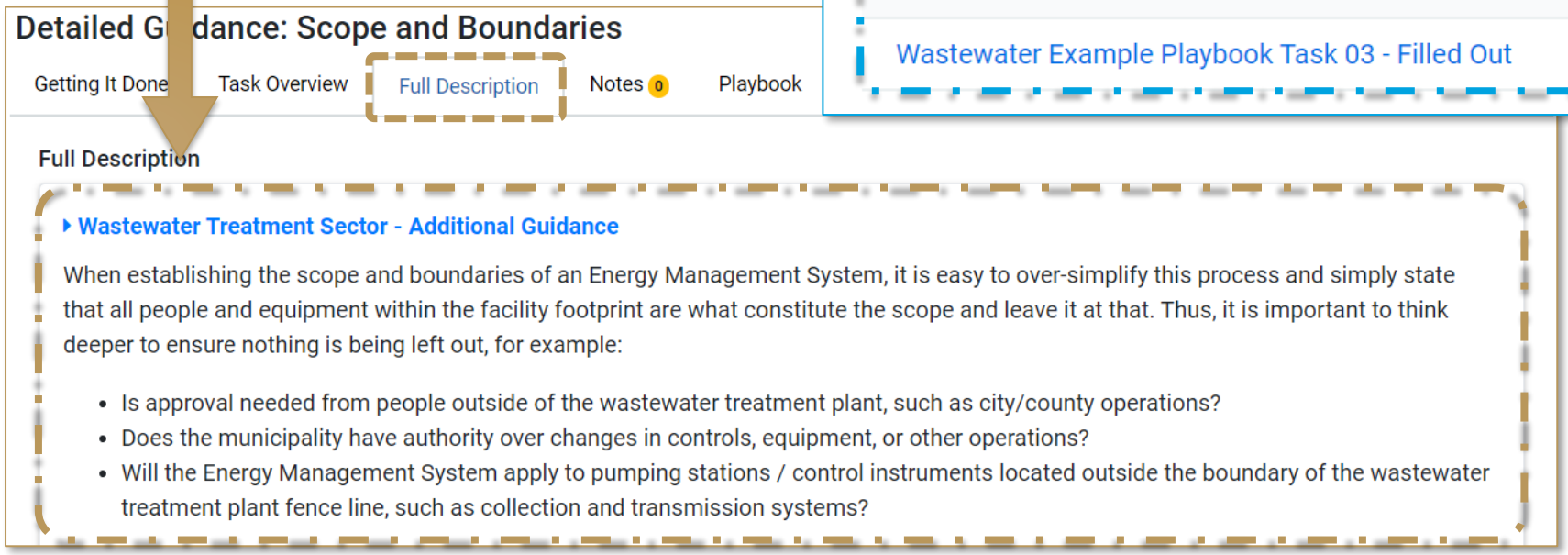
Guidance in Navigator is based on ISO 50001 Principles. There is no fee to use the tool.



50001 Ready Navigator Features – Wastewater Specific

- **Example Playbooks**
- **Tool Tips**





Help Desk:
Free email and phone support from LBNL's EnMS experts at: 50001Ready@lbl.gov

Reach out to us and we can facilitate communication with staff to provide specific ISO 50001 training

50001 in Action

- **The Noman M. Cole, Jr. Pollution Control Plant (NMCPCP) - Fairfax County**
  - 50001 Ready helped NMCPCP's Energy Team account for inefficiencies across its wastewater treatment process. For example, the plant had employed a treatment process that remained relatively unchanged for nearly 10 years, only occasionally adjusting the chemicals used in that process. Engaging with 50001 Ready provided the plant's staff with a framework within which they could perform a thorough assessment of their treatment process that enabled the Energy Team to identify savings opportunities in the tank mixing process.

- **The Glenbard Wastewater Authority (GWA) - Illinois**
  - In using DOE's 50001 Ready Navigator tool, GWA staff found the energy mapping exercises to be most beneficial for their needs. Taking stock of the finer details of the facility's operations – such as tracking runtimes and evaluating energy bills – ensured that staff were capturing the system accurately. Having numbers at hand also allowed them to determine the facility's biggest energy users, some of which were impacting energy use in ways that previously had gone unnoticed.

Summary: 50001 Ready…

✓Helps facilities get recognized for best-in-class energy management

✓Is a tool for onboarding new staff

✓Institutionalizes energy management that can survive leadership change

✓Builds off of current energy efforts

✓Supports your efforts to meet mandates

✓Is a way to develop and prioritize a list of continuous improvement opportunities

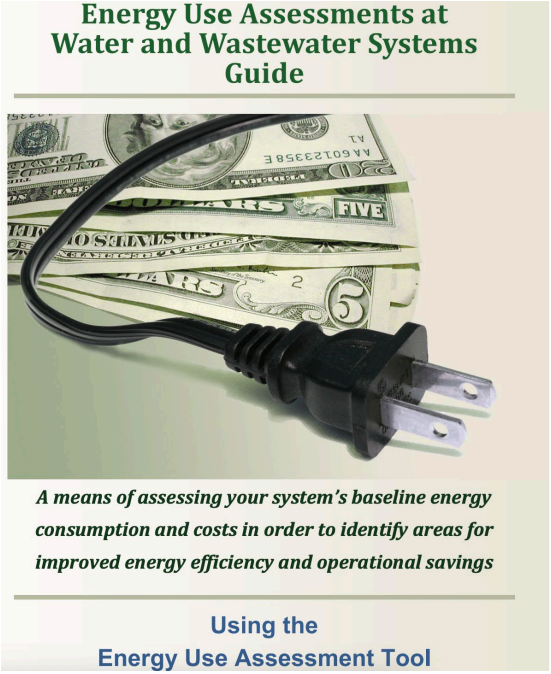
✓Can be delivered by utilities, contractors, ESCOs

✓Enhances resiliency by surviving staff disruptions

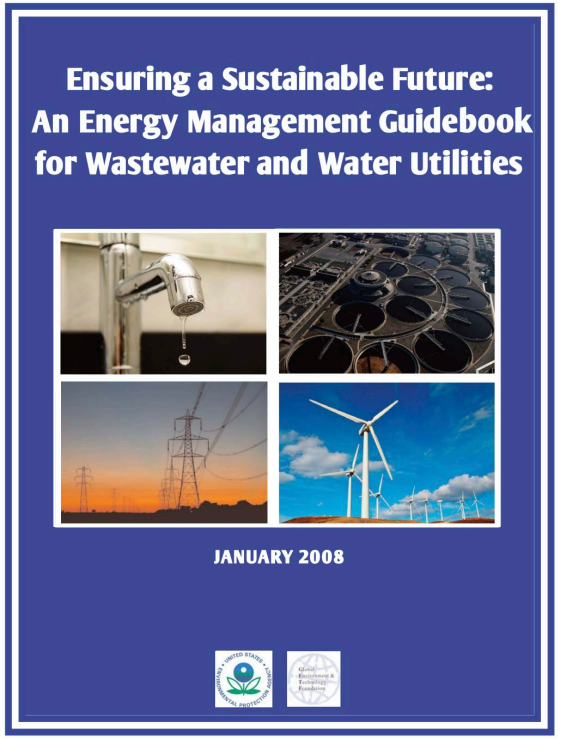
✓Can break down internal stovepipes by creating collaboration

Other Available Resources for EnMS

EPA's Energy Use Assessment Tool



EPA's Guidebook



Energy Data Management Manual

Better Buildings® U.S. DEPARTMENT OF ENERGY

Energy Data Management Manual for the Wastewater Treatment Sector

DECEMBER 2017

Energy Star Program Partnership Member

ENERGY STAR

U.S. DEPARTMENT OF ENERGY
2021–24
Gold
Superior Energy Performance 50001™

Des Moines Water Works General Office Facility has earned the Energy Star. The facility outperforms 82% of similar buildings nationwide and used 32% less energy per square foot than the national median.

2020 ENERGY STAR CERTIFIED FACILITY
ENERGY STAR www.energystar.gov

U.S. DEPARTMENT OF ENERGY

Example Successful Utilities
- City of Santa Cruz, CA
- Des Moines Water Works, IA

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Low- to No- cost Energy Efficiency Measures

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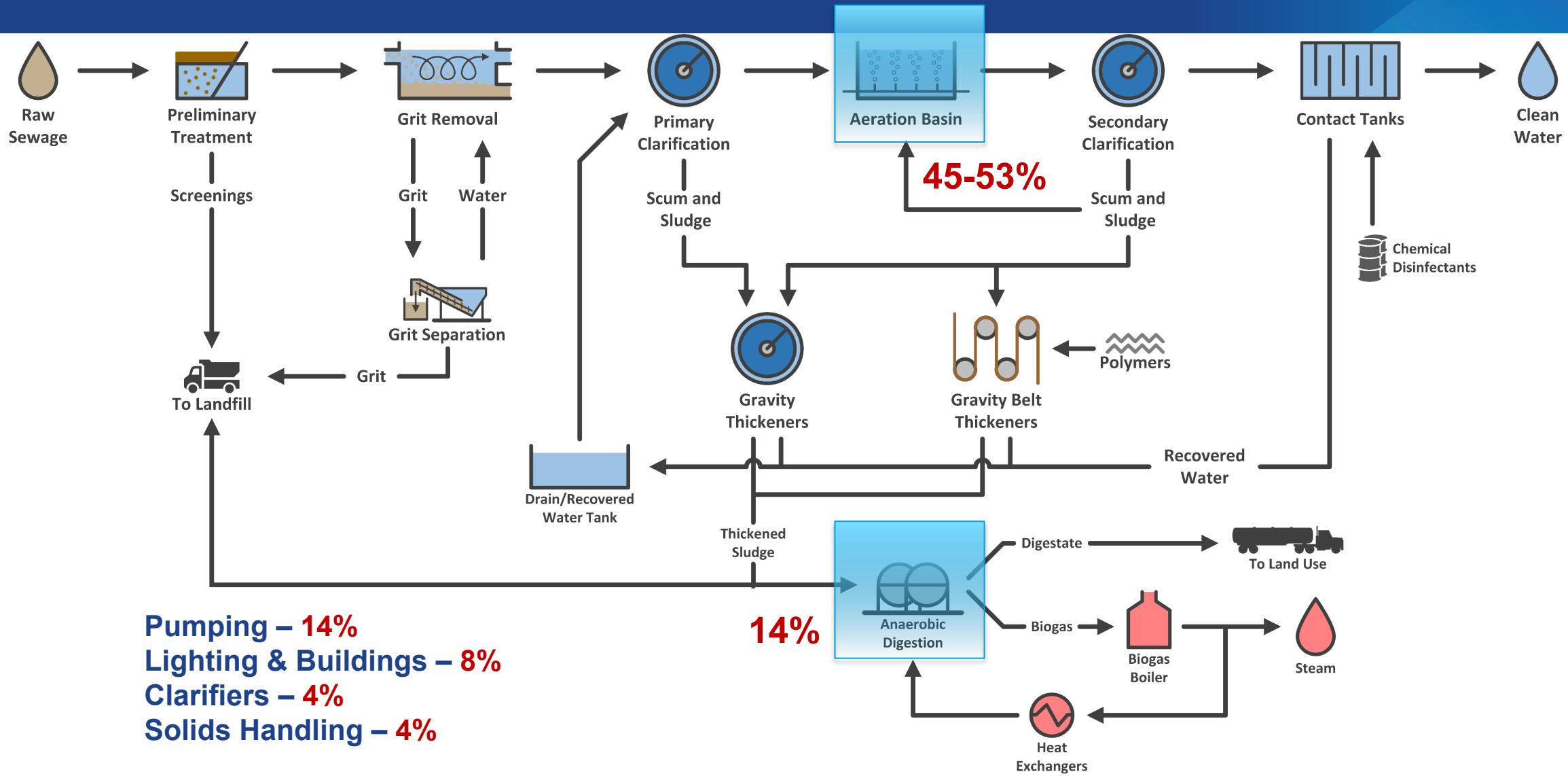
Low- and no-cost energy efficiency practices, and median energy saving opportunities for WRRFs

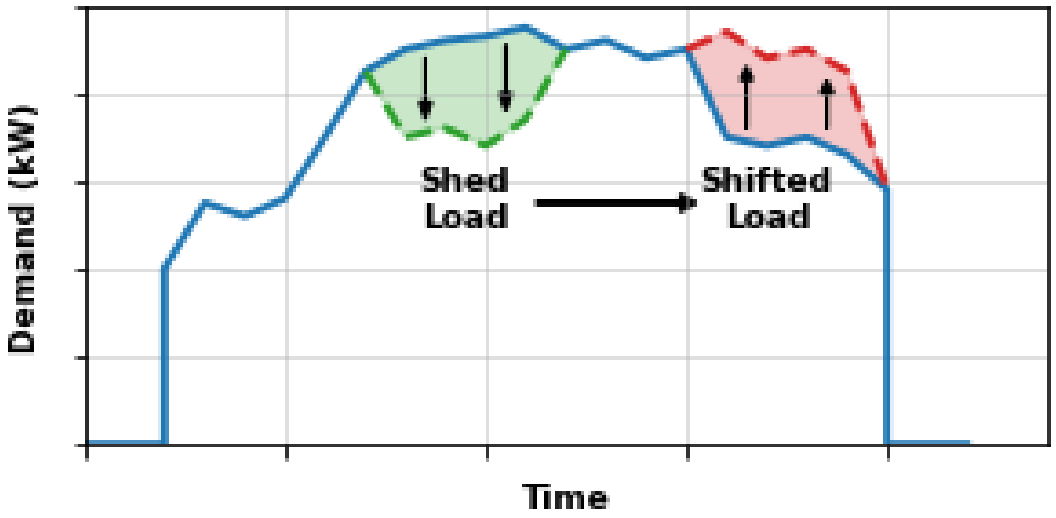


Pumping – 14%
Lighting & Buildings – 8%
Clarifiers – 4%
Solids Handling – 4%

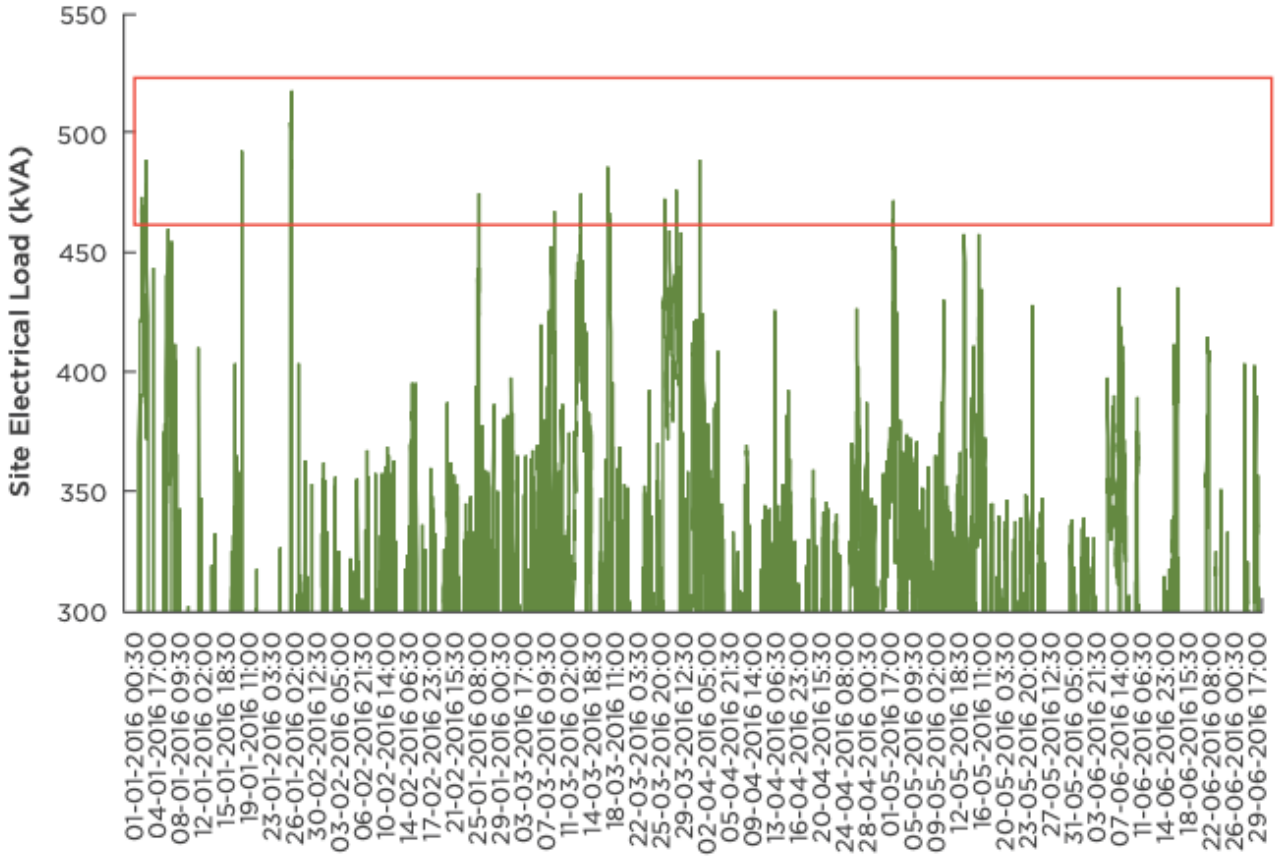
Reference: Water and Wastewater Treatment Energy Savings Guide

Managing Your Demand

- Lowering your demand costs means managing your facility's load profile
- Two main strategies:
  1) ***Load Shedding***:
     A temporary reduction in demand
  2) ***Load Shifting***:
     A transfer of load to off-peak hours
- Some utilities offer financial ***Demand Response*** incentives to shed or shift load during times of high grid stress



Electricity & Energy Demand Response



- Shifting demand response for charging energy at different rates
  - Centrifuges & Backwash Pumps
- Identifying Retailer's Peak, Shoulder and off-peak times
- Use DOE's Energy Performance Indicator (EnPI) Tool
  - Establish baseline and variations in energy consumption
- Other Caveats in Energy and electricity bills with the retailers
  - Pay-on-time discounts
  - Metering charge
  - Time-of-use variations

Reference: Energy Efficiency Opportunities in Wastewater Treatment Facilities

Low- & No-Cost Measures List | ≤ 2-year payback periods

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.

Source: SWIFT 1.0 Analysis & Findings

Example: Lighting Replacement

A WWTP operates 24 hours a day, 7 days a week.

- The plant has several light fixtures that run continuously, each consuming 100 watts of power.
- The plant management decides to install timers on these light switches so the lights only run 12 hours a day instead of 24 hours.

Given:

1. Power consumption of each light fixture: 100 watts (0.1 kW)
2. Number of light fixtures: 50
3. Current operation time: 24 hours/day
4. New operation time with timers: 12 hours/day
5. Cost of electricity: $0.12 per kWh

Tasks:

1. Calculate the current daily energy consumption of the light fixtures.
2. Calculate the new daily energy consumption after installing the timers.
3. Determine the daily energy savings.
4. Calculate the daily cost savings.
5. Determine the annual cost savings after installing the timers.

1. Current Daily Energy Consumption:

•Total power consumption per light fixture per day:

0.1kW×24hours = *2.4 kWh*

•Total energy consumption for 50 light fixtures:

50×(0.1×24) kWh = *120 kWh*

2. New Daily Energy Consumption:

•Total power consumption per light fixture per day with timers:

0.1kW×12hours = *1.2 kWh*

•Total energy consumption for 50 light fixtures:

50×(0.1×12) kWh = *60 kWh*

3. Daily Energy Savings:

120 kWh – 60 kWh = *60 kWh*

4. Daily Cost Savings:

Difference in energy consumption × 0.12USD/kWh

60 kWh × 0.12USD/kWh = *7.2 USD*

5. Annual Cost Savings:

Daily cost savings × 365days

7.2 USD × 365days = 2,628 USD/year

Low- & No-Cost Measures List | ≤ 2-year payback periods

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.

Source: SWIFT 1.0 Analysis & Findings

Low- & No-Cost Measures List for Operations | ≤ 2-year payback periods

- ☐ 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.

Low- & No-Cost Measures List for Operations | ≤ 2-year payback periods

- ☐ 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).

Median energy saving opportunities for WRRFs

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Opportunities- Median Energy Savings

Measure	Median Energy Savings (facility-wide/annual, unless otherwise noted)
TECHNOLOGIES	
Dissolved Oxygen (DO) Control	15%
Blower Technologies + Optimization	15%
Emerging Diffuser Technologies	25%
Pumping System Technologies + Optimization	10%
Ultraviolet (UV) Disinfection Systems	13%
Membrane Bioreactors (MBR)	15%
Pure Oxygen (Pure Ox) System	15%
Solar Photovoltaic (PV)	N/A
MANAGEMENT APPROACHES	
Energy Assessments	15%
Real-Time Monitoring & Control	10%
Energy Management Systems	15%
Infiltration/Inflow (I/I) Studies	38% (annual wet weather flow reduction)
Energy Conservation Programs	25%
Rate Structure Management	15%

- Optimum DO Set-point → Reduced Blower Energy
- Optimize mechanical mixing & bubble diffusion
- Upgrade from coarse bubble diffusion to fine bubble diffusion to increase the efficiency and reduce blower load
- Variable Frequency Drives to adjust speeds based on process needs in real time
- Control UV lamps with turbidity sensors
  - Optimizes the number or intensity of operating UV lamps
  - Upgrade to low-pressure high-output UV

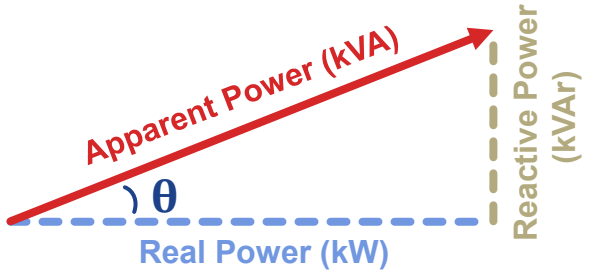
Opportunities- Median Energy Savings

Measure	Median Energy Savings (facility-wide/annual, unless otherwise noted)
PROCESS IMPROVEMENTS	
Ammonia-based Aeration Control (ABAC)	15%
Chemically-enhanced Primary Treatment (CEPT)	10%
Modifying System Operations Seasonally	25%
RESOURCE RECOVERY	
Anaerobic Digestion	25% (equivalent energy generation)
Combined Heat & Power (CHP)	38% (equivalent energy generation)
Heat Recovery	25% (equivalent energy generation)
Biosolids Energy Recovery	$500,000 (annual cost savings)
Inline Hydropower	25% (equivalent energy generation)
Onsite Water Reuse	30% (annual effluent flow diverted)

- Adjust digester mixing systems to use the minimum number of mixers possible for adequate mixing of influent and a high volume of gas
- Upgrade existing systems such as gas lance or draft tube systems to a linear motion mixing system

Power Factor Penalties

- **Power Factor (PF)** is inherent to systems supplied with AC power
- **PF** is a number between 0.0 and 1.0
- Instantaneous power has two parts:
  - Real Power (kW) – Does work!
  - Reactive Power (kVAr) – Does no work!
- Utilities penalize facilities with low **PF**
  - Must deliver extra **Apparent Power (S)**

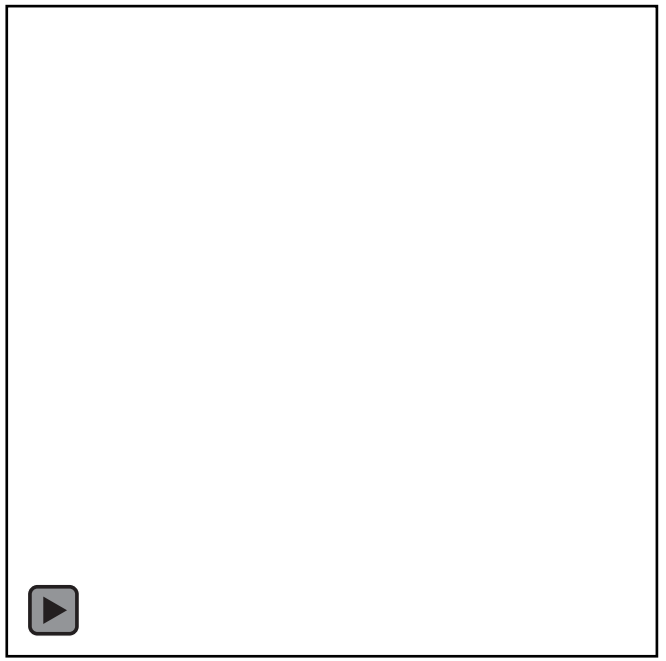


$$S = \sqrt{P_{avg}^2 + Q^2}$$

$$PF = \frac{P_{avg}}{S} = cos(\theta)$$

Example: 100 kW of Real Power

➢ Watch Apparent Power as PF decreases…



Managing Power Factor

- **Power Factor** is the ratio of real power (kW) to apparent power (kVA)
  - When the power factor is low, the apparent power is higher for the same amount of real power
  - Utilities often charge based on apparent power, so improving the power factor reduces the kVA demand.
- Power Factor Correction (PFC) System
  - Minimize costs associated with the switch to demand-based charges
  - Improves power factor and reduce monthly peak kVA demands
  - Reduction in Reactive Power Charges
    - Some utilities charge for reactive power (kVAR) separately or impose penalties for low power factors.
    - Installing a PFC system reduces the reactive power, which can eliminate these penalties or charges.
  - Improved Energy Efficiency
    - Reduces losses in the electrical system by minimizing the current flow.
    - Lower current flow means reduced losses in cables, transformers, and other electrical components, leading to better overall energy efficiency.
  - Increased Capacity
    - Electrical system can deliver more real power without increasing the current.
    - This means that existing infrastructure can handle more load without requiring upgrades, indirectly saving costs
  - Avoidance of Utility Penalties
    - Many utilities impose penalties for maintaining a power factor below a certain threshold (e.g., 0.90)

Power Factor Penalties

- PF is usually listed on your bills
- PF penalties are *rarely* listed directly on your bills
- Penalties depend on how you are billed for demand:

Billed for Real Power (kW)	Billed on Apparent Power (kVA)
PF Adjusted Demand $(AD) = RD \times \frac{PF_{req}}{PF}$	PF Penalty $= C_d \times (BD - RD)$
PF Penalty $= C_d \times (AD - RD)$	PF Penalty $= C_d \times BD \times (1 - PF)$
⚠ **Penalized only if PF ≤ PF_{req}**	✕ **Penalized for any PF < 1**

How Much Does Low PF Cost?

- Consider a facility whose average PF is 0.85 $(PF_{avg} = 0.85)$
- Utility requires a minimum PF of 0.95 $(PF_{req} = 0.95)$
- Demand cost is $8/kW with no ratchet clause $(C_d = \$8/kW)$
- Average billed demand is 2,000 kW $(BD_{avg} = 2{,}000\ kW)$

$$\text{Real Demand } (RD_{avg}) = BD_{avg} \times \frac{PF_{avg}}{PF_{req}} = 1{,}790\ kW$$

$$\text{PF Penalty} = C_d \times \left(BD_{avg} - RD_{avg}\right) \times 12 = \mathbf{\$20{,}160/yr}$$

How Do You Fix Low PF?

- Nearly all facilities have low PF because of large motors used in their production process
- Windings act as large inductors causing current lag
- Install capacitor banks to offset inductive loads
- Two types of capacitors:
  1) Static ($)
  2) Dynamic ($$)
- Fix baseload phase difference with static capacitors
- Fix remaining difference with dynamic capacitors

Wikimedia Commons

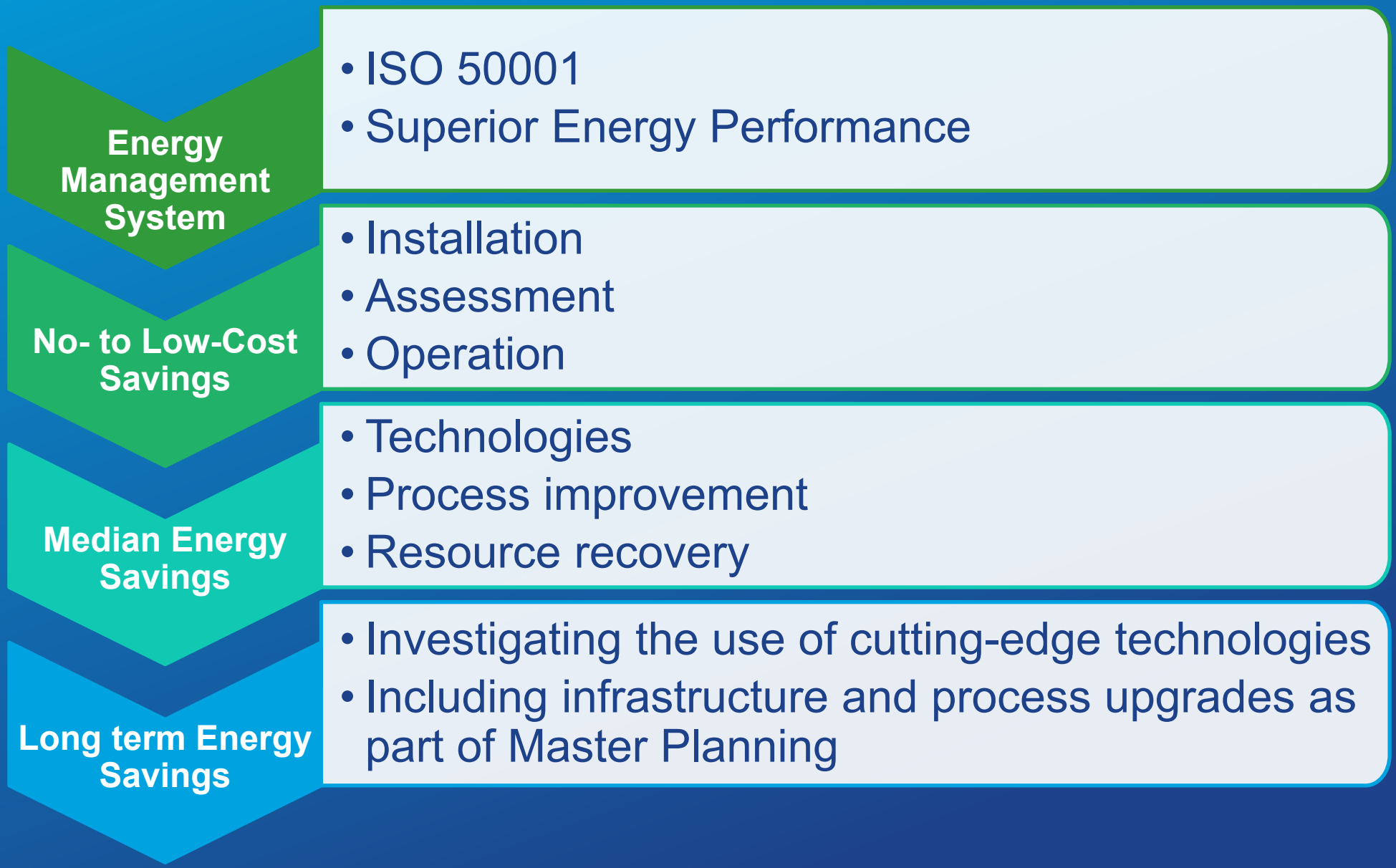
Pumping System Improvements

- Improve controls – to more efficiently deliver the required output
- Modify pumps – to better match the required conditions
- Replace or upgrade equipment – use more efficient technology or more suitable equipment
- Re-design the system – to minimize friction losses, static pressure or required flow rate

Secondary Improvements: Optimize Return Activated Sludge (RAS) Flow Rate

- Purpose of RAS is to re-seed incoming sewage with the activated sludge biomass needed for treatment
- RAS is pumped from the bottom of clarifiers to the bioreactors
  - mixing and aeration of biomass with influent sewage takes place
- Higher RAS rate = higher microbial activity = higher air consumption = higher energy consumption
- To minimize the required RAS pumping rate while ensuring sufficient microbial activity to treatment C and N

Wrapping Up Energy Efficiency



Zoom Poll
Technology Queries

Break

Tools to Evaluate Energy and Efficiency Measures

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DOE Industrial Software Tools

Help energy and sustainability teams identify opportunities for energy and emission savings in their operations.

Energy Systems

MEASUR
Electrification for Decarbonization
Compressed Air Scoping Tool

Energy Management

VERIFI
50001 Ready Navigator
Energy Footprint Tool
Plant Energy Profiler
Implementation Guidance Toolkit

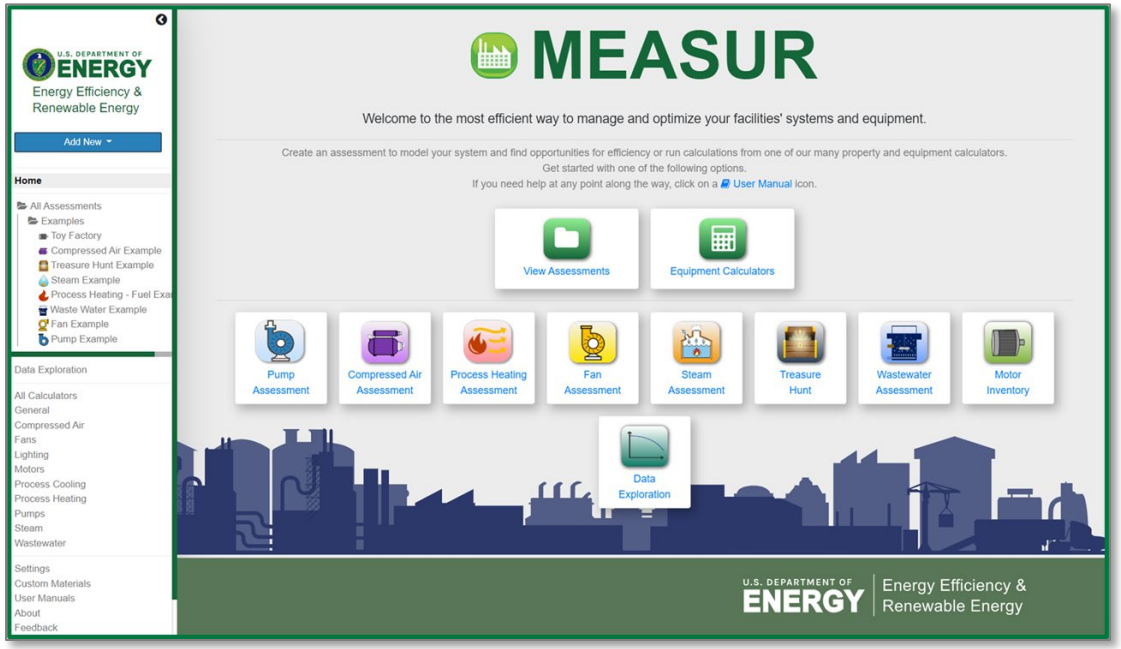
Carbon, Water, & Waste

Plant Water Profiler
Plant Carbon Footprint &
Decarbonization Assessment Tool
Carbon Emissions Calculator
Waste Stream Energy Content

MEASUR

Helps identify, assess, and quantify energy savings and decarbonization opportunities in their manufacturing operations and energy support systems.

- Energy savings analysis
  - Open source
  - Cross-platform tool
  - Technology and vender agnostic
- Key User Features
  - Similar workflow for all assessment modules
  - Graphs & Figures!
  - Easy unit system switching and translation functionality
  - Accessible help text and examples



Find this tool at
https://measur.ornl.gov
https://www.energy.gov/eere/amo/measur

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MEASUR

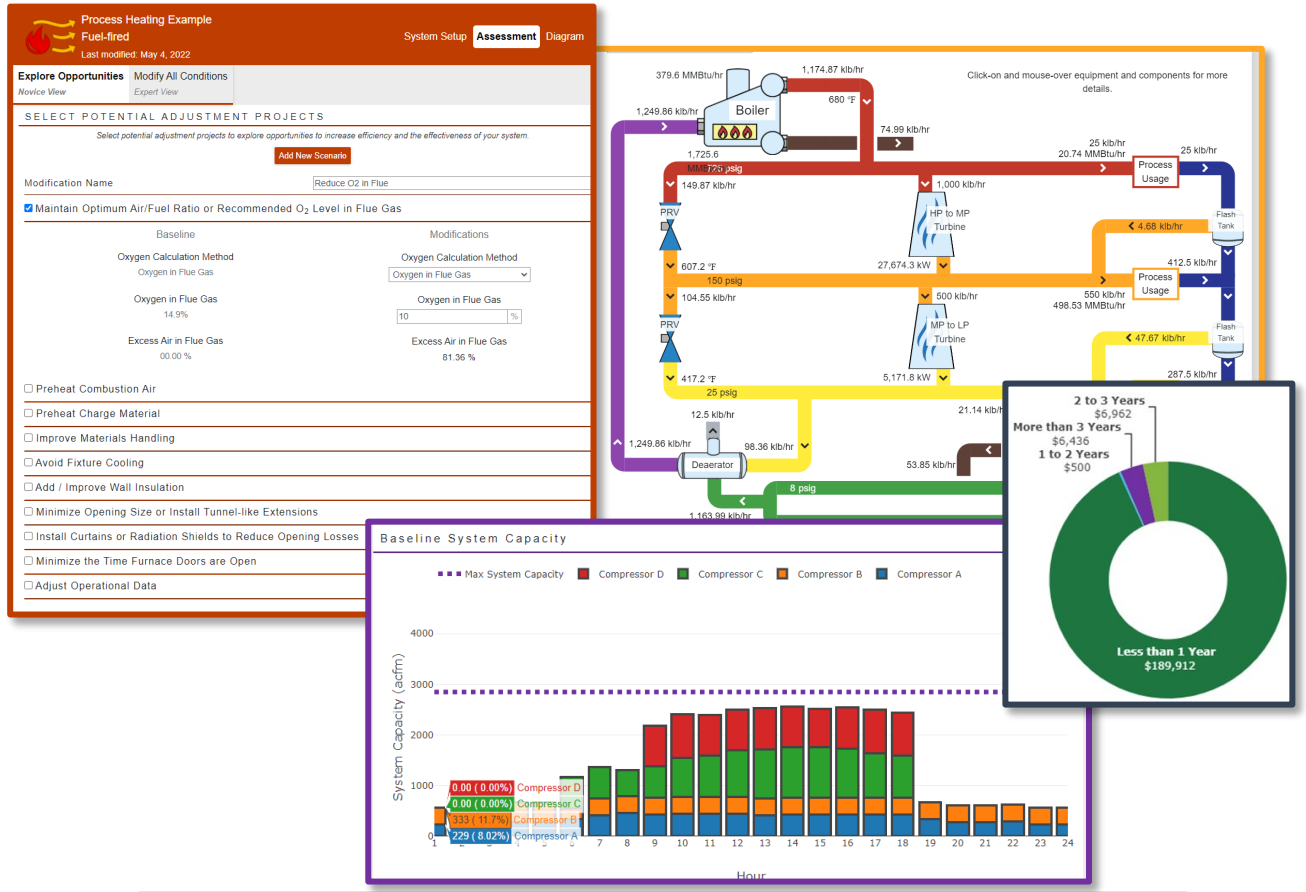
Has 7 industrial system assessment modules, plus equipment inventory and data analysis modules, and over 70 standalone calculators!

Assessment Modules

- Pumps, Fans, Process Heating, **Compressed Air,** Steam, **Wastewater**, and Treasure Hunt
- Baseline and What-if Analyses (Novice & Expert Views)
- Explore energy, cost, and **carbon emissions** impact of projects

Other Modules

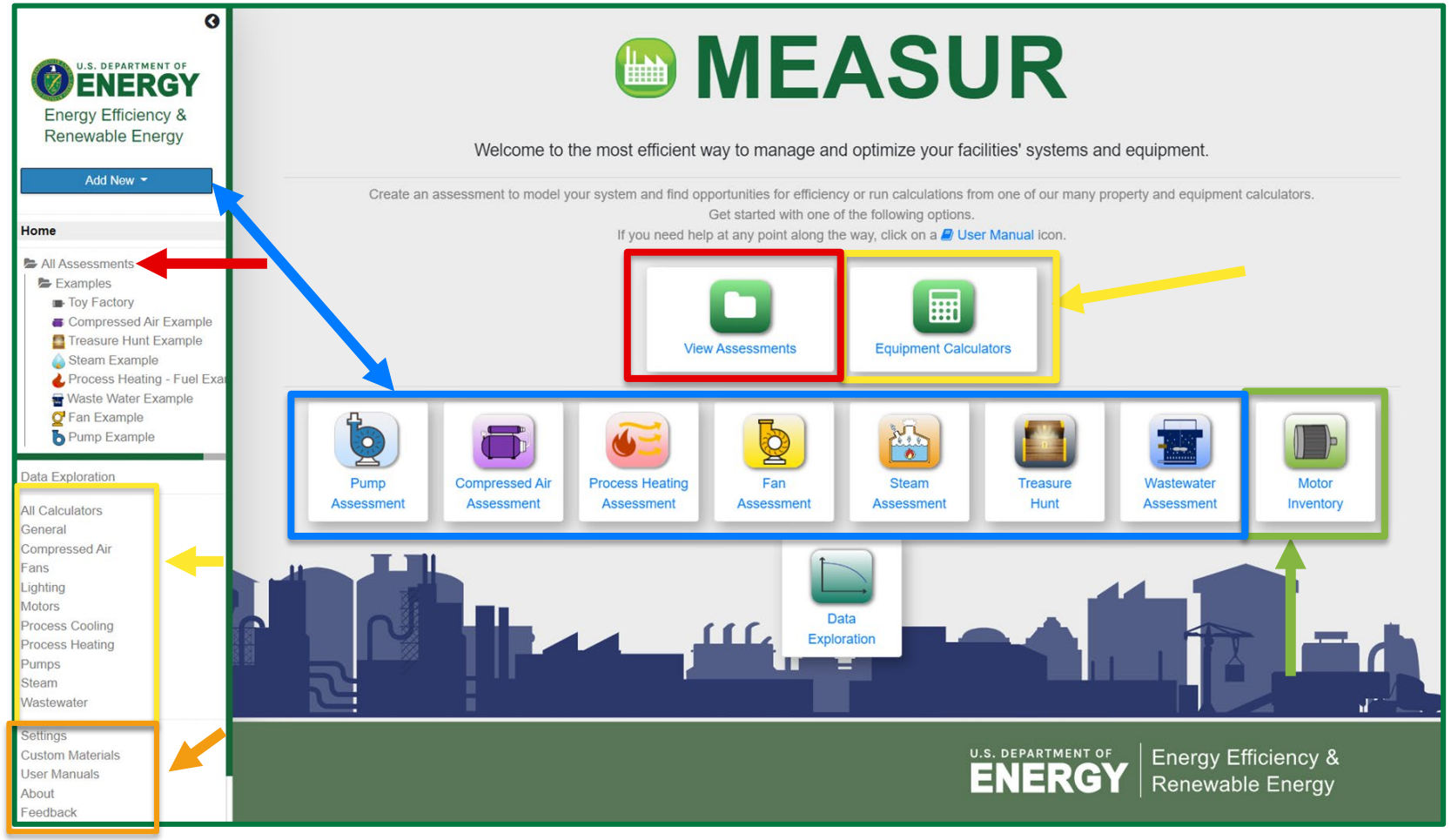
- **Motor Inventory** (others coming soon)
- **Data Analysis** (day type & visual analyses)



Find this tool at
https://measur.ornl.gov
https://www.energy.gov/eere/amo/measur

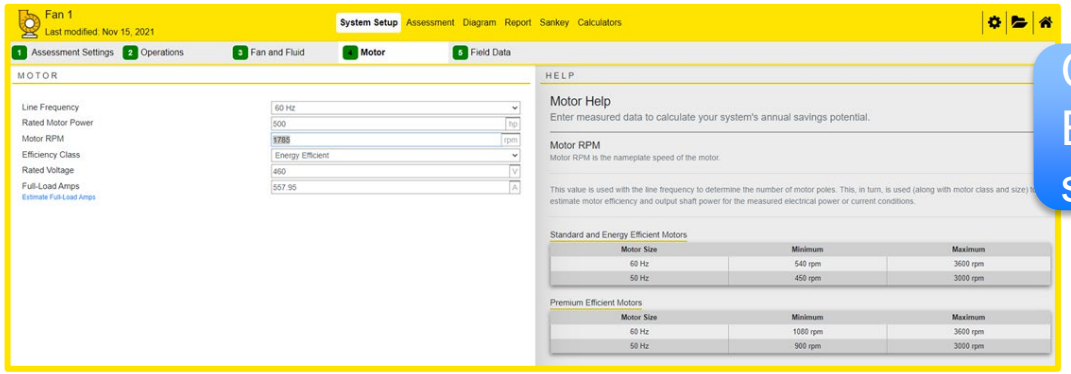
MEASUR – Getting Started

- Start an assessment
- Create an inventory
- View Assessment Dashboard
- Use Properties & Equipment Calculators
- Help and User Experience
  - Change Settings
  - View Tutorials
  - Manage Custom Materials
  - Provide Feedback
  - Translate



Clearing your browser cache DELETES online assessments

MEASUR - Assessments

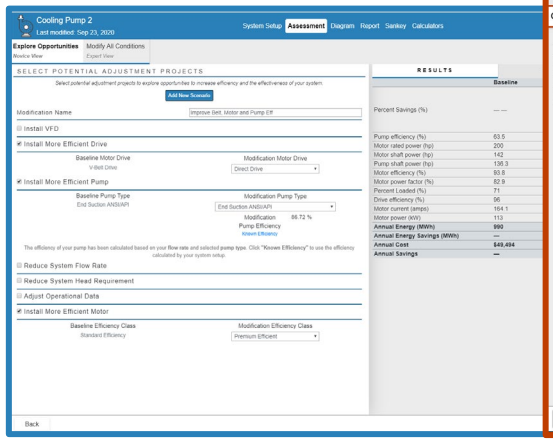


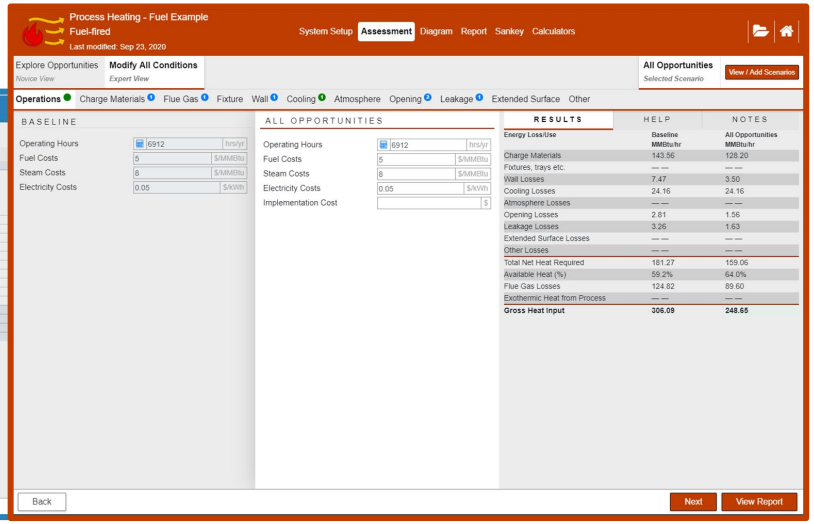
Create a baseline
Enter data about current system setup

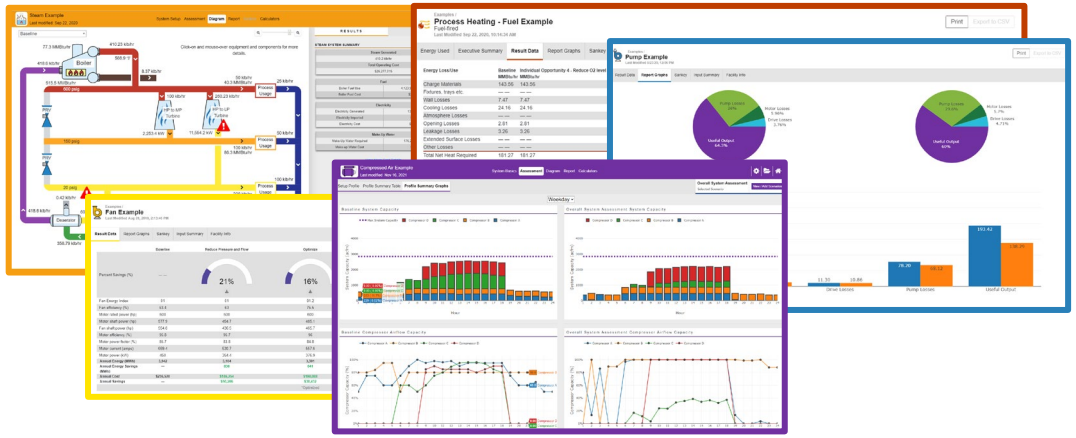
1

Create an assessment
Modify key variables to create What-if scenarios and compare

2







Review Results

3

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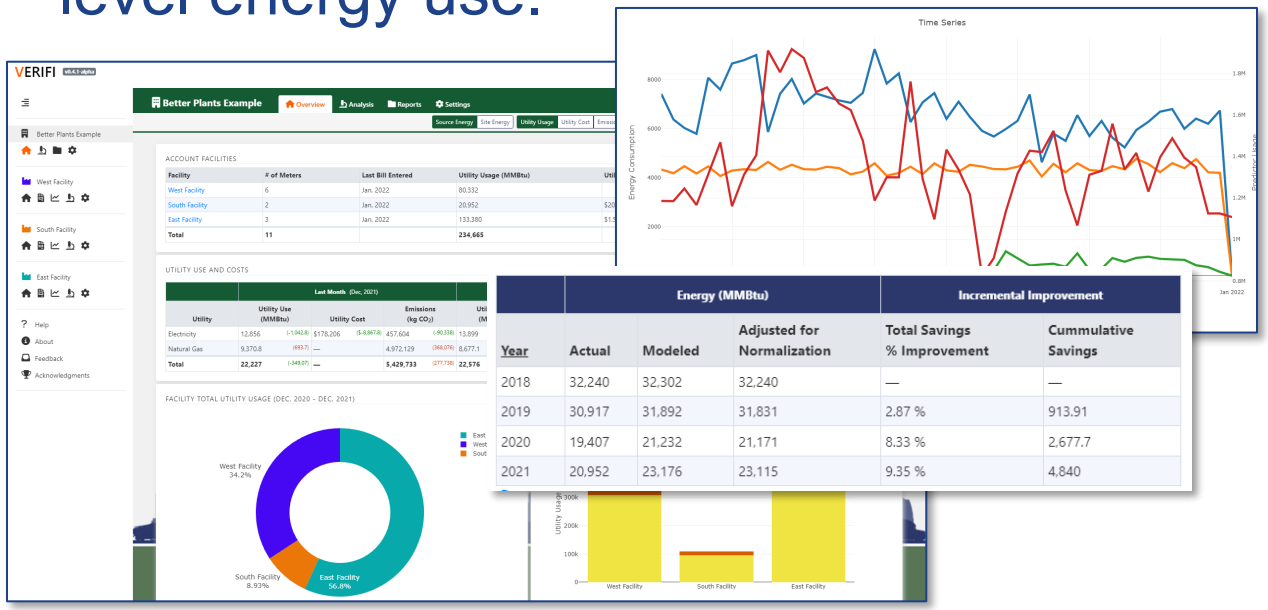
MEASUR - Calculators

- 70+ Stand alone Calculators
  - Motors
  - Pumps
  - Fans
  - Process Heating
  - Process Cooling
  - Steam
  - Compressed Air
  - Lighting
  - General
- Most have graphical results

VERIFI

- Corporate and facility-level views
- Enter utility bills and see total energy use in a new way
  - Calendarization of energy data
  - Annual cost, energy use, and limited carbon emissions overview
- Analyze your data and generate a Better Plants Annual Reporting Form or other custom reports
- Available for “Beta” testing
  - Will replace EnPI tool and other DOE facility-level utility analysis tools
  - Updates currently about every two weeks
  - Updates may impact functioning of existing data

Will help energy management and decarbonization teams track and understand their facility and corporate level energy use.



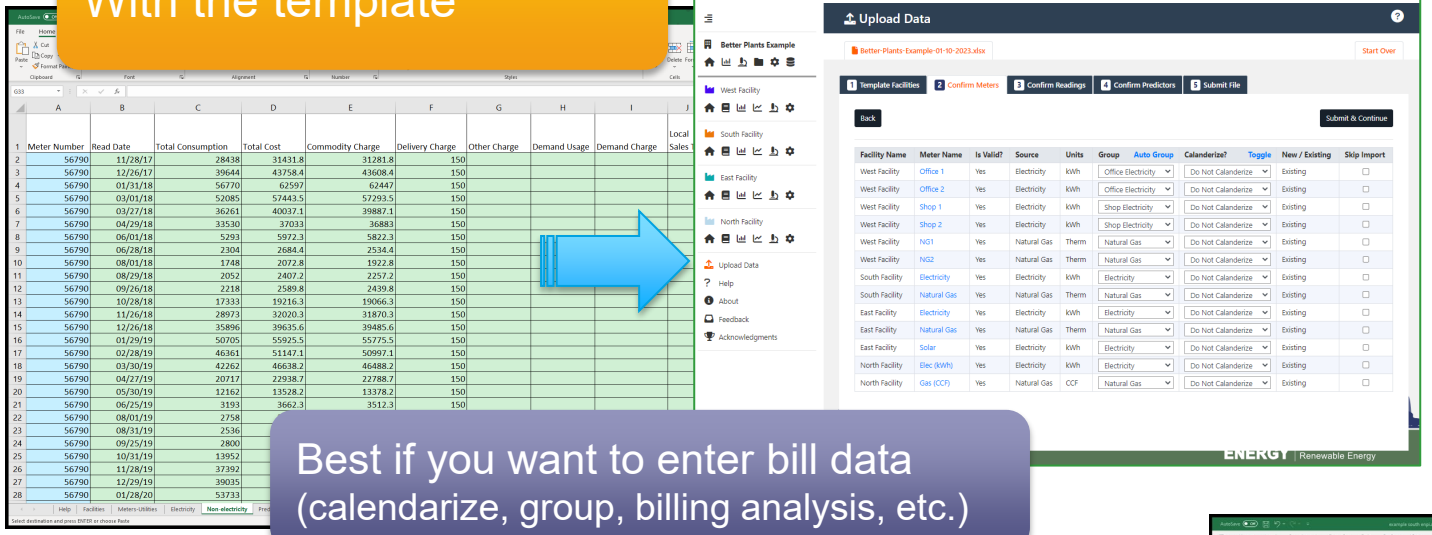
Find this tool at
https://verifi.ornl.gov/
https://github.com/ORNL-AMO/VERIFI/releases

Clearing your browser cache DELETES online data

VERIFI – Entering Data

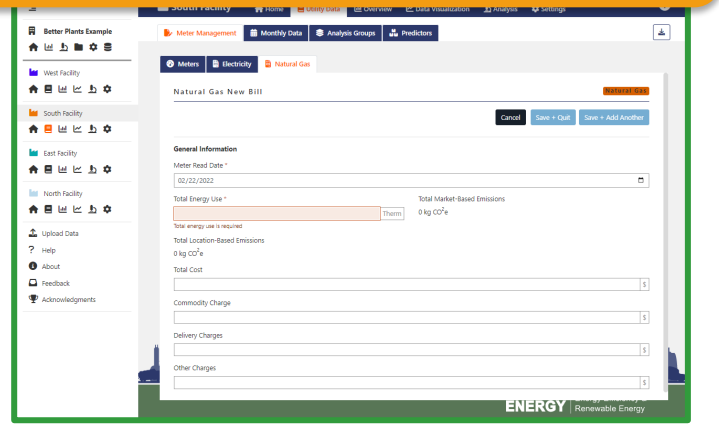
There are several ways to enter data into VERIFI

With the template

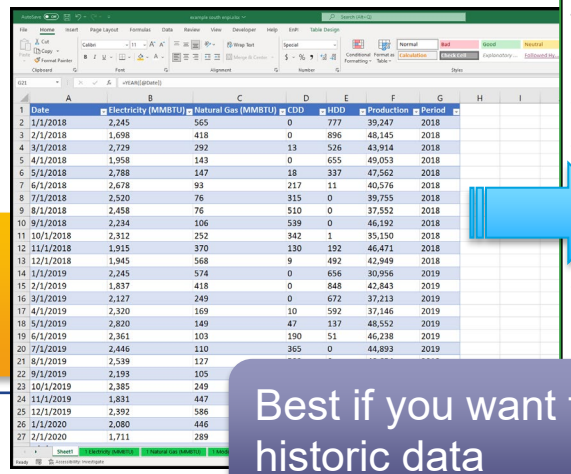


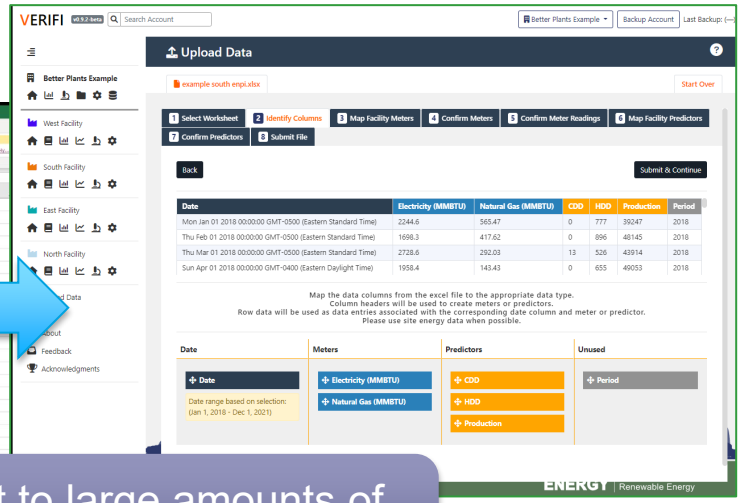
Best if you want to enter bill data
(calendarize, group, billing analysis, etc.)

Enter each bill individually
(best when maintaining)



Directly enter old EnPI files





Best if you want to large amounts of historic data

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VERIFI – Savings Analysis

1 Setup basic info

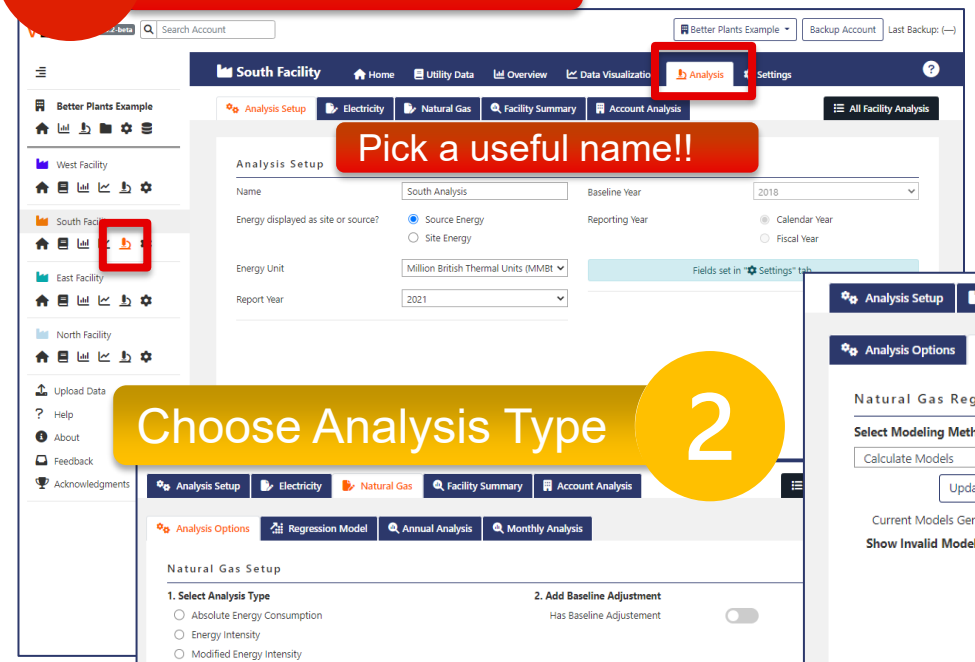
Pick a useful name!!

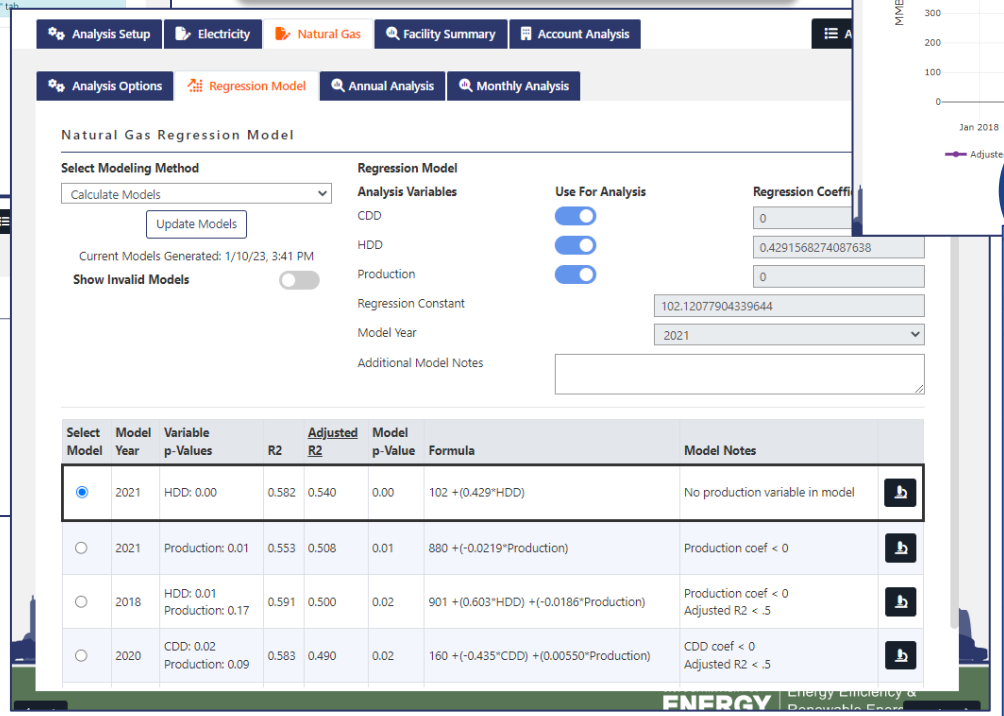
2 Choose Analysis Type

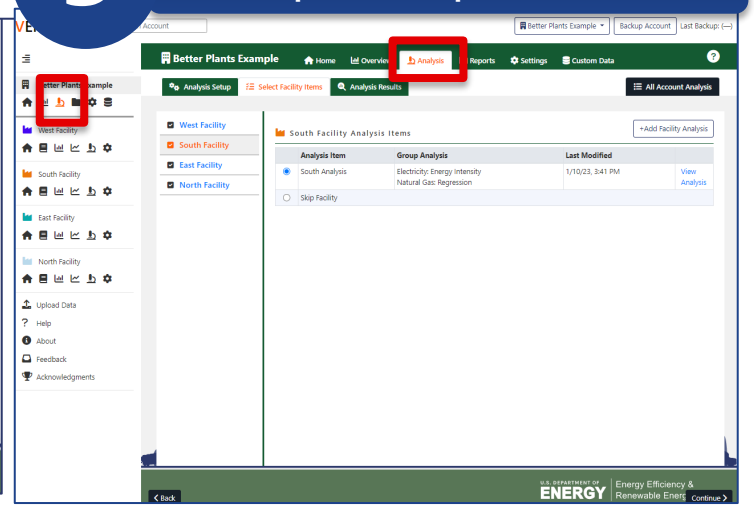
3 Regression made easy!

4 View results!

5 Roll up to corporate level!







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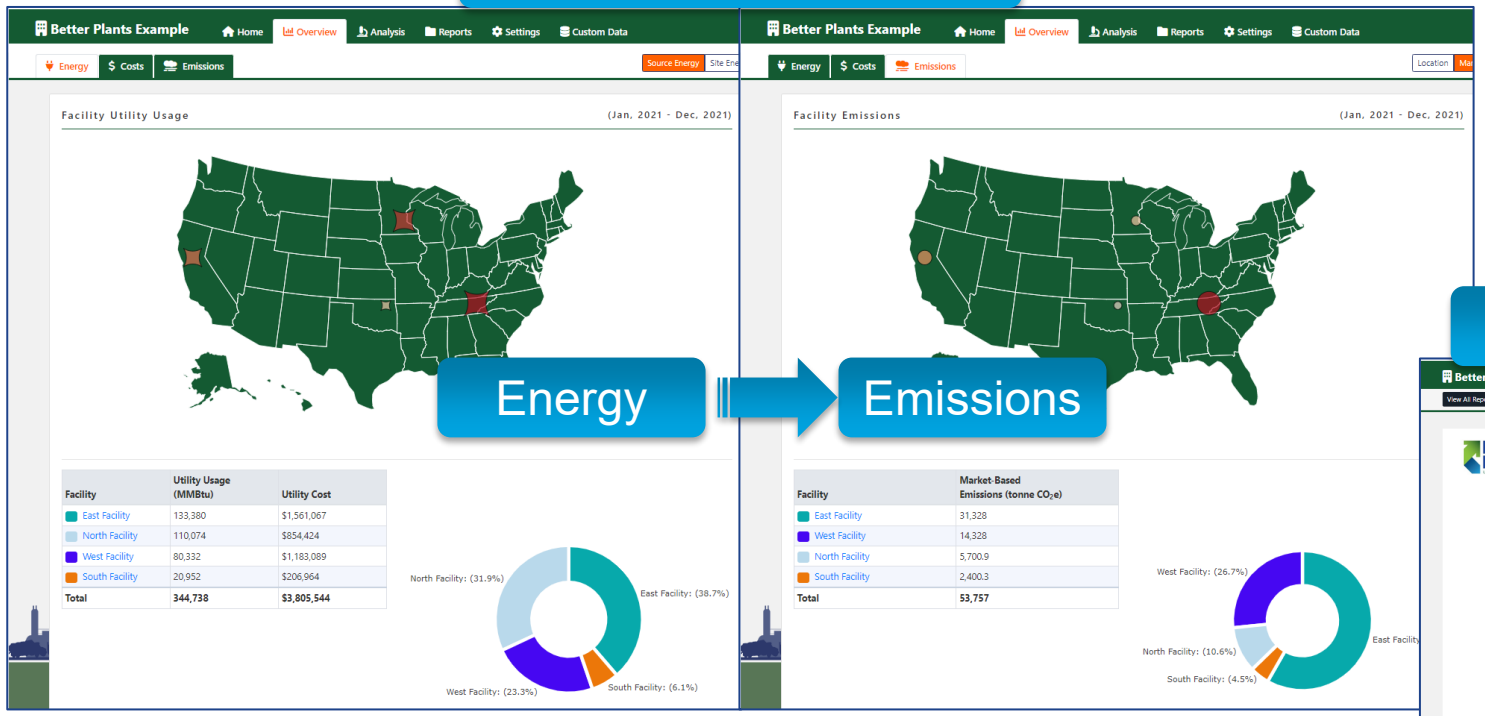
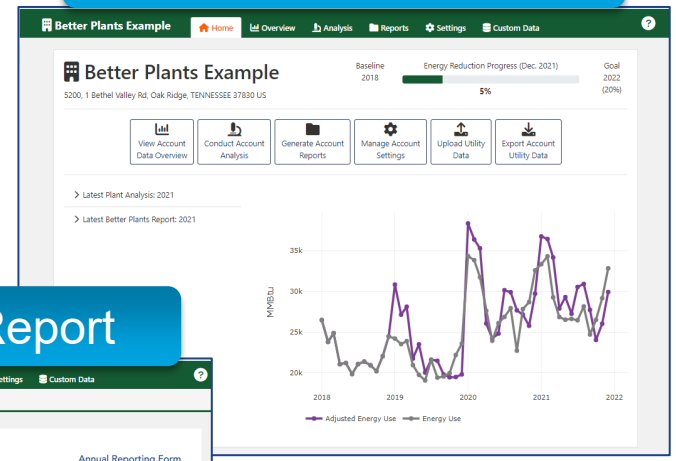
VERIFI – Dashboards & Reports

Overview Dashboard



Home Dashboard



Better Plants Report

- Several Dashboards & Reports to help keep an eye on energy, costs, and decarbonization efforts

More Features & Reports to come!!!

Plant Energy Footprint Tool

- Helps commercial and industrial facilities understand their energy consumption
  - Track energy consumption
  - Track relevant variables affecting energy consumption
  - Identify significant energy users
  - Discover trends and learn where to focus your efficiency efforts
  - Requires MS Excel and enabling macros

Find this tool at
https://www.energy.gov/eere/amo/articles/energy-footprint-tool

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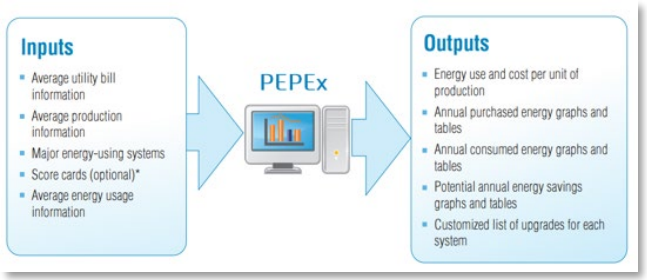
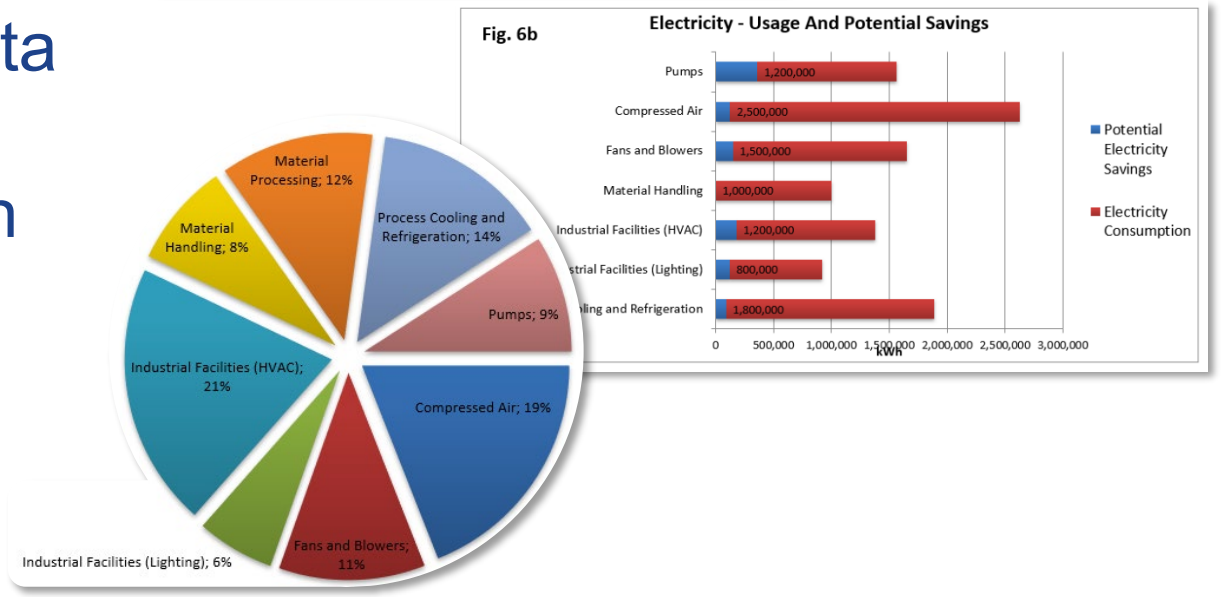
Plant Energy Profiler Tool (PEPEx)

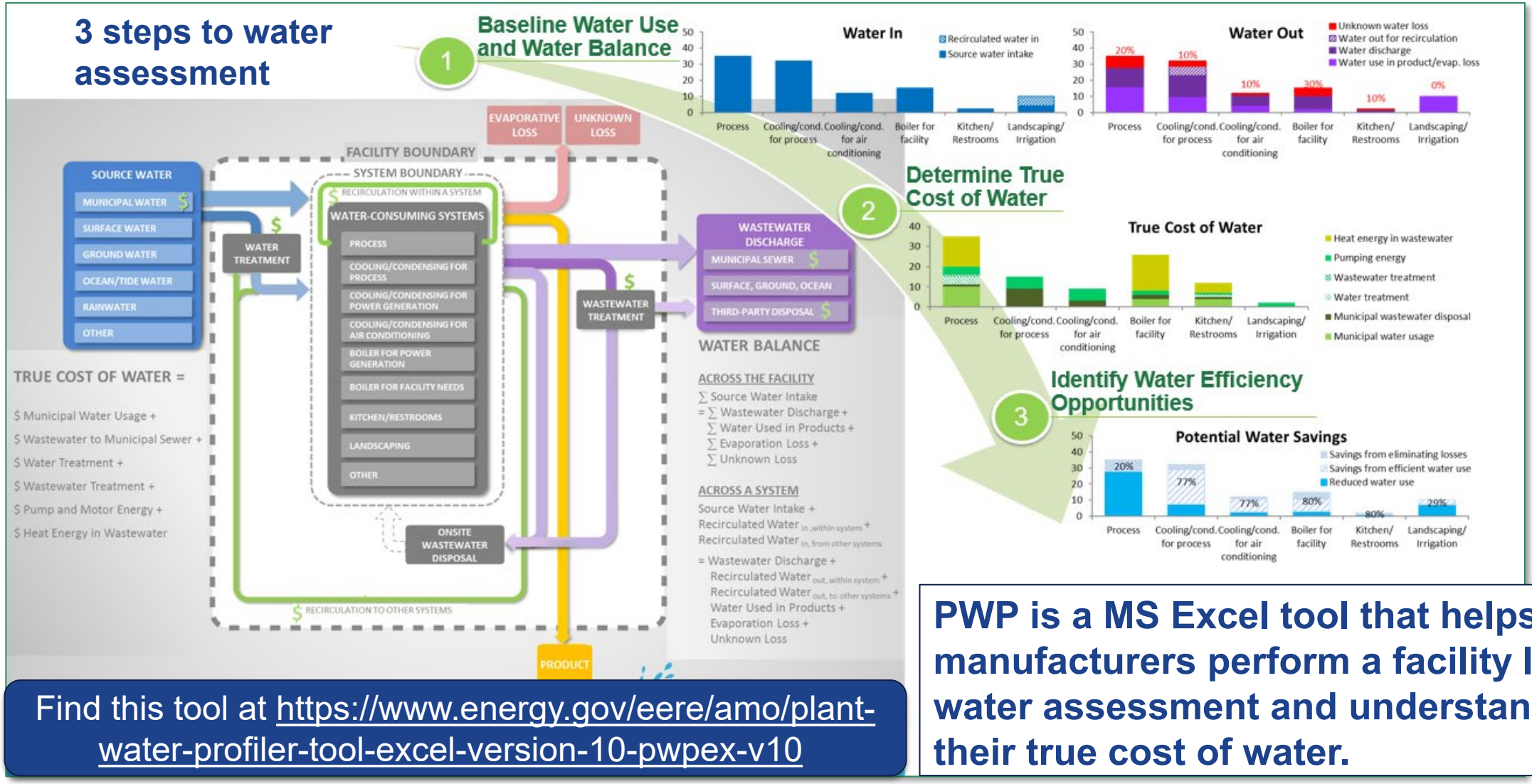
- Identify how much energy is being purchased and consumed and identify and quantify potential energy and cost savings
- Enter basic energy & production data
- System scorecards
- Energy use and costs by production and system
- Energy & cost savings estimates
- List of energy savings measures
- MS Excel-based tool





Find this tool at
https://www.energy.gov/eere/amo/downloads/plant-energy-profiler-excel

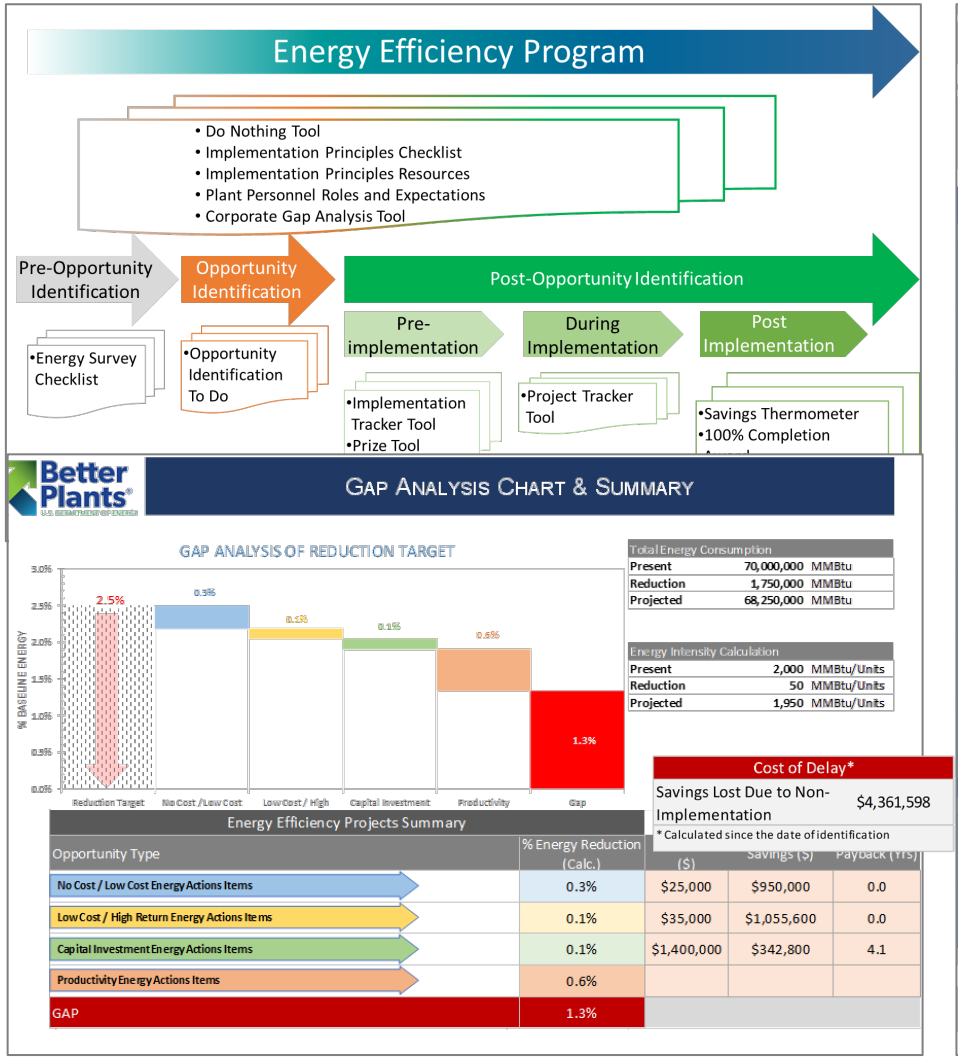
Plant Water Profiler Tool (PWP)

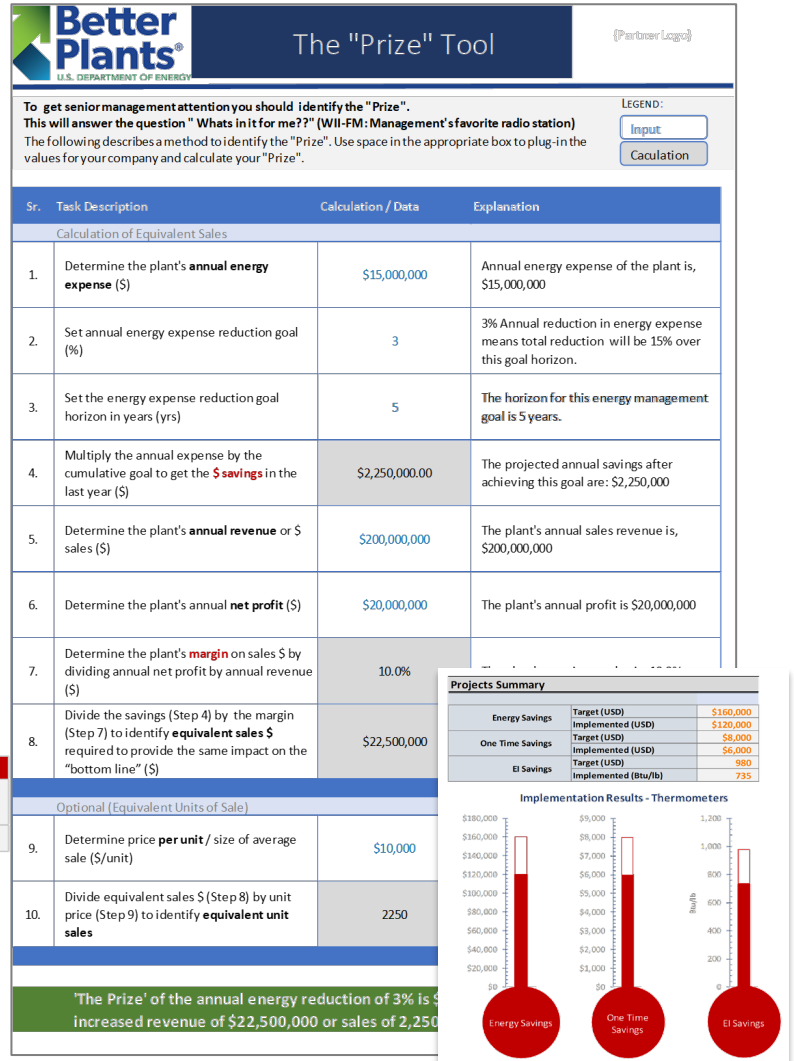


Find this tool at https://www.energy.gov/eere/amo/plant-water-profiler-tool-excel-version-10-pwpex-v10

PWP is a MS Excel tool that helps manufacturers perform a facility level water assessment and understand their true cost of water.

Implementation Guidance Toolkit



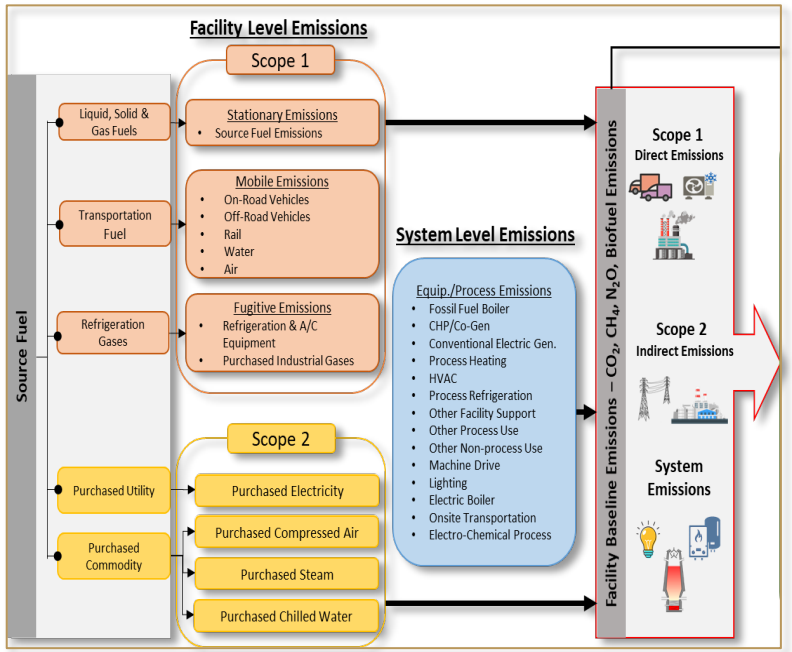


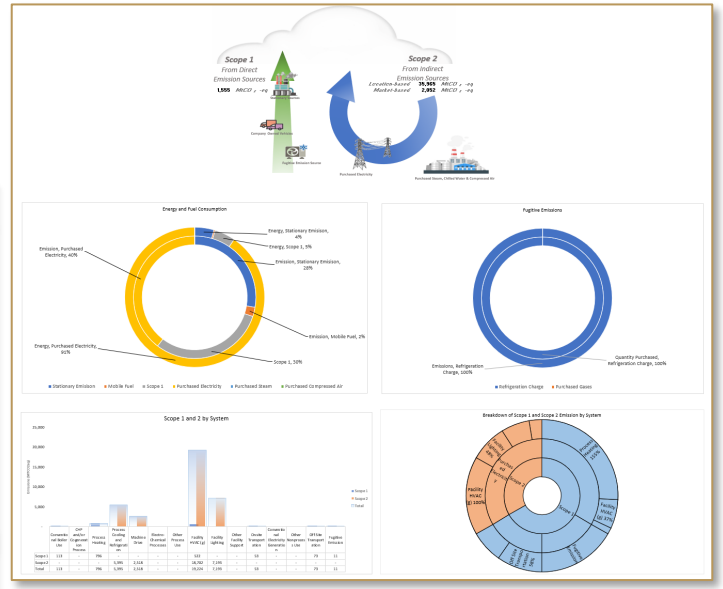
- Collection of tools to help projects implementation and communicate success
- 15 different MS Excel tools focused on different stages of implementation
  - Program level
  - Pre-identification
  - During Identification
  - Post-identification
- Tools to justify projects, track implementation progress, conduct GAP analysis to focus implementation efforts

Find this tool at https://betterbuildingssolutioncenter.energy.gov/better-plants/implementation-guidance-toolkit

Plant Carbon Footprint and Decarbonization Assessment Tool

- Enables users to create and analyze baseline emissions for facility and at system level
- Scope 1 –
  - Stationary, Mobile & Fugitive
- Scope 2 –
  - Purchased Electricity (Location & Market based),
  - Other Purchased Utilities (steam, chilled water, compressed air)
- Future Updates
  - Provide users the ability to evaluate decarbonization scenarios and perform techno-economic analyses
- MS Excel-based tool





Find this tool at https://energyefficiency.ornl.gov/tools-training/

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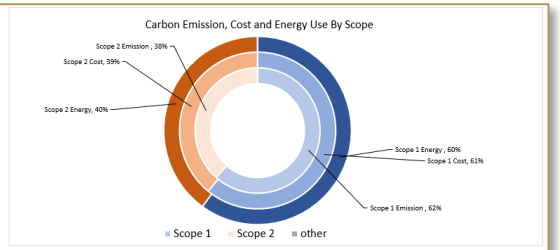
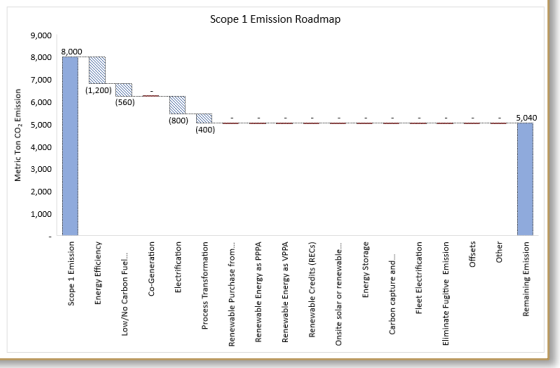
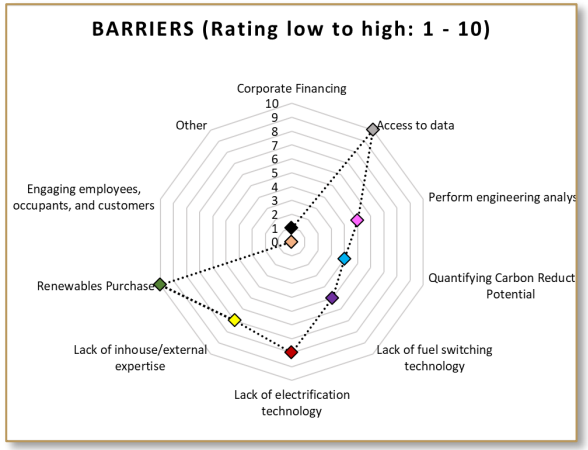
Decarbonization Action Plan Tool

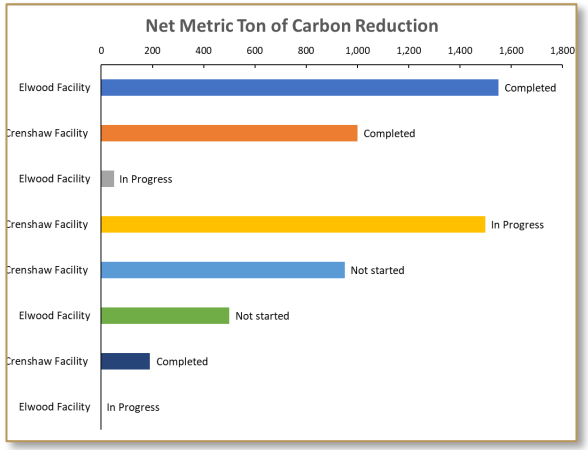
Showcase Plant Name	Elwood Facility			
Scope of Emission	Description	Energy Source (MMBTU)	Energy Cost ($)	CO_{2eq} Emission (Metric Ton)
Scope 1 Emission		15,000	7,000	8,000
Stationary Emission		15,000	7,000	8,000
Natural Gas		15,000	7,000	8,000
Mobile Emission		-	-	-
Fugitive Emission				
Scope 2 Emission		10,000	4,500	5,000
Purchased Electricity		10,000	4,500	5,000
Other				

Pillars of Decarbonization	Opportunity	Barrier	Scope 1 % Carbon Reduction	Scope 2 % Carbon Reduction
Energy Efficiency			15%	30%
Low/No Carbon Fuel Switching			7%	
Co-Generation				
Electrification			10%	-20%
Process Transformation			5%	
Renewable Purchase from Utility				10%
Renewable Energy as PPPA				15%
Renewable Energy as VPPA				
Renewable Credits (RECs)				30%
Onsite solar or renewable energy generation				20%
Energy Storage				
Carbon capture and sequestration				
Fleet Electrification				









Aids industrial partners in visualization of Scope 1 and Scope 2 emissions at corporate and facility level.

- Outline corporate and facility level decarbonization roadmap
- Identify barriers faced on their journey to low carbon future
- MS Excel-based tool

Find this tool at https://energyefficiency.ornl.gov/tools-training/

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Upcoming SWIFt Resources

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New Additions: Wastewater Energy Management Toolkit

Based on the work done during SWIFt, these new documents, tools, and resources are designed to support wastewater facilities beyond SWIFt's time.

To learn more or access available SWIFt recordings and material go to:
https://bptraining.ornl.gov/swift/

Advanced Energy Conservation and Resource Recovery Upgrades Implementation Strategies

Wastewater Technical Reports

Energy Capture, Energy Efficiency, Advanced Data Management, and Resource Recovery

Decarbonization Roadmap for WRRF

50001 Ready Strategic Energy Management Sample Plan

Wastewater Treatment Energy Management Data Tool

Opportunities for Wastewater Facilities

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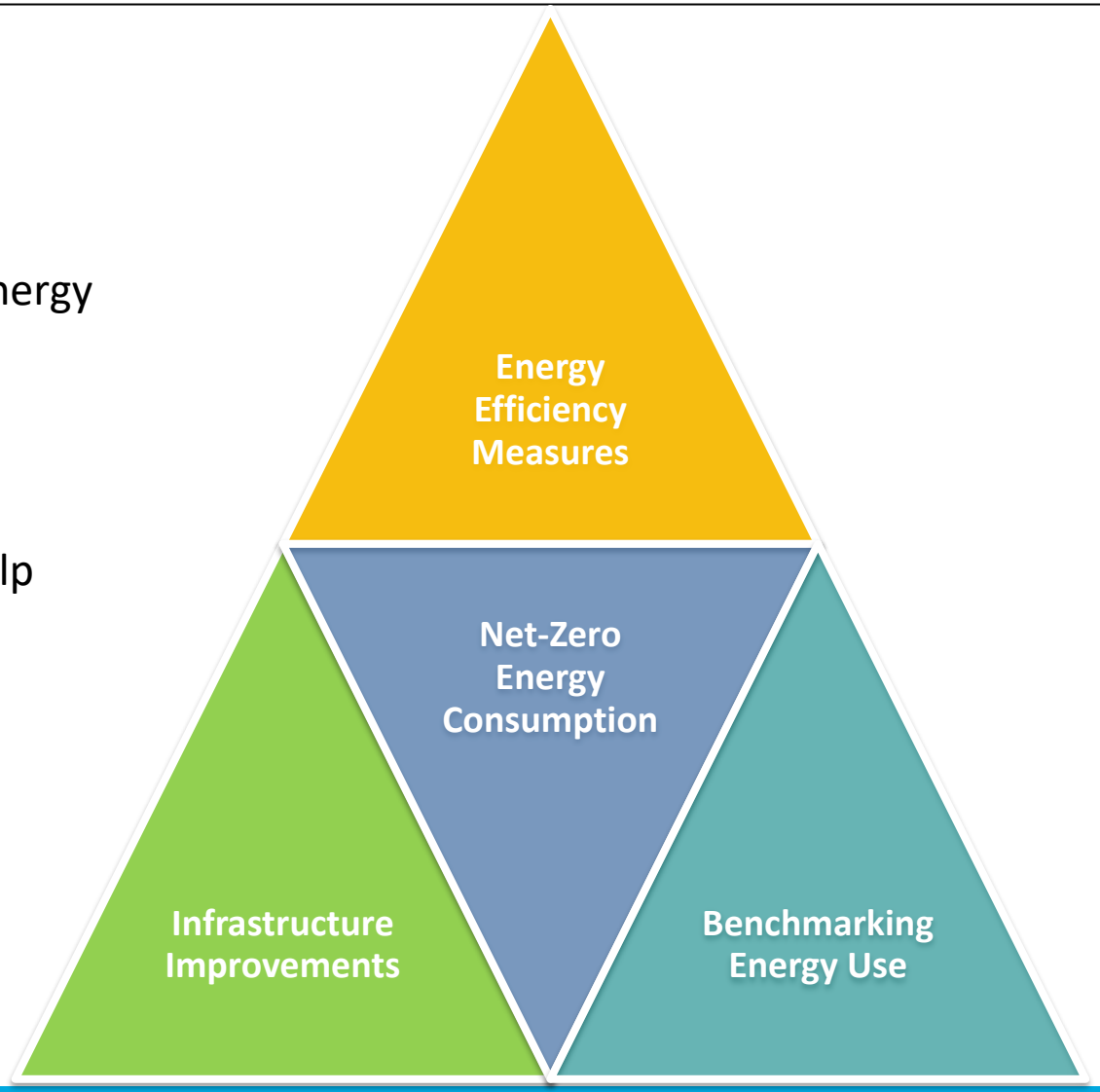
Net-Zero Energy VIPLNT Series

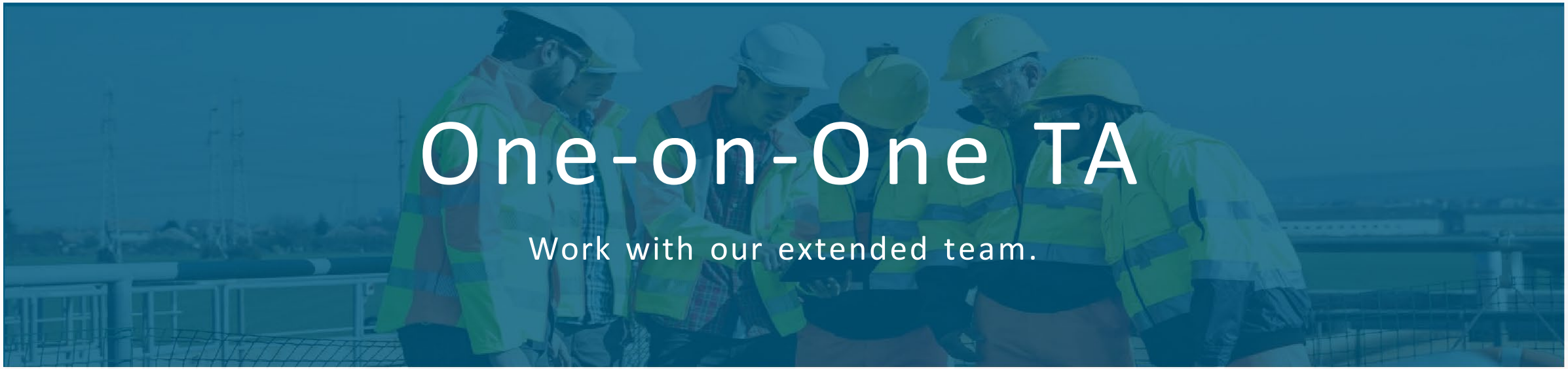
Launching this Fall *2024*

Designed to help wastewater treatment facilities achieve net-zero energy consumption through energy efficiency measures, infrastructure improvements, and benchmarking energy use.

This series will operate with the intention of helping wastewater treatment facilities realize tangible changes and developments to help their facility achieve energy neutrality.

The VIPLNT series will host sessions with subject-matter experts and provide opportunities for peer-exchange and engagement.





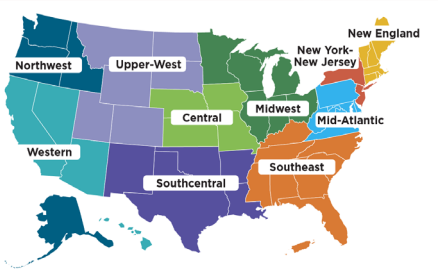
One-on-One TA

Work with our extended team.

Industrial Assessment Center
U.S. DEPARTMENT OF ENERGY

Industrial Assessment Centers

Free assessment that identifies energy saving recommendations. IACs typically identify more than $130,000 in potential annual savings opportunities.



Onsite Energy TAPs

As leading experts in CHP (as well as microgrids, heat to power, and district energy) Onsite Energy TAPs work with sites to screen for CHP opportunities as well as provide advanced services to maximize the economic impact.

WNTR
Water Network Tool for Resilience

Wastewater Infrastructure Resilience

Provides systems level modeling which integrates network structure, operations, and performance to quantify how utilities are impacted by disruptions.

Continuing on with DOE's Better Plants Program

Voluntary and free to participate

Partners set long-term strategic goals

DOE works with you to achieve your goal

Why Partner with Better Plants?

1

Technical Assistance

3

Peer-to-Peer Networking Opportunities

National Recognition

2

Access to DOE and National Lab R&D

4

Wastewater Specific Partners

If you are interested in joining Better Plants, please visit [Join | Better Buildings Initiative (energy.gov)]

Or reach out to betterplants@ee.doe.gov

Thank You for Joining

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Questions?

Follow us on Twitter
@BetterBldgsDOE

Better Buildings Solution Center
https://betterbuildingssolutioncenter.energy.gov/

General Inquiries
stateandlocal@ee.doe.gov

Program Support
sharman@ornl.gov
lemarpl@ornl.gov

Thank you for joining us!
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Oak Ridge National Laboratory
sharman@ornl.gov