

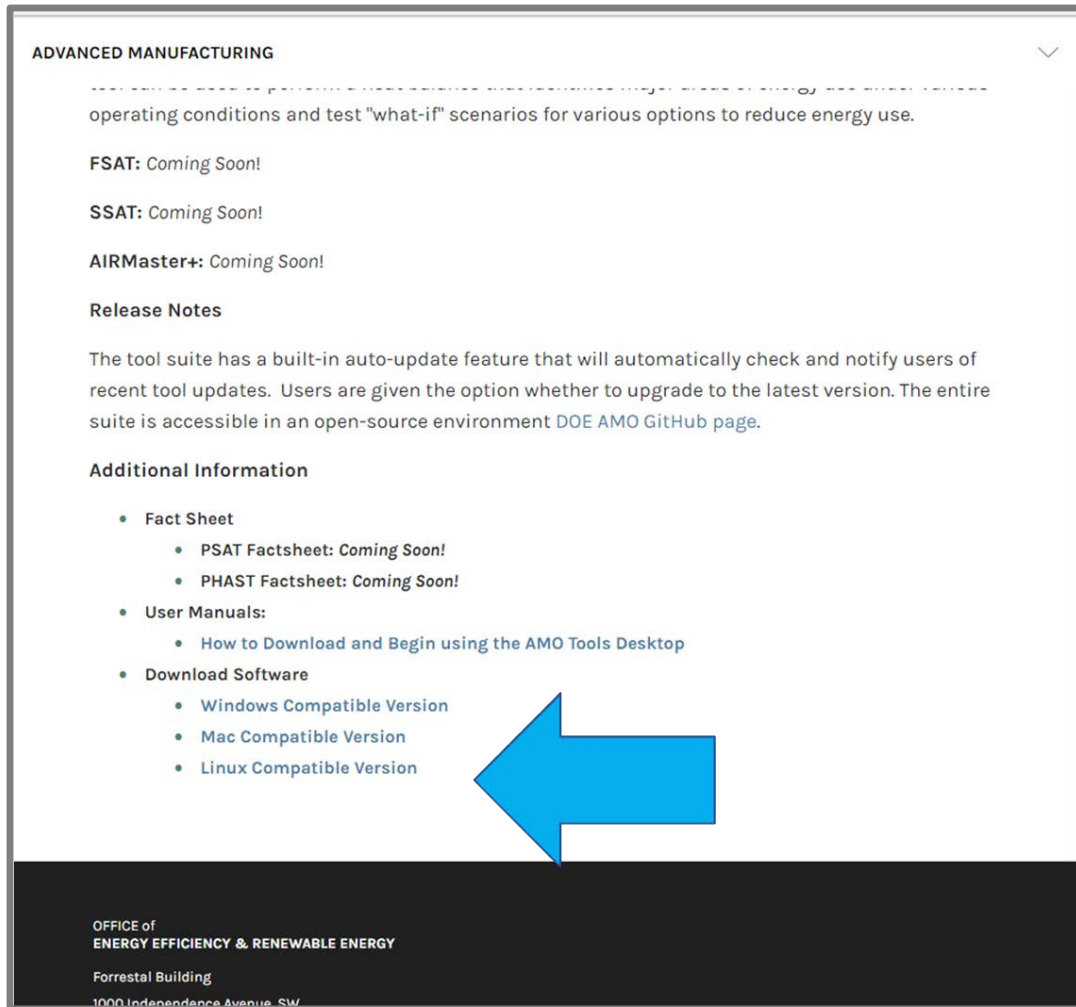


How to Download and Begin using MEASUR:

The Manufacturing Energy Assessment Software
for Utility Reduction

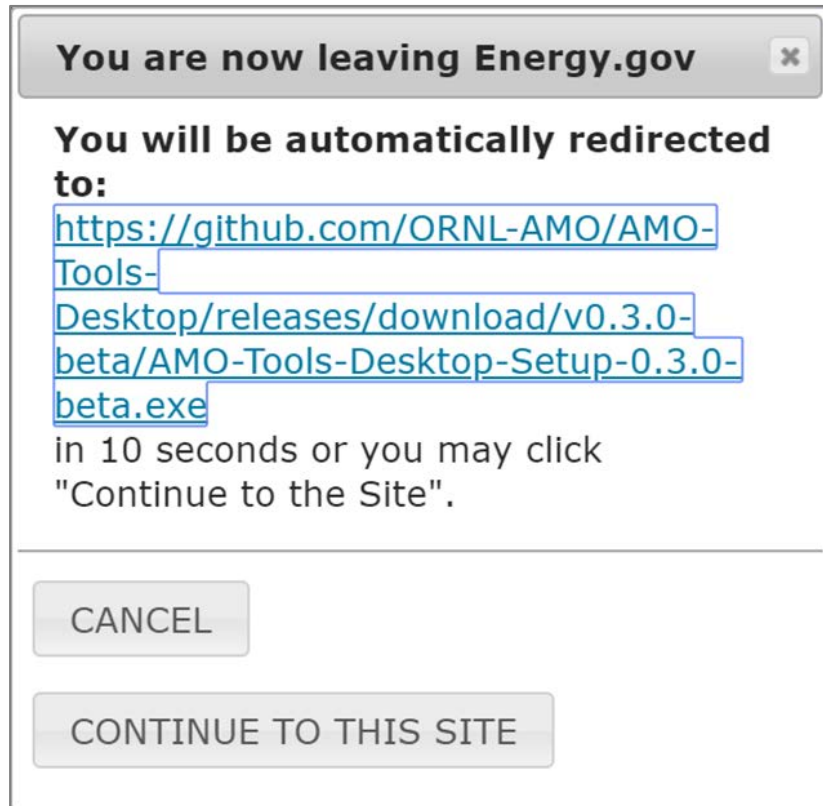


Download via DOE-EERE- AMO website



- <https://www.energy.gov/eere/amo/measur>
- Includes overview of the effort to reprogram our legacy tools
- Scroll to the bottom to find and download your version

Download via DOE-EERE- AMO website

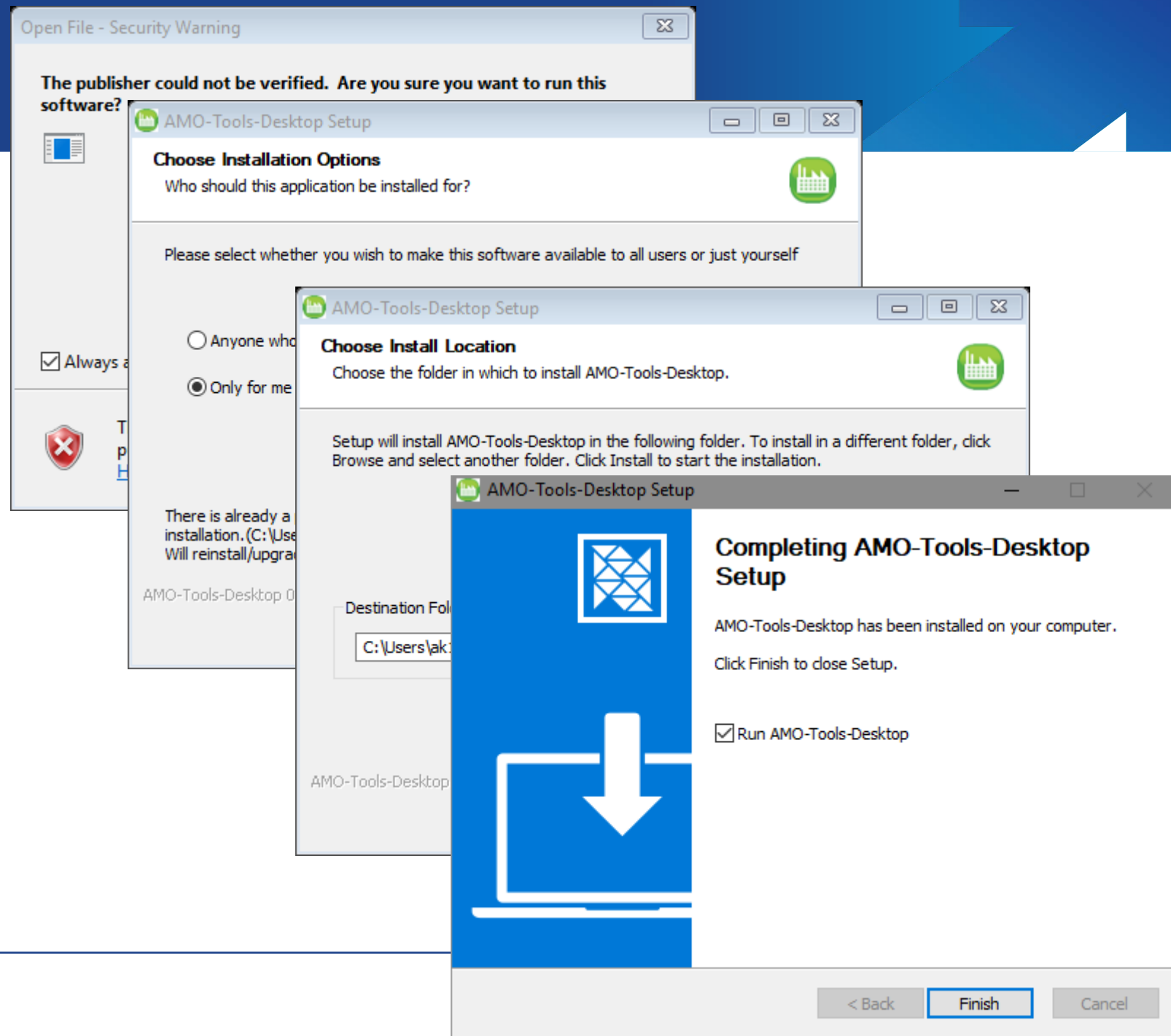


- This message will appear indicating that the file you are downloading is hosted on another website.
- That web site is GitHub, the common repository for software applications and is perfectly safe.



Download

- Click the file extension that matches your operating system
- Open the download
- Click “Run”
- Follow the instructions for the Installation Wizard
- If updating via the webpage DO NOT uninstall first

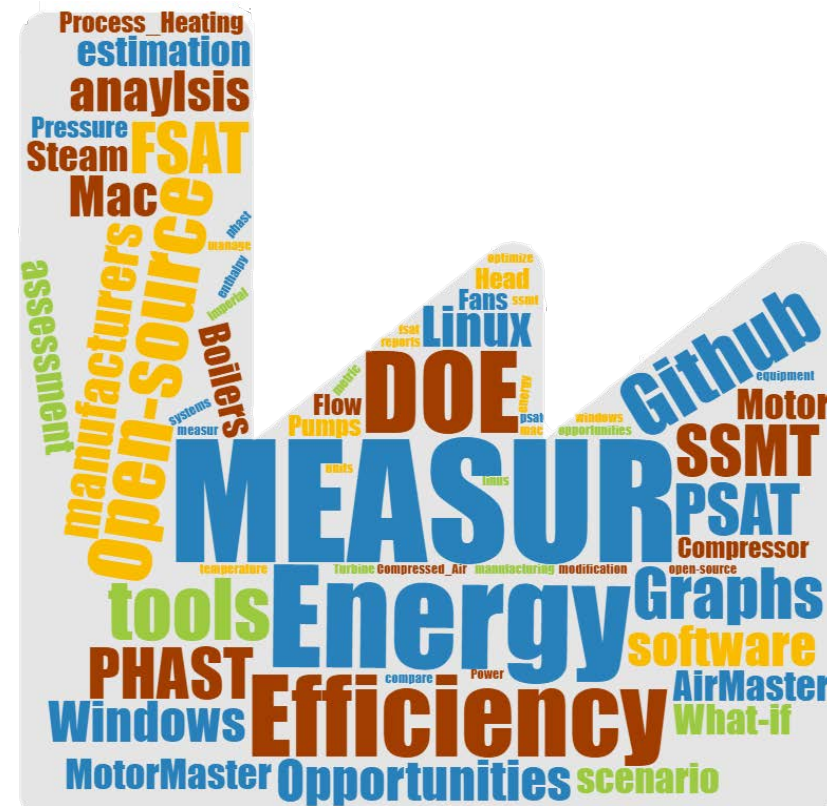


Updating

- This Tool is in beta, so we are constantly upgrading it and publishing releases fairly often.
- After installation, if an update becomes available, a popup will appear at startup to notify you.
 - You can choose to update right away, or you can wait.
 - If for some reason this does not happen, you can download from the AMO Tools Download Center
- **DO NOT UNINSTALL** before updating, you will lose ALL your assessments.

MEASUR Demo

Using 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

The screenshot displays the MEASUR web application interface. The top left features the U.S. Department of Energy logo and the text "Energy Efficiency & Renewable Energy". Below this is a sidebar with navigation links: "Home", "All Assessments", "Examples", "Plant B", "Data Exploration", "All Calculators", "Motors", "Process Cooling", "Pumps", "Fans", "Process Heating", "Steam", "Compressed Air", "Lighting", "General", "Settings", "Custom Materials", "Tutorials", "About", "Feedback", "Acknowledgments", "Translate", and "v0.8.0-beta". The main content area is titled "MEASUR" and includes a welcome message: "Welcome to the most efficient way to manage and optimize your facilities' systems and equipment." Below this, it says "Create an assessment to model your system and find opportunities for efficiency or run calculations from one of our many property and equipment calculators. Get started with one of the following options." The interface is divided into three main sections: "Create Assessment" (left), "Properties & Equipment Calculators" (middle), and "Inventory Management" (right). The "Create Assessment" section lists five options: "Create Pump Assessment" (formerly DOE Pumping System Assessment Tool (PSAT)), "Create Process Heating Assessment" (formerly DOE Process Heating Assessment and Survey Tool (PHAST)), "Create Fan Assessment" (formerly DOE Fan System Assessment Tool (FSAT)), "Create Steam Assessment" (formerly DOE Steam System Modeler Tool (SSMT)), and "Create Treasure Hunt" (Energy efficiency calculators for facilitating a Treasure Hunt). The "Properties & Equipment Calculators" section lists six categories: "Motors", "Process Cooling", "Pumps", "Fans", "Process Heating", "Steam", "Compressed Air", "Lighting", and "General". The "Inventory Management" section includes a link to "Create Motor Inventory" (based on DOE's MotorMaster+ tool). A red arrow points from the "Add Assessment" button in the sidebar to the "Create Assessment" section. A yellow arrow points from the "All Calculators" link in the sidebar to the "Properties & Equipment Calculators" section. A green arrow points from the "Settings" link in the sidebar to the "Inventory Management" section. A blue arrow points from the "Home" link in the sidebar to the "Create Assessment" section. A red arrow points from the "View All Your Assessments" link at the bottom to the "All Assessments" link in the sidebar.

Settings

- Set global units & utility costs
- Change language
 - MUST be connected to internet
- Turn on/off Tutorials
- Clear Data

General Settings

These will be default settings for any new assessments and folders.

Language [Translate Application Using Google Translate](#)

Currency

Units of Measure ☒ Imperial ☐ Metric

Energy Result Unit

Default Panel Tab ☒ Results ☐ Help

Energy Costs for Operation

Fuel	<input type="text" value="3.99"/>	<input type="text" value="\$/MMBtu"/>
Steam (as utility)	<input type="text" value="4.69"/>	<input type="text" value="\$/klb"/>
Electricity	<input type="text" value="0.066"/>	<input type="text" value="\$/kWh"/>
Compressed Air (as utility)	<input type="text" value="0.022"/>	<input type="text" value="\$/SCF"/>
Other Fuel	<input type="text" value="0"/>	<input type="text" value="\$/MMBtu"/>
Water	<input type="text" value="0"/>	<input type="text" value="\$/gal"/>
Waste Water	<input type="text" value="0"/>	<input type="text" value="\$/gal"/>

Pump Settings

Process Heating Settings

Fan Settings

Steam Settings

Tutorial Settings

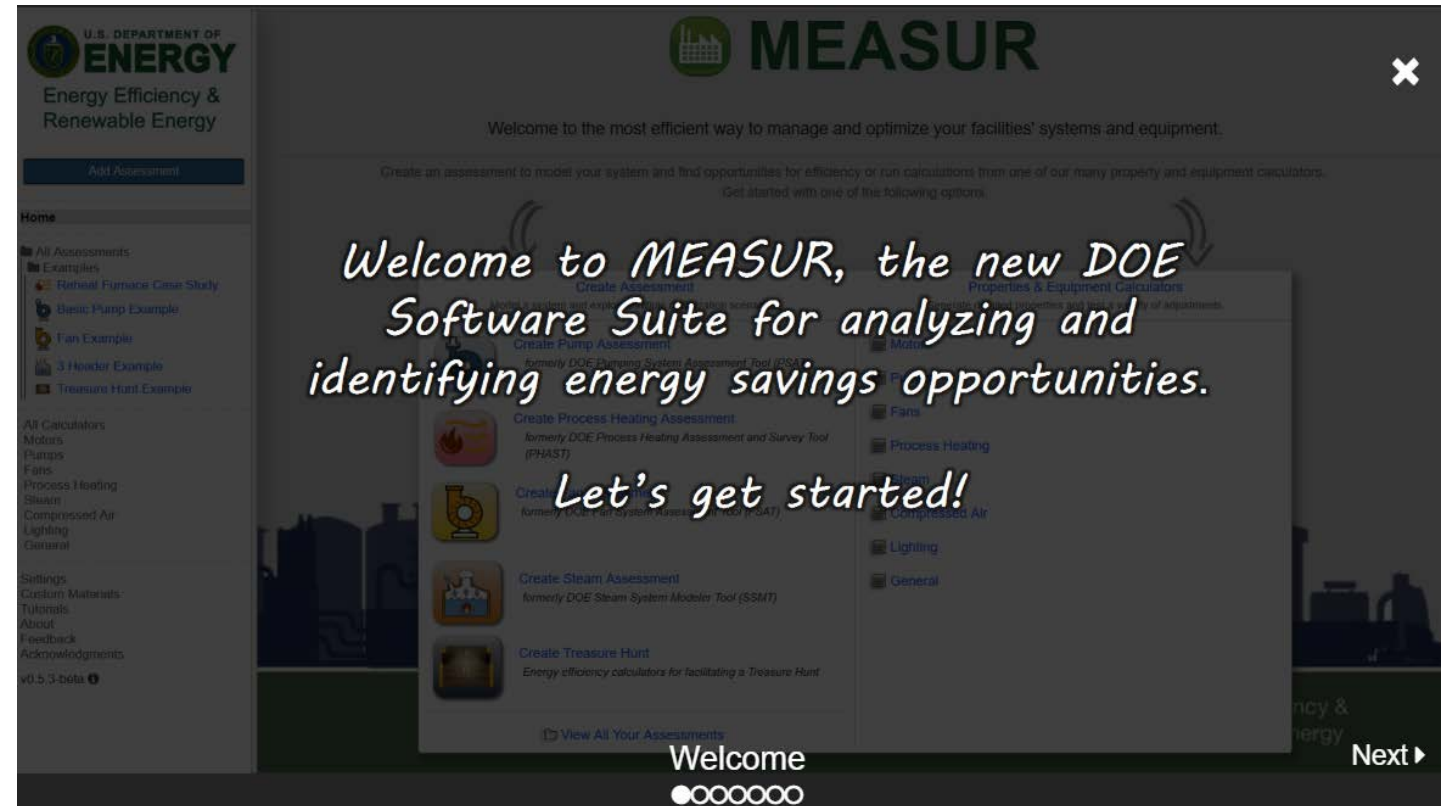
Restore System Settings

Restoring system settings will provide options for resetting all application settings to their default values, returning all example assessments to their original state, deleting all user-created assessments/pre-assessments, and deleting all user-created materials. **This cannot be undone!**

Restore System Settings

Tutorials & Feedback

- View all Tutorials
- Let us know if you like MEASUR!
 - [Survey](#)
- Bug Reporting
 - Email
 - accawigk@ornl.gov
 - armstrongko@ornl.gov
 - Download full Data set
 - This will help us identify the problem
 - Screenshots please



Dashboard - Overview

View all your assessments in a folder-based organization

U.S. DEPARTMENT OF ENERGY
Energy Efficiency & Renewable Energy

Navigation Sidebar:

- Home
- All Assessments
- Examples
- Plant B
 - Plant B Motors
 - Electric Arc Furnace
 - Pusher Furnace
 - Reheat Furnace
 - HVAC Fan
 - Coal Dryer
 - Process Pump 1
 - Cooling Pump 2
 - Cooling Pump 1
- Data Exploration
- All Calculators
 - Motors
 - Process Cooling
 - Pumps
 - Fans
 - Process Heating
 - Steam
 - Compressed Air
 - Lighting
 - General
- Settings
 - Custom Materials
 - Tutorials
 - About
 - Feedback
 - Acknowledgments
 - Translate
- v0.8.0-beta

Top Navigation Bar:

- Sort By: Last Updated
- Filter
- Grid View
- Buttons: Add Assessment, Add Pre-Assessment, Add Folder, Add Inventory, Generate Report, Delete, Export, Import

PLANT B INFO

Company: A Company | Facility: Plant B | Date: 9/16/2020

PLANT B SUMMARY

Type	Assessments	Annual Energy Used	Annual Energy Cost
Pumps	3	6,508.68 MWh	\$373,614.00
Process Heating	3	2,753,210 MMBtu	\$21,766,724.55
Fans	2	15,659.6 MWh	\$939,573.03
Steam	0	0.00000 MMBtu	\$0.00
Total	8	2,753,210 MMBtu	\$23,079,911.58

PLANT B PRE-ASSESSMENT

Add Pre-Assessment / Screening

No Pre-Assessment found for this facility.

PLANT B SETTINGS

Units of Measure	Imperial
Fuel Cost	\$3.99 /MMBtu
Steam Cost	\$4.69 /MMBtu
Electricity Cost	\$0.07 /kWh

Assessment Details:

- PLANT B MOTORS**
 - Inventory Summary: Number of Departments: 2, Number of Motors: 10, Annual Energy Use: 13,706,283 kWh/yr, Annual Energy Cost: \$904,615
 - Analysis: Payback Threshold: 2 yrs, Replace Now: 1, Replace When Fail: 0, Rewind When Fail: 8
 - Last updated Sep 22, 2020
- ELECTRIC ARC FURNACE**
 - Furnace Type: Electric Arc Furnace (EAF)
 - Baseline Data: Annual Energy Use: 165,017,656 kWh, Annual Energy Costs: \$10,891,165
 - Modification Data: Number of Modifications: 3
 - Actions: Equipment Setup, Assessment, Assessment Report, Quick Report
 - Last updated Sep 17, 2020
- PUSHER FURNACE**
 - Furnace Type: Pusher Furnace
 - Baseline Data: Annual Energy Use: 74,450 MMBtu, Annual Energy Costs: \$297,056
 - Modification Data: Number of Modifications: 4, Max Energy Savings: 31,415 MMBtu, Max Cost Savings: \$125,348
 - Actions: Fan Setup, Assessment
 - Last updated Sep 16, 2020
- REHEAT FURNACE**
 - Furnace Type: Reheat Furnace
 - Baseline Data: Annual Energy Use: 2,115,701 MMBtu, Annual Energy Costs: \$10,578,503
 - Modification Data: Number of Modifications: 5, Max Energy Savings: 396,998 MMBtu, Max Cost Savings: \$1,984,992
 - Actions: Fan Setup, Assessment
 - Last updated Sep 16, 2020
- HVAC FAN**
 - Baseline Data: Annual Energy Use: 3,942 MWh, Annual Energy Costs: \$236,520
 - Modification Data: Number of Modifications: 4, Max Energy Savings: 856 MWh, Max Cost Savings: \$51,376
 - Actions: Fan Setup, Assessment
 - Last updated Sep 16, 2020
- COAL DRYER**
 - Baseline Data: Annual Energy Use: 11,718 MWh, Annual Energy Costs: \$703,053
- PROCESS PUMP 1**
 - Baseline Data: Annual Energy Use: 4,818 MWh, Annual Energy Costs: \$289,080
- COOLING PUMP 2**
 - Baseline Data: Annual Energy Use: 990 MWh, Annual Energy Costs: \$49,454

- ➡ Move, copy, import and export assessments
- ➡ Add/view facility information and folder-wide settings
- ➡ Make pre-assessment screenings
- ➡ Generate rollup reports of several assessments
- ➡ Add New Assessment
- ➡ Add New Inventory

Dashboard – Folders are Facilities

The Dashboard is designed to treat each folder like a facility or business unit

Dashboard interface for Plant B:

Sort By: Last Updated | Filter | [Icons]

Buttons: Add Assessment, Add Pre-Assessment, Add Folder, Add Inventory, Generate Report, Select all folder content, Delete, Export, Import

PLANT B INFO

Company	A Company	Facility	Plant B	Date	9/16/2020
Assessment Contact	K. Armstrong	Facility Contact	S. Body	Address	789 A Street, Anytown, TN 37830, USA
	armstrongko@ornl.gov		sbody@companyA.com		

[Hide Details](#) | [Edit Info](#)

PLANT B SUMMARY

Type	Assessments	Annual Energy Used	Annual Energy Cost
Pumps	3	6,508.68 MWh	\$373,614.00
Process Heating	3	2,753,210 MMBtu	\$21,766,724.55
Fans	2	15,659.6 MWh	\$939,573.03
Steam	0	0.00000 MMBtu	\$0.00
Total	8	2,753,210 MMBtu	\$23,079,911.58

PLANT B SETTINGS

Units of Measure	Imperial
Fuel Cost	\$3.99 /MMBtu
Steam Cost	\$4.69 /MMBtu
Electricity Cost	\$0.07 /kWh

[Edit Settings](#)

Plant B Facility Information.

Company Name: A Company | Facility Name: Plant B

Assessment Date: 9/16/2020

Facility Contact Info

Name: S. Body | Phone Number: | Email: sbody@companyA.com

Assessment Contact Info

Name: K. Armstrong | Phone Number: | Email: armstrongko@ornl.gov

Facility Location

Street: 789 A Street | City: Anytown | State: TN | Zip: 37830 | Country: USA

Quick Summary of all assessments in folder

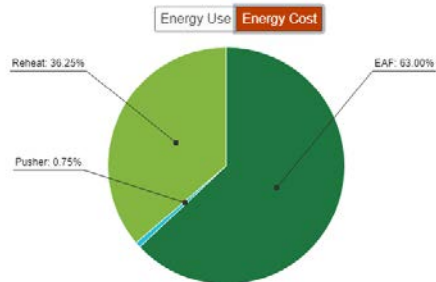
Enter information about facility. This will appear in reports

Set units and utility costs for any NEW assessments created

Dashboard - Pre-Assessments

Pre-Assessments are to help you triage equipment to best utilize assessment time

Enter either design specifications or meter data to determine your priorities



Switch between Energy Use and Cost if equipment uses different fuel

The screenshot shows the 'PRE-ASSESSMENT SCREENING' interface on the left and the 'RESULTS' interface on the right. The screening interface includes tabs for 'Furnace', 'Pump', and 'Fan'. Under 'Furnace', there are sub-tabs for 'Metered' and 'Designed'. The 'Designed' sub-tab is active, showing input fields for 'Total Burner Rated Capacity' (550 MMBtu/hr), '% of Rated Capacity Used' (96%), 'Operating Hours' (4000 hrs/yr), 'Fuel Cost' (3.99 \$/MMBtu), 'Steam Cost' (4.69 \$/MMBtu), and 'Electricity Cost' (0.066 \$/kWh). The 'Energy Used' is 2,112,000 MMBtu/yr and the 'Energy Cost' is \$8,426,880.00. The 'RESULTS' interface shows a pie chart with three segments: Reheat Furnace (2,112,000 MMBtu, green), Electric Arc Furnace (556,859 MMBtu, dark green), and Pusher Furnace (74,000 MMBtu, light blue). Below the chart, there is a text box: 'Enter metered or design energy data for multiple systems to compare their energy consumption.'

Equipment	Energy Used (MMBtu/yr)
Reheat Furnace	2,112,000
Electric Arc Furnace	556,859
Pusher Furnace	74,000

Graphed to quickly see most impactful

Dashboard - Rollup Reports

Create Rollup Reports to see the impacts of opportunities on overall energy use

Choose which assessments & pre-assessments to include in rollup

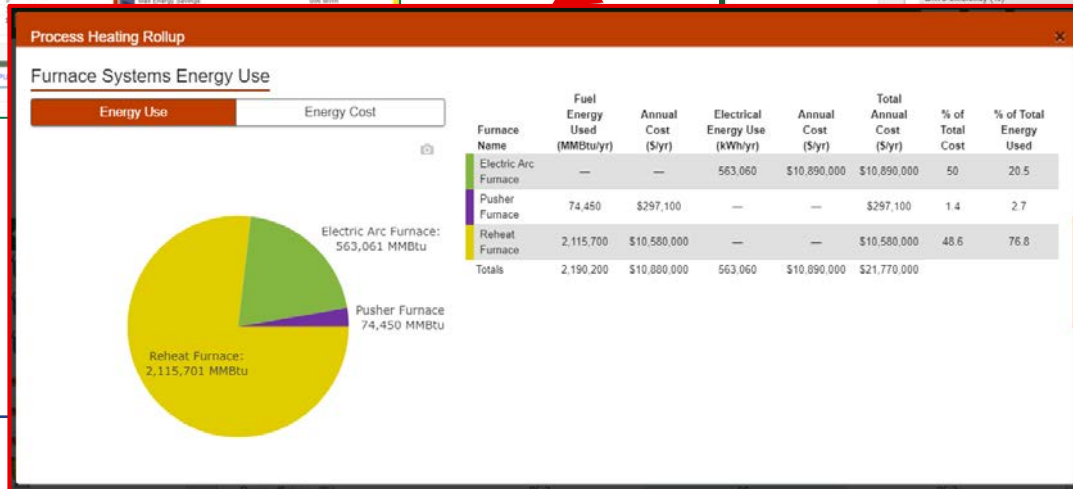
Then Click

Review all reports

View Equipment Summary

Choose which scenario to include

The screenshot shows the MEASUR dashboard with several assessment cards. A green arrow points from the 'Then Click' text to the 'FURNACE SURVEY' card. The cards display summary information such as 'Number of Furnaces', 'Annual Energy Use', and 'Annual Energy Cost'.

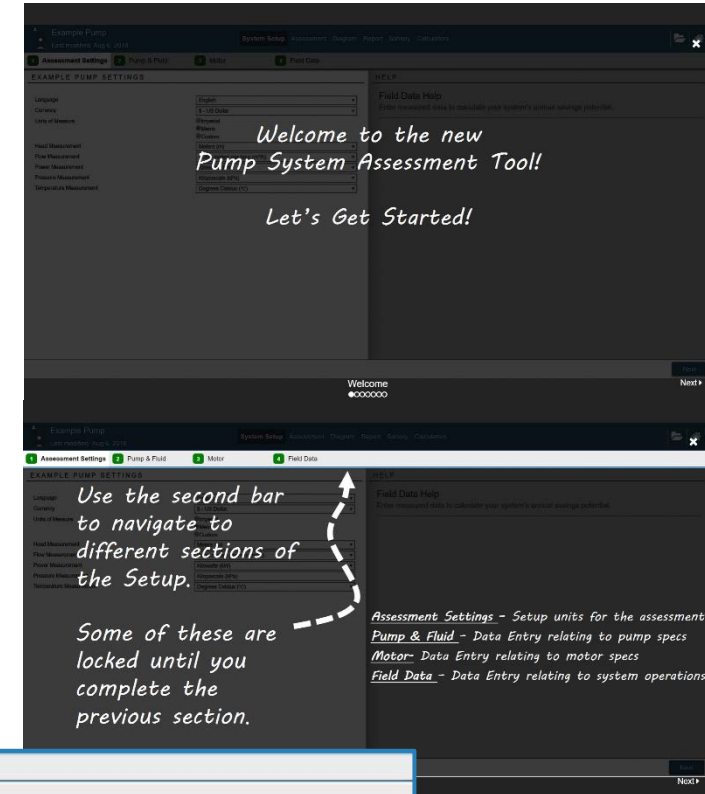
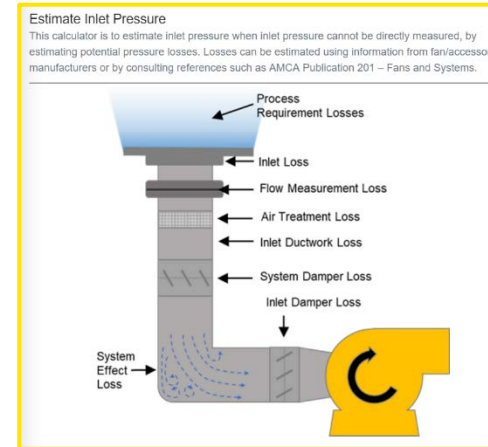


The screenshot shows the 'MEASUR Summary Report' for 'Plant B'. It includes sections for 'Pumps', 'Furnaces', and 'Fans'. A red arrow points from the 'View Equipment Summary' text to the 'Cooling Pump 1' section. Below these sections is a large table comparing 'Baseline' and 'Improve Belt, Motor and Pump Eff' scenarios across various equipment metrics.

	Baseline	Improve Belt, Motor and Pump Eff	Adjust Fluid Temperature
Pump rated power (hp)	200	200	85.2
Motor shaft power (hp)	99.6	98.4	98.5
Pump shaft power (hp)	95.5	90.4	94.5
Motor efficiency (%)	92.9	96.1	92.8
Motor power factor (%)	78.1	72.6	75.8
Percent Loaded (%)	50	45	49
Drive efficiency (%)	95.9	100	95.9
	126.5	116.2	125.5
	80	70.2	79.2
	201	615	693
	—	86.2	7.41
	\$35,940	\$30,732	\$34,670
	—	\$4,308	\$378
	—	\$00	\$00
	—	0.00013927	0.0016204
	—	*Optimized	*Optimized

Key Features - Help Text & Tutorials

- Tutorials
 - Help to get started using tool
- Help text for each data entry field
 - Diagrams to help understand where to obtain data
 - Can switch between help or results being shown by default



RESULTS

HELP

Charge Material Help

Enter measured data to calculate your system's annual savings potential.

Savings Suggestions

Explore possibilities of lowering the final product temperature
Preheating the charge or load material entering the furnace
Pre-drying to reduce moisture content of the load entering the furnace
Maintain charge feed rate as close to the rated capacity as possible
Consider possibility of reducing endothermic reactions by controlling process conditions

Note: These energy saving measures are for guidance only. Not all measures are applicable under all operating conditions. There may additional measures when considering specific situations and the user is encouraged to review and apply the appropriate measures

HELP

Motor Help

Enter measured data to calculate your system's annual savings potential.

Motor RPM

Motor RPM is the nameplate speed of the motor.
This value is used with the line frequency to determine the number of motor poles. This, in turn, is used (along with motor class and size) to estimate motor efficiency and output shaft power for the measured electrical power or current conditions.

Efficiency Class	Line Frequency	Minimum	Maximum
Standard Efficient	60 Hz	540 rpm	3600 rpm
Standard Efficient	50 Hz	450 rpm	3000 rpm
Energy Efficient	60 Hz	540 rpm	3600 rpm
Energy Efficient	50 Hz	450 rpm	3000 rpm
Premium Efficient	60 Hz	1080 rpm	3600 rpm
Premium Efficient	50 Hz	900 rpm	3000 rpm

Key Features – Customize Units & Notes

- Units are easily customizable and can be changed after data entry!
- Add notes on assessment conditions to add to report

Charge (wet)-Feed Rate 4226 lb/hr



1 Assessment Settings 2 Heat Balance 3 Aux Equipment 4 Design Energy Use 5 Metering

REHEAT FURNACE 2 SETTINGS

Your units have changed! Click here to update your data to reflect these changes!

Language	English
Currency	\$ - US Dollar
Units of Measure	<input type="radio"/> Imperial
	<input checked="" type="radio"/> Metric
Energy Result Unit	Gigajoules (GJ)

Can also change unit settings for all new assessments in global settings or in the dashboard



Charge (wet)-Feed Rate 1916.8798 kg/hr

Starting an Assessment

The screenshot shows the MEASUR web application interface. A modal dialog titled "Create New Assessment" is open in the center. The dialog has three main input sections: "Assessment Name" with a text field containing "New Assessment" and an example "Example: 'Pump123' or 'ORNL Pump 3'"; "Assessment Type" with a dropdown menu set to "Pump"; and "Folder Location" with a dropdown menu set to "All Assessments/Plant B/". Below the folder location dropdown is a link "Add a new folder for this assessment". At the bottom of the dialog are "Close" and "Add Assessment" buttons. The background shows the MEASUR dashboard with a sidebar on the left containing navigation links like "All Assessments", "Data Exploration", and "Settings". The main area displays various assessment creation options like "Create Pump", "Create Process Heating Assessment", "Create Fan Assessment", "Create Steam Assessment", "Create Treasure Hunt", "Properties & Equipment Calculators", and "Inventory Management".

- Choose a unique name for the assessment
- Set Assessment type (Pump, Fan, Process Heater, Steam, Treasure Hunt)
- Choose folder location
 - Or make a new folder

System Setup

Reheat Furnace Case Study
Fuel-fired

System Setup | Assessment | Diagram

1 Assessment Settings | 2 Heat Balance | 3 Aux Equipment | 4 Design Energy Use | 5 Diagram

REHEAT FURNACE CASE STUDY SETTINGS

Language: English
Currency: \$ - US Dollar
Units of Measure: Imperial
Energy Result Unit: Millions British Thermal Units (MMBtu)
Select Energy Source Type: Fuel-fired
Common Result Unit: Millions British Thermal Units (MMBtu)
Common Fuel Unit: Millions British Thermal Units (MMBtu)
Common Electricity Unit: Kilowatt-hours (kWh)
Common Steam Unit: Millions British Thermal Units (MMBtu)

EQUIPMENT NOTES
Add additional information for your equipment

OPERATING CONDITIONS AT TIME OF ASSESSMENT
The furnace was running at the full load capacity during the PH assessment.

Start with current equipment and operations -
Baseline

Fan Example
Last modified: Aug 28, 2018

System Setup | Assessment | Diagram | Report | Sankey | Calculators

1 Assessment Settings | 2 Fluid | 3 Fan | 4 Motor | 5 Field Data

MOTOR

Line Frequency: 60 Hz
Rated Motor Power: 600 hp
Motor RPM: 1125
Efficiency Class: Energy Efficient
Rated Voltage: 480
Full-Load Amps: 683.25

Motor Help
Enter measured data to calculate your system's annual savings potential.

Motor RPM
Motor RPM is the nameplate speed of the motor.

Standard and Energy Efficient Motors

Motor Size	Minimum	Maximum
60 Hz	540 rpm	3600 rpm
50 Hz	450 rpm	3000 rpm

Premium Efficient Motors

Motor Size	Minimum	Maximum
60 Hz	1080 rpm	3600 rpm
50 Hz	900 rpm	3000 rpm

- Assessment Settings: Set units and basic assessment settings
- Assessment Specific Tabs
 - Data Entry for baseline assessment
 - Intermediate Results
 - Help text for each data entry field

Assessments

Explore energy savings opportunities

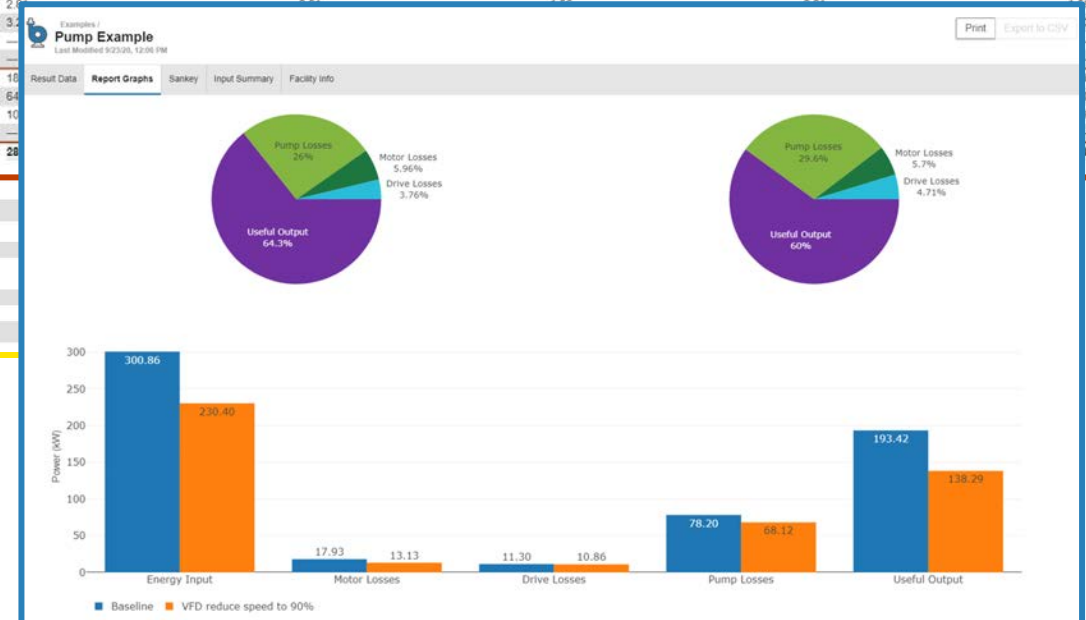
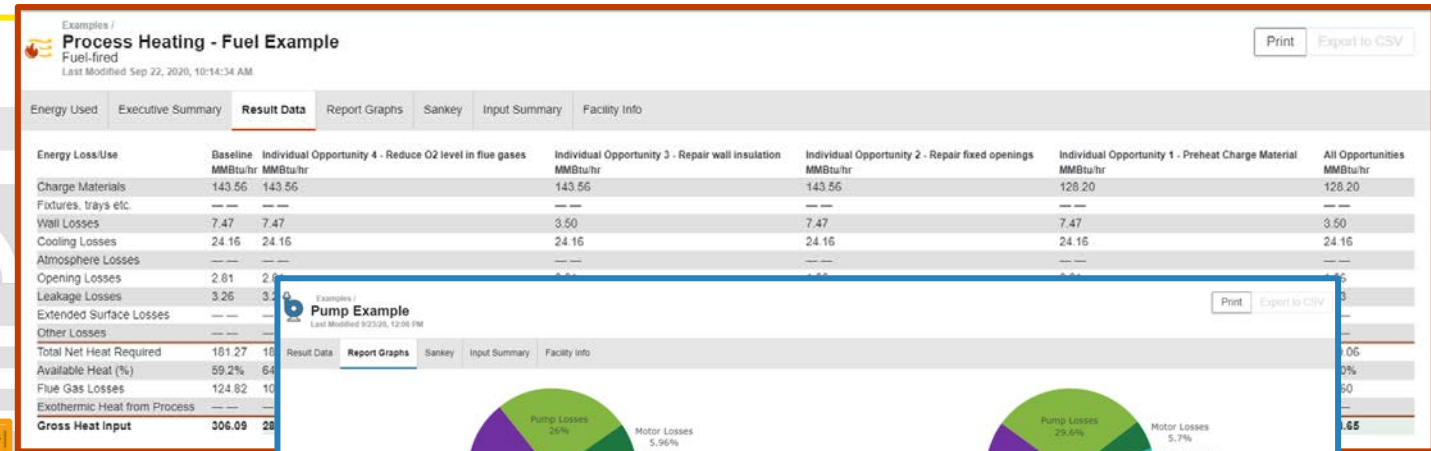
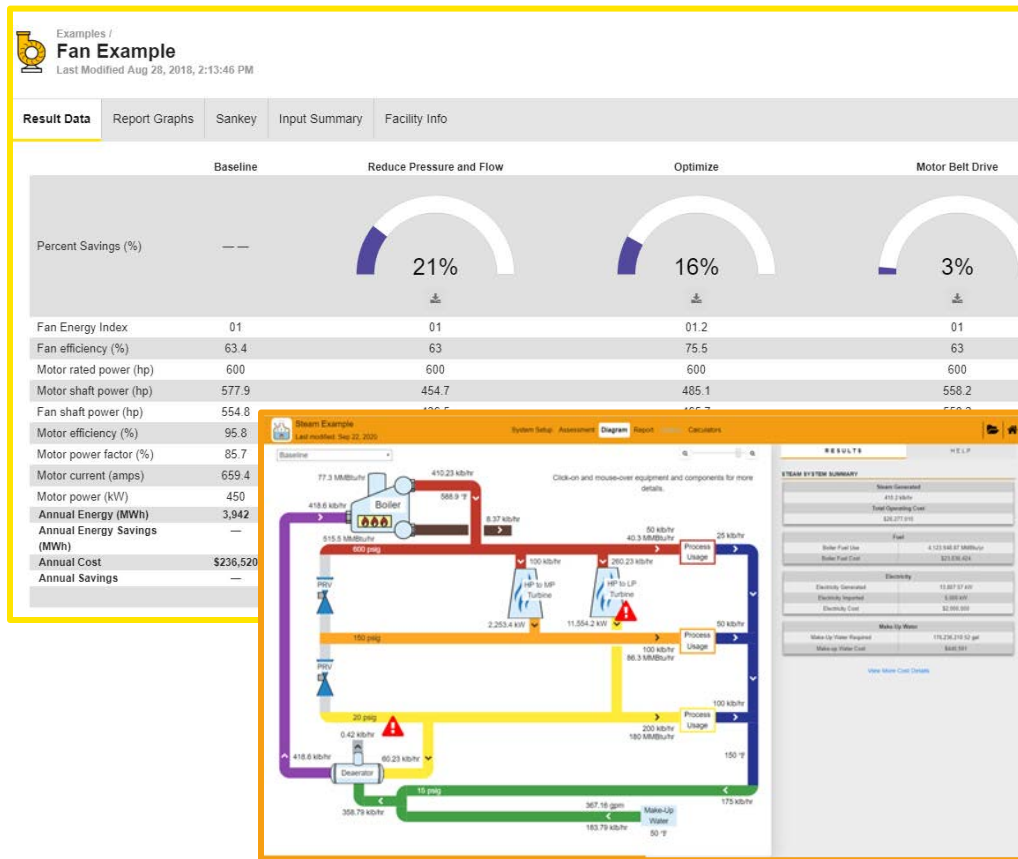
	Baseline	Improve Belt, Motor and Pump Eff
Pump efficiency (%)	83.5	96.7
Motor rated power (hp)	200	200
Motor shaft power (hp)	142	99.9
Pump shaft power (hp)	136.3	99.9
Motor efficiency (%)	93.8	96.4
Motor power factor (%)	82.9	74.9
Percent Loaded (%)	71	50
Drive efficiency (%)	96	100
Motor current (amps)	164.1	124.2
Motor power (kW)	113	77.3
Pump Efficiency	890	977
Annual Energy (MWh)	—	213
Annual Cost	\$49,494	\$33,864
Annual Savings	—	\$15,630

	Baseline	All Opportunities
Energy Loss/Use	MMBtu/hr	MMBtu/hr
Charge Materials	143.56	128.20
Fixtures, trays etc.	—	—
Wall Losses	7.47	3.50
Cooling Losses	24.16	24.16
Atmosphere Losses	—	—
Opening Losses	2.81	1.56
Leakage Losses	3.26	1.63
Extended Surface Losses	—	—
Other Losses	—	—
Total Net Heat Required	181.27	159.06
Available Heat (%)	59.2%	64.0%
Flue Gas Losses	124.82	89.60
Exothermic Heat from Process	—	—
Gross Heat Input	306.09	248.66

- Explore Opportunities: build scenarios from pre-established energy savings measures
- Modify All Conditions: build scenarios using same forms as baseline
 - Badges and field highlighting for visual cues

Reports

View side-by-side comparison of all scenarios and graphs for data visualization



Reports - Printing


Print to PDF for Assessment Reports & Rollup Reports

Examples / **Process Heating - Fuel Example**
Fuel-fired
Last Modified Sep 22, 2020, 10:14:34 AM

Energy Used Executive Summary **Result Data** Report Graphs Sankey Input Summary Facility Info

Energy Loss/Use	Baseline MMBtu/hr	Individual Opportunity 4 - Reduce O2 level in flue gases MMBtu/hr	Individual Opportunity 3 - Repair wall insulation MMBtu/hr	Individual Opportunity 2 - Repair fixed openings MMBtu/hr	Individual Opportunity 1 - Preheat Charge Material MMBtu/hr	All Opportunities MMBtu/hr
Charge Materials	143.56	143.56	143.56	143.56	128.20	128.20
Fixtures, trays, etc.	---	---	---	---	---	---
Wall Losses	7.47	7.47	3.50	7.47	3.50	3.50
Cooling Losses	24.16	24.16	24.16	24.16	24.16	24.16
Atmosphere Losses	---	---	---	---	---	---
Opening Losses	2.81	2.81	2.81	1.56	2.81	1.56
Leakage Losses	3.26	3.26	3.26	3.26	3.26	1.63
Extended Surface Losses	---	---	---	---	---	---
Other Losses	---	---	---	---	---	---
Total Net Heat Required	181.27	181.27	---	---	165.91	159.06
Available Heat (%)	59.2%	64.0%	---	---	59.2%	64.0%
Flue Gas Losses	124.82	102.11	---	---	114.25	89.60
Exothermic Heat from Process	---	---	---	---	---	---
Gross Heat Input	306.09	283.38	---	---	280.15	248.65

Print Export to CSV


U.S. DEPARTMENT OF
ENERGY
Energy Efficiency &
Renewable Energy

Energy Assessment
Summary Report
May 22, 2019, 5:02:39 PM

ASUR Summary Report Units Print Close Report

Pumps 3
Maximum Annual Energy Savings: 1,920 MWh
Annual Energy: 4,589 MWh
Click for details

Furnaces 3
Maximum Annual Cost Savings: \$2,110,339
Annual Cost: \$19,656,385
Maximum Annual Energy Savings: 428,414 MMBtu
Annual Energy: 2,324,798 MMBtu
Click for details

Fans 2
Maximum Annual Cost Savings: \$79,735
Annual Cost: \$859,836
Maximum Annual Energy Savings: 1,329 MWh
Annual Energy: 14,331 MWh
Click for details

Collapse Sidebar
Cooling Pump 1
Cooling Pump 2
Process Pump 1
Electric Arc Furnace
Roller Furnace
Preheat Furnace
Cooling Dryer
HVAC Fan

Plant B / Cooling Pump 1
Last Modified 9/23/20, 12:40 PM

Result Data Report Graphs Sankey Input Summary Facility Info

	Baseline	Improve Belt, Motor and Pump Eff	Adjust Fluid Temperature
Percent Savings (%)	---	12.0%	1.0%
Pump efficiency (%)	85.2	90	85.2
Motor rated power (hp)	200	200	200
Motor shaft power (hp)	99.6	90.4	98.5
Pump shaft power (hp)	95.5	90.4	94.5
Motor efficiency (%)	92.9	96.1	92.8
Motor power factor (%)	76.1	72.6	75.8
Percent Loaded (%)	50	45	49
Drive efficiency (%)	95.9	100	95.9
Motor current (amps)	126.5	116.2	125.5
Motor power (kW)	80	79.2	79.2
Annual Energy (MWh)	701	615	693
Annual Energy Savings (MWh)	---	86.2	7.41
Annual Cost (\$)	\$35,040	\$38,732	\$34,670
Annual Savings (\$)	---	\$4,308	\$370
Implementation Cost	---	\$00	\$00
Payback Period (months)	---	0.00013927	0.0016204
Selected Energy Projects	---	*Optimized Install More Efficient Drive Install More Efficient Pump Install More Efficient Motor	*Optimized
Modifications	---	Pump and Fluid Motor	Pump and Fluid

Assessments

- 5 different assessment types
 - Pumps
 - Process Heating
 - Fans
 - Steam System
 - Treasure Hunt

The screenshot displays the MEASUR web application interface. On the left is a sidebar with the U.S. Department of Energy logo and navigation links: Home, All Assessments (with sub-links for Examples and Plant B), Data Exploration, All Calculators (listing Motors, Process Cooling, Pumps, Fans, Process Heating, Steam, Compressed Air, Lighting, and General), Settings, Custom Materials, Tutorials, About, Feedback, Acknowledgments, Translate, and version information (v0.8.0-beta). The main content area features the MEASUR logo and a welcome message. Below this, a 'Create Assessment' panel is highlighted with a blue border, containing five options: 'Create Pump Assessment' (formerly DOE Pumping System Assessment Tool (PSAT)), 'Create Process Heating Assessment' (formerly DOE Process Heating Assessment and Survey Tool (PHAST)), 'Create Fan Assessment' (formerly DOE Fan System Assessment Tool (FSAT)), 'Create Steam Assessment' (formerly DOE Steam System Modeler Tool (SSMT)), and 'Create Treasure Hunt' (Energy efficiency calculators for facilitating a Treasure Hunt). To the right of this panel are sections for 'Properties & Equipment Calculators' (listing Motors, Process Cooling, Pumps, Fans, Process Heating, Steam, Compressed Air, Lighting, and General) and 'Inventory Management' (with a link to 'Create Motor Inventory' based on DOE's MotorMaster+ tool). A 'View All Your Assessments' link is at the bottom of the highlighted panel.

Pumps

Pump Example
Last modified: Sep 23, 2020

System Setup **Assessment** Diagram Report Sankey Calculators

Explore Opportunities **Modify All Conditions**
[Novice View](#) [Expert View](#)

Pump Fluid **Motor** Field Data

BASELINE

Line Frequency: 60 Hz
 Rated Motor Power: 350.01 hp
 Motor RPM: 2000
 Efficiency Class: Standard Efficiency
 Rated Voltage: 460 V
 Full-Load Amps: 172.63 A

Inputs to this calculated value have changed. Consider re-estimating.

NEW PUMP AND MOTOR

Line Frequency: 60 Hz
 Rated Motor Power: 350 hp
 Motor RPM: 2000
 Efficiency Class: Premium Efficient
 Rated Voltage: 460 V
 Full-Load Amps: 376.95 A

RESULTS

	Baseline	New Pump and Motor
Percent Savings (%)	—	20.0%
Pump efficiency (%)	71.2	87.5
Motor rated power (hp)	350	350
Motor shaft power (hp)	379.3	308.6
Pump shaft power (hp)	304.1	296.2
Motor efficiency (%)	94	96.1
Motor power factor (%)	201.9	90.2
Percent Loaded (%)	108	88
Drive efficiency (%)	96	96
Motor current (amps)	187	333.6
Motor power (kW)	300.9	236.6
Annual Energy (MWh)	2,636	2,099
Annual Energy Savings (MWh)	—	537
Annual Cost	\$173,943	\$138,826
Annual Savings	—	\$35,417

[View Report](#)

Pump Example
Last modified: Sep 23, 2020

System Setup **Assessment** Diagram Report Sankey Calculators

Explore Opportunities **Modify All Conditions**
[Novice View](#) [Expert View](#)

SELECT POTENTIAL ADJUSTMENT PROJECTS

Select potential adjustment projects to explore opportunities to increase efficiency and the effectiveness of your system.

[Add New Scenario](#)

Modification Name: New Pump and Motor

☒ Install VFD

☒ Install More Efficient Drive

☒ Install More Efficient Pump

Baseline Pump Type: End Suction ANSI/API
 Modification Pump Type: End Suction ANSI/API
 Modification: 87.52 %
 Pump Efficiency: Known Efficiency

The efficiency of your pump has been calculated based on your flow rate and selected pump type. Click "Known Efficiency" to use the efficiency calculated by your system setup.

☒ Reduce System Flow Rate

☒ Reduce System Head Requirement

☒ Adjust Operational Data

☒ Install More Efficient Motor

Baseline Efficiency Class: Standard Efficiency
 Modification Efficiency Class: Premium Efficient

RESULTS

	Baseline	New Pump and Motor
Percent Savings (%)	—	20.0%
Pump efficiency (%)	71.2	87.5
Motor rated power (hp)	350	350
Motor shaft power (hp)	379.3	308.6
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Annual Savings	—	\$35,417

[View Report](#)

- Compute motor full load amps, load current and power factor, fluid head, and fan and motor efficiency
- Explore the savings from changing pump and motor efficiency (which can be optimized automatically), flow and head, or even fluid temperature

Process Heating

Process Heating - Fuel Example
Fuel-fired
Last modified: Sep 23, 2020

System Setup **Assessment** Diagram Report Sankey Calculators

Explore Opportunities **Modify All Conditions**
Novice View Expert View

Operations Charge Materials Flue Gas Fixture Wall Cooling Atmosphere Opening Leakage Extended Surface Other

BASELINE

Operating Hours	6912	hrs/yr
Fuel Costs	5	\$/MMBtu
Steam Costs	8	\$/MMBtu
Electricity Costs	0.05	\$/kWh

ALL OPPORTUNITIES

Operating Hours	6912	hrs/yr
Fuel Costs	5	\$/MMBtu
Steam Costs	8	\$/MMBtu
Electricity Costs	0.05	\$/kWh
Implementation Cost		\$

RESULTS

Energy Loss/Use	Baseline MMBtu/hr	All Opportunities MMBtu/hr
Charge Materials	143.56	128.20
Fixtures, trays etc.	---	---
Wall Losses	7.47	3.50
Cooling Losses	24.16	24.16
Atmosphere Losses	---	---
Opening Losses	2.81	1.56
Leakage Losses	3.26	1.63
Extended Surface Losses	---	---
Other Losses	---	---
Total Net Heat Required	181.27	159.06
Available Heat (%)	59.2%	64.0%
Flue Gas Losses	124.82	89.60
Exothermic Heat from Process	---	---
Gross Heat Input	306.09	248.65

Back Next View Report

Process Heating - Fuel Example
Fuel-fired
Last modified: Sep 23, 2020

System Setup **Assessment** Diag

Explore Opportunities **Modify All Conditions**
Novice View Expert View

SELECT POTENTIAL ADJUSTMENT PROJECTS

Select potential adjustment projects to explore opportunities to increase efficiency and the effectiveness of your system.

Add New Scenario

Modification Name All Opportunities

☒ Maintain Optimum Air/Fuel Ratio or Recommended O₂ Level in Flue Gas

Baseline	Modifications
Oxygen Calculation Method	Oxygen Calculation Method
Oxygen in Flue Gas	Oxygen in Flue Gas
6%	2%
Excess Air in Flue Gas	Excess Air in Flue Gas
36.52%	09.90%

☐ Preheat Combustion Air

☒ Preheat Charge Material

☒ Modify Initial Temperature: Material #1

Baseline	Modifications
Initial Temperature	Initial Temperature
60 °F	300 °F

☒ Control and Optimize Furnace Pressure

☐ Modify Furnace Draft Pressure: Loss #1

☒ Modify Opening Area: Loss #1

Baseline	Modifications
Opening Area	Opening Area
4 ft ²	2 ft ²

Back

- Calculate heat losses from several heater components
- Explore the savings from reducing flue gas oxygen or temperature, preheating air or charge materials, controlling furnace pressure, closing openings, etc.

Fans

CALCULATE FLOW AND PRESSURES

[Return to Setup](#)

2 INPUT PLANE DATA

INPUT PITOT TUBE DIFFERENTIAL PRESSURE READINGS

		TRAVERSE HOLES									
		1	2	3	4	5	6	7	8	9	10
INSERTION POINTS	1	0.662	0.568	0.546	0.564	0.463	0.507	0.865	1.17	1.247	1.63
	2	0.639	0.542	0.53	0.57	0.603	0.75	0.965	1.014	1.246	1.596
	3	0.554	0.452	0.453	0.581	0.551	0.724	0.844	1.077	1.323	1.62

[Finish and Return to Plane Data](#)

RESULTS

[Use Static Pressure](#) [Use Total Pressure](#)

ASSESSMENT DATA

Inlet Pressure	-17.5500 in H ₂ O
Outlet Pressure	6.64000 in H ₂ O
Flow Rate	379,792 ft ³ /min

FULL PLANAR RESULTS

Plane #	Gas Density lb/scf	Volume Flow ft ³ /min	Gas Velocity ft/min	Static Pressure in H ₂ O	Velocity Pressure in H ₂ O	Total P in
1	0.0209268	379,792	5,834.67	-17.5500	0.593081	-16
2	0.0220295	361,787	9,541.64	6.64329	1.66502	8.3
3a	0.0208934	191,147	5,873.12	-18.1000	0.00000	0.0
3b	0.0209602	188,649	5,796.35	-17.0000	0.00000	0.0
4	0.0209268	379,792	5,834.67	-17.5500	0.593081	-16
5	0.0135984	584,468	25,105.7	1.80000	7.13531	8.9

Fan Example

Last modified: Aug 28, 2018

System Setup **Assessment** Diagram Report Sankey Calculators

Explore Opportunities **Modify All Conditions**

Novice View Expert View

Fluid Fan Motor

Field Data

Baseline	Reduce Pressure and Flow
Operating Fraction	1
Cost	0.06 \$/kWh
Inlet Pressure	-16.36 in H ₂ O
Outlet Pressure	1.1 in H ₂ O
Flow Rate	129691 ft ³ /min
Motor Power	450 kW
Measured Voltage	460 V
Specific Heat Ratio (γ)	1.4
Compressibility Factor	0.988

☐ Optimize Pump and Motor combination for a Fixed Specific Speed

Size Margin 0 %

Implementation Costs \$

RESULTS

Percent Savings (%) 21%

	Baseline	Reduce Pressure and Flow
Fan Energy Index	01	01
Fan efficiency (%)	63.4	63
Motor rated power (hp)	600	800
Fan shaft power (hp)	577.9	454.7
Fan shaft power (kW)	554.8	436.5
Motor efficiency (%)	95.8	95.7
Motor power factor (%)	85.7	83.8
Motor current (amps)	659.4	530.7
Motor power (kW)	450	354.4
Annual Energy (MWh)	3,942	3,104
Annual Energy Savings (MWh)	—	838
Annual Cost	\$236,620	\$186,254
Annual Savings	—	\$50,366

[View Report](#)

- Compute motor full load amps, load current and power factor, pressure and flow from a traverse analysis, and fan and motor efficiency
- Explore the savings from changing fan and motor efficiency (which can be optimized automatically), flow and pressure, or even fluid characteristics

Steam

Steam Example
Last modified: Sep 22, 2020

System Setup **Assessment** Diagram

Explore Opportunities Modify All Conditions
Novice View Expert View

SELECT POTENTIAL ADJUSTMENT PROJECTS
Select potential adjustment projects to explore opportunities to increase efficiency and the effectiveness of your system.

[Add New Scenario](#)

Modification Name:

☐ Adjust General Operations

☐ Adjust Unit Costs

☐ Adjust Boiler Operations

☒ Adjust Condensate Handling

☒ Adjust High Pressure Condensate Recovery Rate

Baseline	Modifications
Condensate Recovery Rate	Condensate Recovery Rate
50%	75%

☒ Adjust Medium Pressure Condensate Recovery Rate

Baseline	Modifications
Condensate Recovery Rate	Condensate Recovery Rate
50%	75%

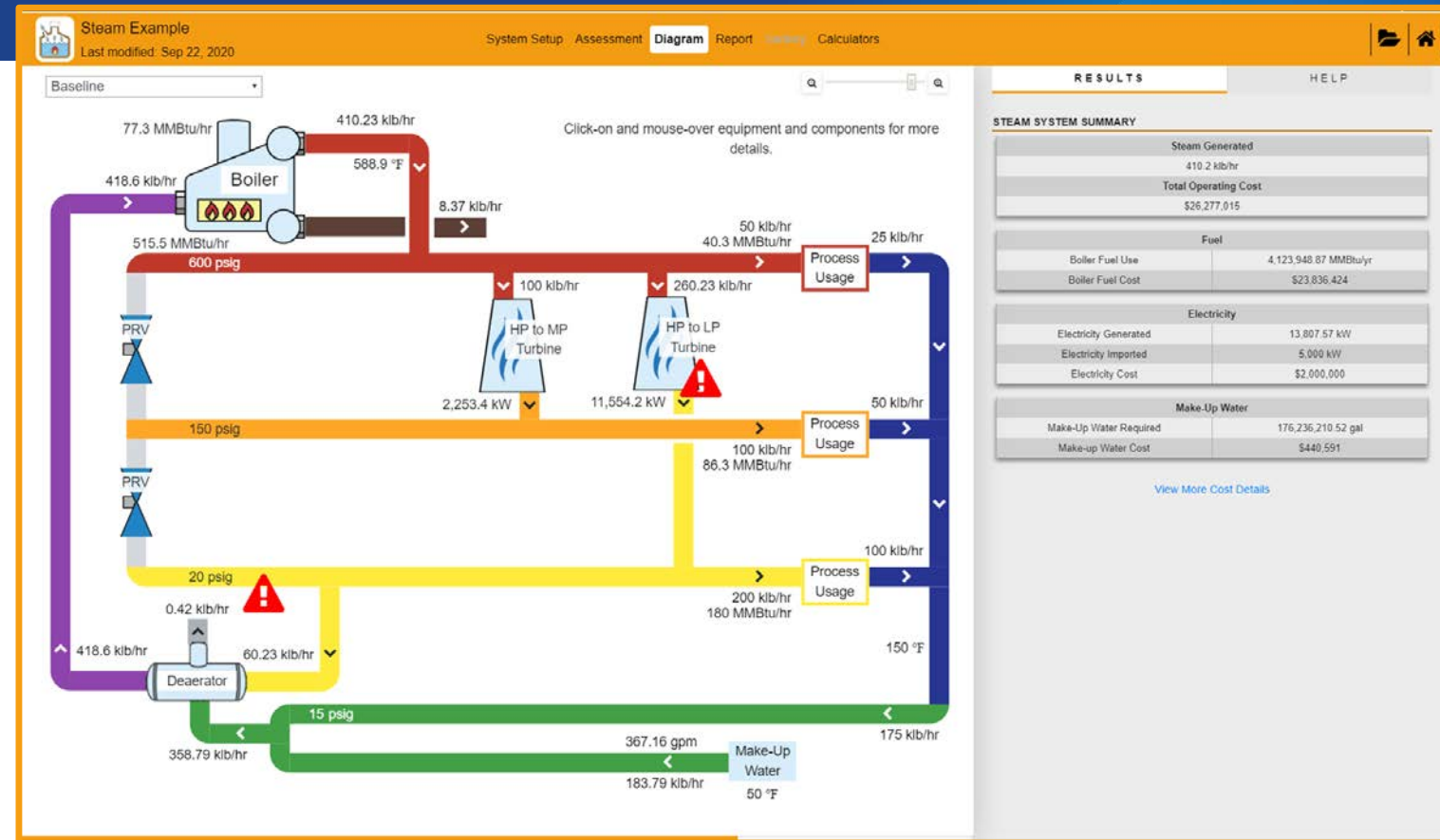
☒ Adjust Low Pressure Condensate Recovery Rate

Baseline	Modifications
Condensate Recovery Rate	Condensate Recovery Rate
50%	75%

☐ Flash Condensate to Medium Pressure

☐ Flash Condensate to Low Pressure

☐ Modify Condensate Return Temperature



- Determine steam flows, fuel use, electricity production throughout system
- Explore the savings from adding/removing turbines, adding flash tanks, increasing condensate recycle, etc.

Treasure Hunt

Treasure Hunt Example
Last modified: Sep 23, 2020

Facility Basics **Find Treasure** Treasure Chest Report

Find ways to save your hard earned treasure!

Use one of the following calculators to determine savings opportunities within your manufacturing facility.

Once an opportunity has been found, save the opportunity to your "Treasure Chest".

Add more details to each opportunity by clicking the icon and filling out an opportunity sheet.

Click the "Treasure Chest" tab to view a summary of your found treasures.

Filter Calculators by Utility Type: All

Lighting Replacement
The calculator is designed to quantify the energy savings associated with lighting opportunities.

Replace Existing Motor
This calculator calculates the energy savings, cost savings, and payback period for replacing an existing motor with a higher efficiency motor.

Upgrade Motor Drive
The Motor Drive Calculator compares the annual energy cost of three motor drives: V-belt drive, Notched V-Belt drive, and Synchronous Belt Drive.

Natural Gas Reduction
This calculator is used to quantify the energy savings associated with reducing natural gas usage.

Electricity Reduction
This calculator is used to quantify the energy savings associated with reducing electricity usage.

Compressed Air Reduction
This calculator is used to quantify the energy savings associated with reducing compressed air usage.

Compressed Air Pressure Reduction
This calculator is used to quantify the energy savings associated with reducing compressed air system pressure.

Water Reduction
This calculator is used to quantify the energy savings associated with reducing water usage and wastewater disposal.

Steam Reduction
This calculator is used to quantify the energy savings associated with reducing steam use.

Pipe Insulation
This calculator is used to quantify the energy savings associated with insulating hot pipes.

Tank Insulation
This calculator is used to quantify the energy savings associated with insulating storage tanks.

Compressed Air - Leak Survey
Used to quantify the energy savings associated with compressed air leaks.

Custom Savings Opportunity
This calculator provides a space to add custom savings opportunities.

Energy Efficiency & Renewable Energy

Treasure Hunt Example
Last Modified: 9/23/20, 12:52 PM

Print Export to CSV

Utility Type: Calculator Type: Teams: Equipment:

Executive Summary Opportunity Summary Opportunity Payback Details Report Graphs Facility Info

Cost Summary

Utility	Cost Savings	Implementation Cost	Payback
Electricity	\$153,282	\$120,550	0.79
Natural Gas	\$43,901	\$10,200	0.23
Water	\$6,628	\$2,300	0.35
Mixed		\$100	0.02
Total	\$203,811	\$133,150	0.65

Bar Chart: Savings From Baseline vs Modification Costs

Utility	Savings From Baseline	Modification Costs
Electricity	\$153,282	\$120,550
Natural Gas	\$43,901	\$10,200
Water	\$6,628	\$2,300

Detailed Summary

Utility	Current Use
Electricity	kWh 32,000,000
Natural Gas	MMBtu 125,000
Water	kgal 40,000,000
Mixed	
Total	

Team Summary

Payback Length Summary

Payback Length	Number of Opportunities	Total Savings
Less than 1 year	12	\$189,912
1 to 2 years	1	\$6,436
2 to 3 years	1	\$6,962
More than 3 years	2	\$6,436
Total	16	\$203,811

Bar Chart: Payback Length Summary

Payback Length	Total Savings
Less than 1 Year	\$189,912
1 to 2 Years	\$6,436
2 to 3 Years	\$6,962
More than 3 Years	\$6,436

Donut Chart: Payback Length Summary

Payback Length	Total Savings
Less than 1 Year	\$189,912
1 to 2 Years	\$6,436
2 to 3 Years	\$6,962
More than 3 Years	\$6,436

- Find low/no cost energy savings opportunities in motor systems, process heating, compressed air, lighting, etc.

Calculators

- 50+ Stand alone Calculators
 - Motors
 - Pumps
 - Fans
 - Process Heating
 - Steam
 - Compressed Air
 - Lighting
 - General
- Access via sidebar or center

The screenshot displays the MEASUR web application interface. On the left is a sidebar for the U.S. Department of Energy, Energy Efficiency & Renewable Energy. It includes a 'Home' section with links to 'All Assessments', 'Examples', and 'Plant B'. Below this is a 'Data Exploration' section and a list of 'All Calculators' which includes Motors, Process Cooling, Pumps, Fans, Process Heating, Steam, Compressed Air, Lighting, and General. Further down are 'Settings', 'Custom Materials', 'Tutorials', 'About', 'Feedback', 'Acknowledgments', and a 'Translate' button. The version 'v0.8.0-beta' is also shown. The main content area features the MEASUR logo and a welcome message. It provides instructions to 'Create an assessment to model your system and find opportunities for efficiency or run calculations from one of our many property and equipment calculators.' Two curved arrows point to two highlighted boxes. The first box, titled 'Create Assessment', lists five options: 'Create Pump Assessment' (formerly DOE Pumping System Assessment Tool (PSAT)), 'Create Process Heating Assessment' (formerly DOE Process Heating Assessment and Survey Tool (PHAST)), 'Create Fan Assessment' (formerly DOE Fan System Assessment Tool (FSAT)), 'Create Steam Assessment' (formerly DOE Steam System Modeler Tool (SSMT)), and 'Create Treasure Hunt' (Energy efficiency calculators for facilitating a Treasure Hunt). The second box, titled 'Properties & Equipment Calculators', lists eight categories: Motors, Process Cooling, Pumps, Fans, Process Heating, Steam, Compressed Air, Lighting, and General. Below this is an 'Inventory Management' section with a 'Create Motor Inventory' option, noted as being based on DOE's MotorMaster+ tool. A 'View All Your Assessments' link is at the bottom of the main content area.

Calculators

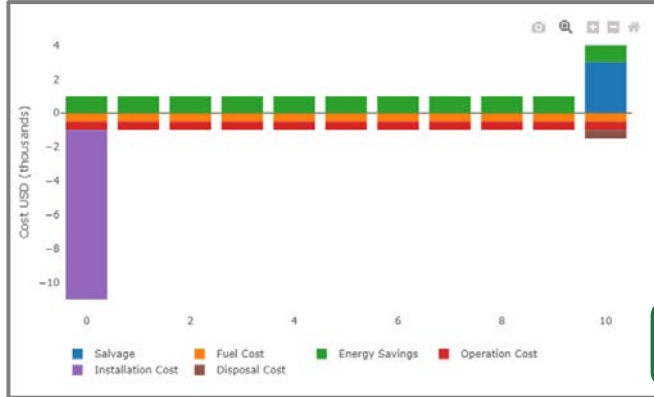
- 50+ Stand alone Calculators

- Motors
- Pumps
- Fans
- Process Heating
- Process Cooling
- Steam
- Compressed Air
- Lighting
- General

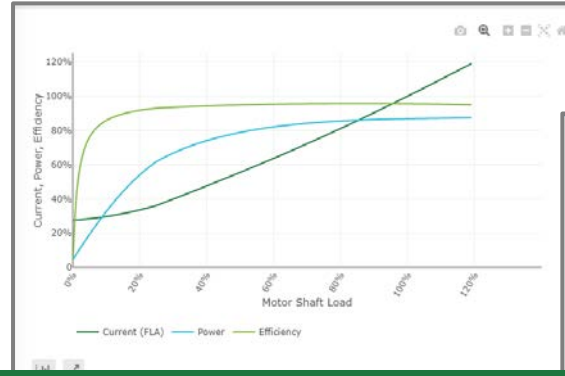
- Most have graphical results



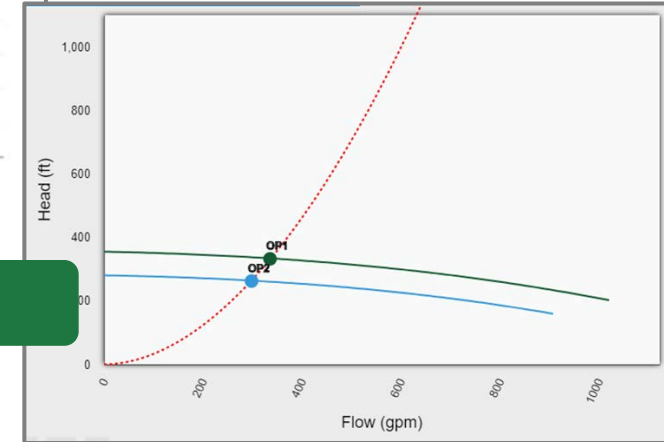
Example Calculators



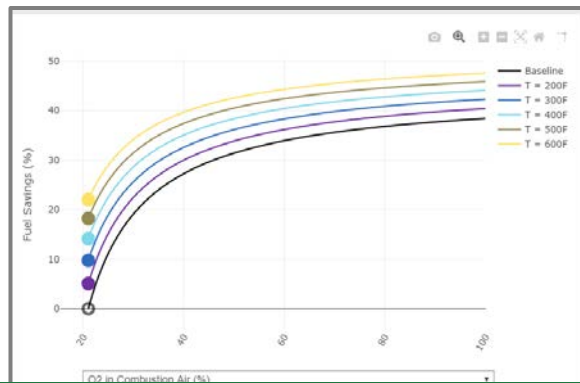
Cash Flow Diagram



Motor Performance

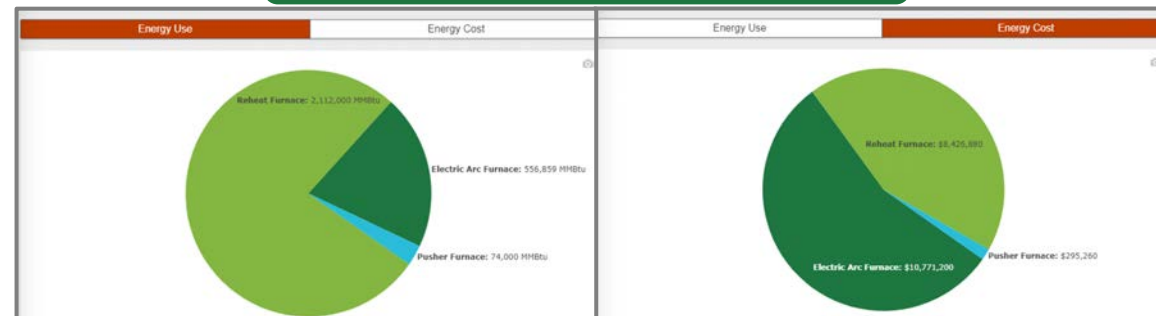


Pump Curve



O₂ Enrichment

Pre-assessment



Other features

- Data Exploration
- Inventory Management

The screenshot displays the MEASUR web application interface. The header includes the U.S. Department of Energy logo and the MEASUR title. A welcome message states: "Welcome to the most efficient way to manage and optimize your facilities' systems and equipment. Create an assessment to model your system and find opportunities for efficiency or run calculations from one of our many property and equipment calculators. Get started with one of the following options." The interface is divided into three main sections: "Create Assessment" (left), "Properties & Equipment Calculators" (right), and "Inventory Management" (bottom right). The "Create Assessment" section lists five tools: "Create Pump Assessment" (formerly DOE Pumping System Assessment Tool (PSAT)), "Create Process Heating Assessment" (formerly DOE Process Heating Assessment and Survey Tool (PHAST)), "Create Fan Assessment" (formerly DOE Fan System Assessment Tool (FSAT)), "Create Steam Assessment" (formerly DOE Steam System Modeler Tool (SSMT)), and "Create Treasure Hunt" (Energy efficiency calculators for facilitating a Treasure Hunt). The "Properties & Equipment Calculators" section lists eight categories: Motors, Process Cooling, Pumps, Fans, Process Heating, Steam, Compressed Air, Lighting, and General. The "Inventory Management" section, highlighted with a blue box, includes a "Create Motor Inventory" option based on DOE's MotorMaster+ tool. A sidebar menu on the left contains links to "Home", "All Assessments", "Examples", "Plant B", "Data Exploration" (highlighted with a blue box), "All Calculators", "Motors", "Process Cooling", "Pumps", "Fans", "Process Heating", "Steam", "Compressed Air", "Lighting", "General", "Settings", "Custom Materials", "Tutorials", "About", "Feedback", "Acknowledgments", "Translate", and "v0.8.0-beta".

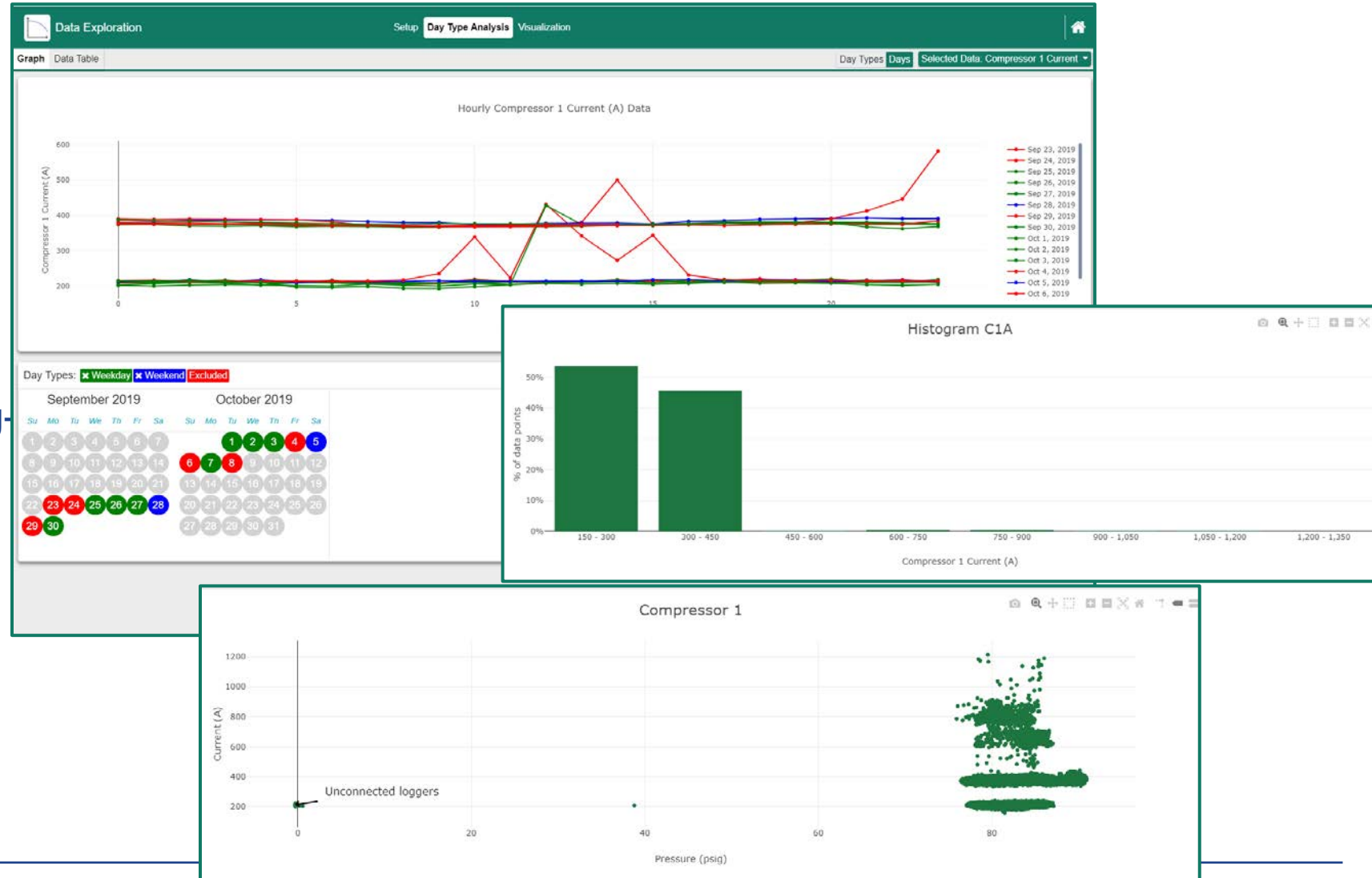
Data Explorer

■ Two Key Functions

■ Day Type Analysis

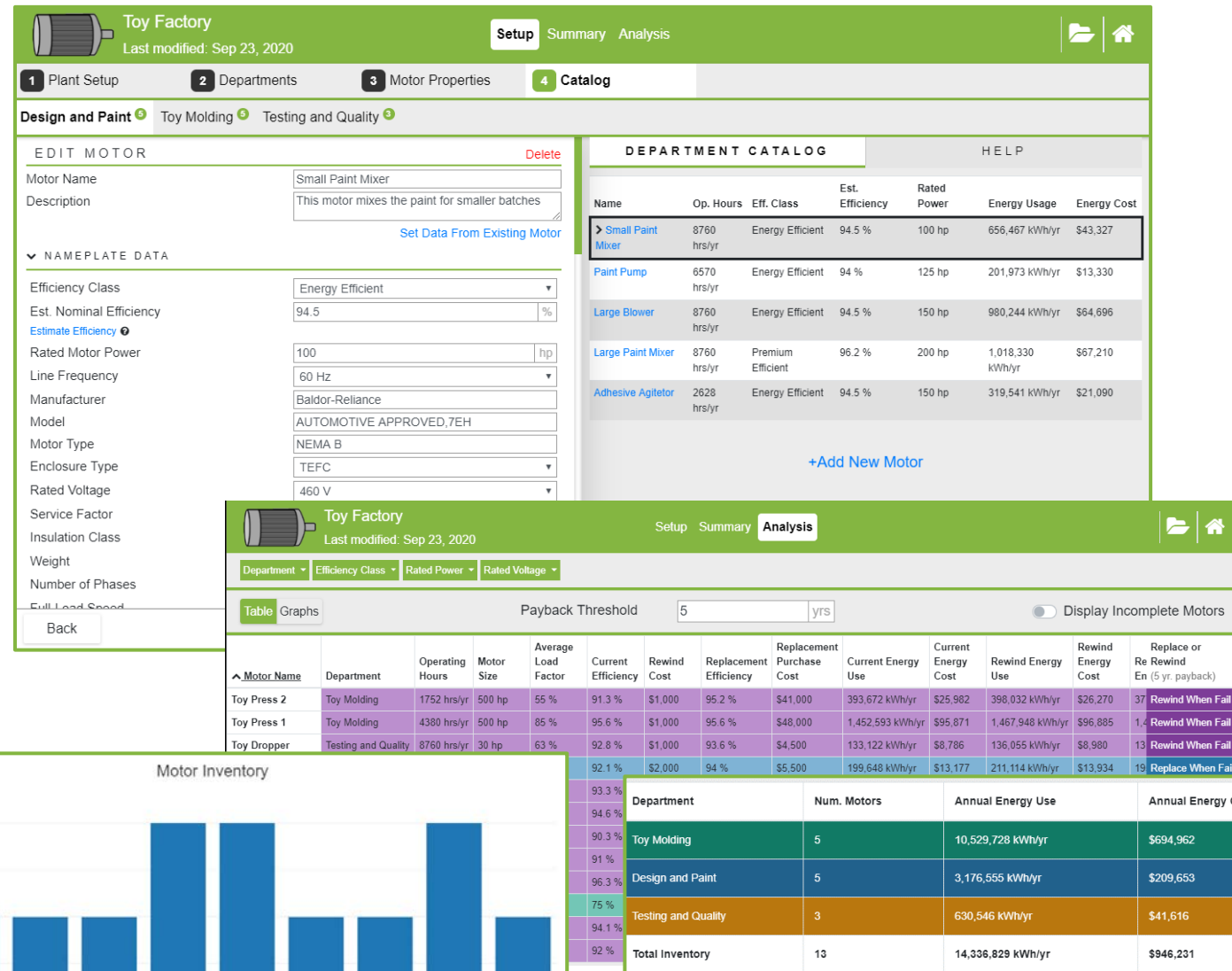
- Used for finding hourly averages for similar load profiles
- For Compressed Air Assessment and other long-term analyses
- Based on LogTool

■ Data Visualization – easy graphing capabilities to explore large datasets



Equipment Inventories

- Modeled after MotorMaster
- Record key information about equipment in one place
 - Motors – Beta
 - Pumps, fans, compressors, maintenance - Planning
- Sort & filter, summary graphs, inventory printouts
- Batch analysis for simple calculators



Coming Soon

- **Compressed Air Assessment**
 - Modeled after AirMaster+ with LogTool
 - Conduct Compressed Air Energy Assessment
 - Quantify Energy Savings Opportunities
- **More Equipment Databases**
 - Modeled after MotorMaster+ Database
 - Keep inventory of equipment (pumps, fans, compressors, etc.) connected to assessments

Feedback or bugs?

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