Simple Tools for Saving Energy - DOE's New Energy Assessment Software

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Better Buildings, Better Plants

- **What is Better Plants?** 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 recognition**

- Manufacturers have two opportunities to engage in Better Plants:
  1. Broader-based **Program** level
  2. Higher-level **Challenge**

Productivity + Cost Savings = Competitiveness
**Better Plants Overview**

*Energy savings and program footprint continue to grow*

<table>
<thead>
<tr>
<th>Better Plants Snapshot</th>
<th>Total</th>
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<tbody>
<tr>
<td>Number of Partners</td>
<td>202</td>
</tr>
<tr>
<td>Approximate Number of Plants</td>
<td>3,000</td>
</tr>
<tr>
<td>Percent of U.S. Manufacturing Energy Footprint</td>
<td>12%</td>
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**Reported Savings**

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<tr>
<td>Cumulative Energy Savings (TBtu)</td>
<td>1,056</td>
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<tr>
<td>Cumulative Cost Savings (Billions)</td>
<td>$5.3</td>
</tr>
<tr>
<td>Cumulative Avoided CO₂ Emissions (Million Metric Ton)</td>
<td>36</td>
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<tr>
<td>Average Annual Energy Intensity Improvement Rate</td>
<td>3.2%</td>
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52 goal achievers total, 9 this year!
Why Partner with Better Plants?

Technical Assistance

- **Technical Account Manager**: navigate program and access resources
- **In-Plant Trainings**: expert instructors come to your plant
- **Resources**: Diagnostic & Software Tools/Industrial Assessment Centers/CHP TAPs/Water Savings Tools/Connection to National Labs
- **Supply Chain Engagement**: resources to advance supplier energy efficiency

National Recognition

- **Awards** for Goal Achievers
- **Better Project/Better Practice Awards**

Peer-to-Peer Networking Opportunities
Technical Assistance: Diagnostic Equipment Program

Field data is best for evaluating system performance

- Free of charge, including shipping
- Use equipment for one day, or up to four weeks
- Some technical assistance with selection and usage
- First come, first serve application
Better Plants hosts events at National Laboratories to:

- **Tour** World-Class Facilities
- **View** Demonstrations of innovative technologies
- **Hear** from experts and Industry peers
- **Learn** about research partnerships
- **Network** with BP partners and researchers
Treasure Hunt Toolkit

Key Aspects:

- Empower and enable plant personnel
- Focus on low-cost/no-cost opportunities
- Observing the idle facility
- Facility employees conduct and have ownership of the ideas / opportunities

https://betterbuildingssolutioncenter.energy.gov/energy-treasure-hunt-exchange-toolkit
DOE Software Tools

www.energy.gov/eere/amo/software-tools
Overview: Current DOE Software Tools

Energy Management & Performance Tracking
- 50001 Ready Navigator
- Automated Register of Implemented Actions
- PEP (Plant Energy Profiler)
- PWP (Plant Water Profiler)
- Energy Footprint Tool
- EnPI and EnPI Lite Tools
  - Corporate Energy Performance Tracking for Better Plants partnership
  - Facility Energy Performance Tracking for Superior Energy Performance

Energy Systems Analysis
- Motors
- Pumps
- Fans
- Compressed Air
- Steam
- Process Heating
- Data Centers
- Simple Calculators
- Treasure Hunt Toolkit

www.energy.gov/eere/amo/software-tools
Overview – DOE Software Tool History

- **Technology and Vendor Agnostic** tools to identify, quantify and validate energy saving opportunities
- Most DOE software tools were **developed in the ’90’s**
  - Operating Systems updated…DOE did not!
  - Many **no longer work** with current operating systems
- Original tools were **developed with industry experts**
- **Highly valued by the manufacturing community** – including end-users, trade associations, utility programs, etc.
- Foundational tools to support other DOE activities
  - Energy Saving Assessments (ESAs)
  - Better Plants In-Plant Trainings
  - Industrial Assessment Centers
  - Case Studies & Fact Sheets
Software Changes, Systems Don’t

High-level Plant Energy & Savings Profile

Typical Energy Consumption Rates

- Process Heating/Steam Systems: 60 – 80%
- Electric Motor Systems: 8-15%
- Pumping Systems: 7-15%
- Compressed Air Systems: 2-7%
- Other*: < 2%

* Other ancillary energy usages such as lighting represent less than 2% of energy consumption

Potential Energy Saving Opportunities

- 10% to 30%
- 5% to 10%
- 10% to 20%
- 10% to 20%
- 5% to 10%
MEASUR Software Tools

- Modernize to **Open-Source Software**!
  - DOE will own and control code
  - Upgrading tool capabilities where feasible
    - **Ex: Auto-Update** capability (silent updates)
  - UT-Battelle Permissive License – “Do whatever, but please provide attribution”
- Desktop (Windows, Mac & Linux) & Web/Mobile
- Provide industry with technology/vendor agnostic analysis and evaluation tools
All system level software tools will be available to through **one platform**

Includes system modelers and individual calculators for **field validation**

Includes **built-in guides** and **tutorials**
Using MEASUR
Getting Started

Start an assessment
View Assessment Dashboard
Use Properties & Equipment Calculators
Change Settings, view tutorials, manage custom materials
Assessments Dashboard

View all your assessments in a folder-based organization

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

- Choose a unique name for the folder
- Set Equipment type (Pump, Fan, Process Heater)
- Choose folder location
  - Or make a new folder
**System Setup**

Start with current equipment and operations - baseline

- **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

- 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
- 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
- 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
- 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.
Calculators

- 40+ Stand alone Calculators
- Motors
- Pumps
- Fans
- Process Heating
- Steam
- Compressed Air
- Lighting
- General

- Most have graphical results
Example Calculators

- **Cash Flow Diagram**
  - Benefits / Cost: $2000
  - Simple Payback Period: 80 months

- **Motor Performance**
  - Current: 28.04% FLK
  - Power Factor: 13.76%
  - Efficiency: 66.77%

- **Pump Curve**

- **O₂ Enrichment**

- **Pre-assessment**
**Community Engagement:** Key Point – want to engage end users!

**Tool Development Schedule**

- **Systems completed:**
  - Process Heat (PHAST)
  - Pumps (PSAT)
  - Fans (FSAT)

- **Under Development:**
  - Steam (SSMT/SSAT) – Jan 2019
  - Compressed Air (AirMaster+) – May 2019
  - Motors (MotorMaster+) – May 2019

- [www.energy.gov/eere/amo/measur](http://www.energy.gov/eere/amo/measur)

- Ongoing Feedback link - [https://www.surveymonkey.com/r/DOE-AMO-TOOLS](https://www.surveymonkey.com/r/DOE-AMO-TOOLS)
What will this effort help enable going forward?

- **Open-Source** Library Suite - https://github.com/ORNL-AMO
  - Greater transparency
  - Future-proofing
  - New algorithms can be added to characterize other plant processes and equipment
  - Equipment providers can develop equipment specific databases that interface with the tool
- Library can be used to **effectively test** real-world equipment performance versus theoretic capabilities
- Leverage **sensors** for real-time data collection, monitoring and optimization
  - Leverage the Internet of Things devices coming online within manufacturing
- Enable **real-time system analysis and optimization**
  - Possibilities for exploring machine learning algorithms for system optimization
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Questions & Discussion?

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