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

Better Tools for Better Plants

November 15, 2011

Andre de Fontaine

Bill Orthwein, CEM

Advanced Manufacturing Office, Office of Energy Efficiency and Renewable Energy

U.S. Department of Energy

Today

- New opportunities
  - AMO Overview
  - Better Buildings, Better Plants Program
  - Better Buildings, Better Plants Challenge
- New and revised tool suite
  - Energy Management Toolkit
  - Updated system assessment tools
  - Tool-related training

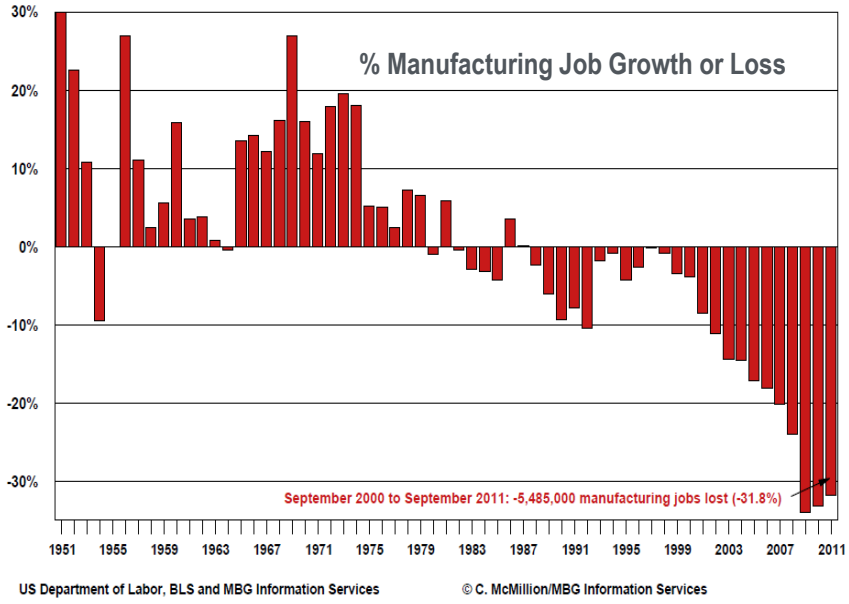
Manufacturing Matters

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

- 11% of U.S. GDP
- 12 million U.S. jobs
- 60% of U.S. engineering and science jobs
- 57% of U.S. Exports
- Nearly 20% of the worlds manufactured value added

Jobs

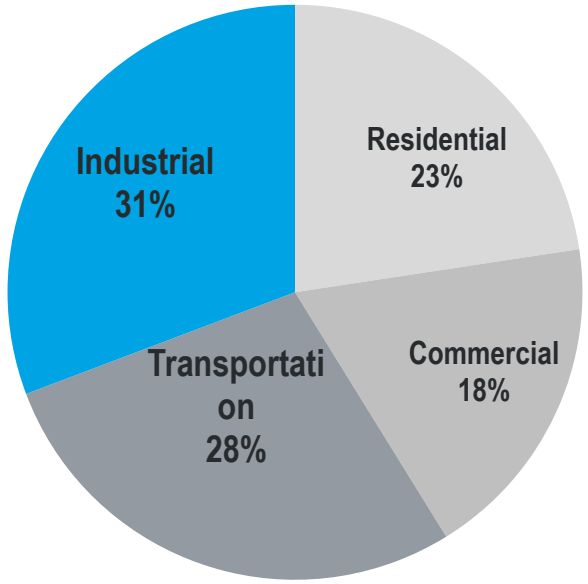
31.8% of all manufacturing jobs lost from 2000-2011



First 11-year private sector job losses since the 1930s

Energy

31% of all 2010 U.S. total energy consumption



*Includes total primary energy direct use and electricity use in end-use sectors including losses
Source: *Annual Energy Review 2010*, US EIA

Office Implementation

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

Next Generation Materials

Pervasive materials technologies that lead to better products

Next Generation Manufacturing Processes

Broadly applicable processes that lead to better production

Technology Deployment

Promote better energy use practices to capture U.S. competitive advantage

Technology Projects - Innovative Manufacturing Initiative (IMI)

Competitively selected, cost-shared technology projects:

- Produce pre-competitive and generic products
- Reduce energy consumption over product life-cycles
- Increase the adaptability of manufacturers through alternate materials and process pathways
- Not directed at products to be sold competitively in existing markets
- Maintained project support through manufacturing-scale demonstration

Targeted Partnerships

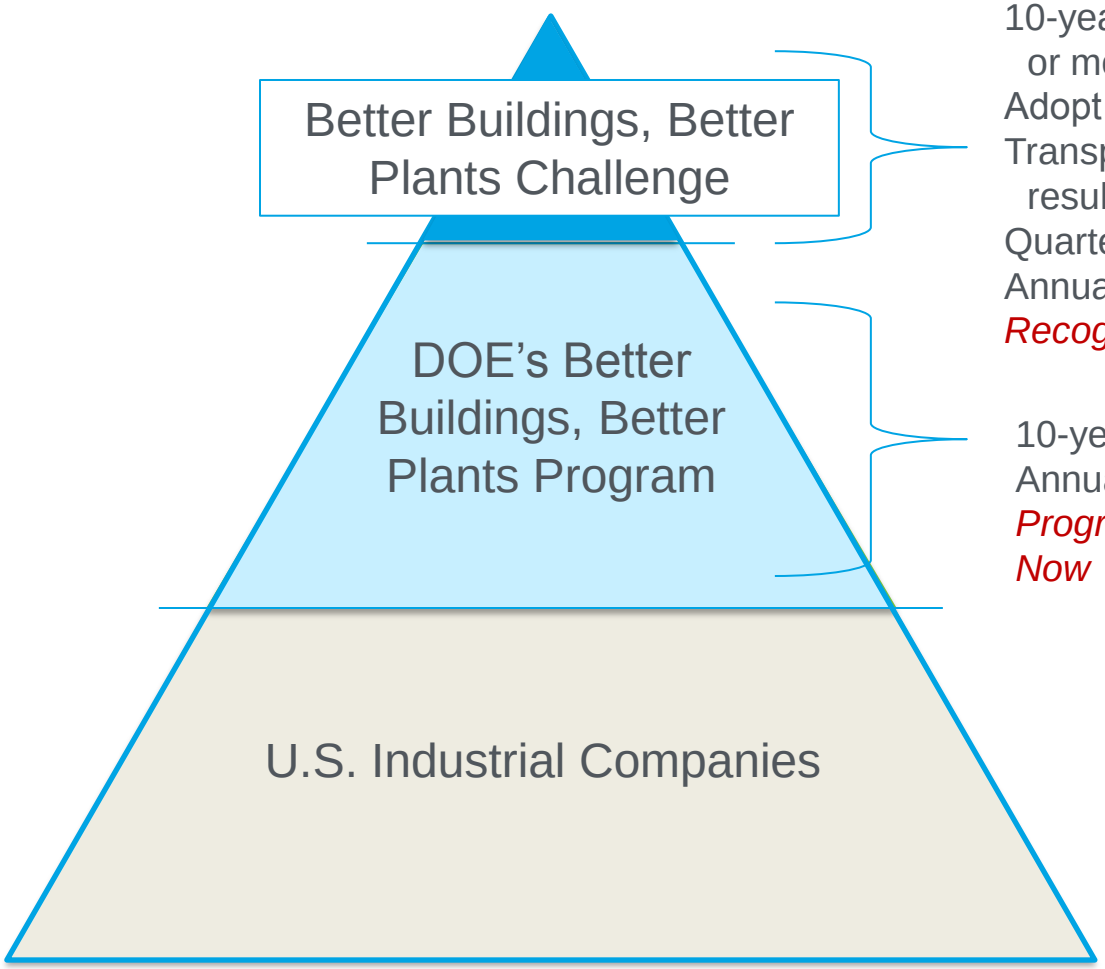
- Superior Energy Performance
- Better Buildings, Better Plants
- Workforce Development
- Clean Energy Application Centers
- Supply Chain Initiative

TRL 2-6 → TRL 2-8 → TRL 9

New Opportunities

- DOE is evolving its industrial partnership program to align it with the **Better Buildings Challenge** and provide greater integration across the industrial and commercial sectors
- The industrial component of the Better Buildings Challenge provides different opportunities for national recognition based on level of commitment:
  - **Better Buildings, Better Plants *Program Partners*** pledge energy savings goals consistent with national targets and agree to report progress annually to DOE. Program requirements largely match those of the *Save Energy Now* LEADER initiative
  - **Better Buildings, Better Plants *Challenge Partners*** agree to transparently pursue innovative approaches to energy efficiency, and make a significant, near-term investment in an energy saving project or set of projects

Highlighting Industrial Leadership in the Better Buildings Challenge



10-year, 25% savings target (or equivalent) or more
Adopt "market innovations"
Transparency in market innovations and results
Quarterly reporting on innovations
Annual reporting on results
Recognized as premier market leaders

10-year, 25% savings target
Annual reporting
Program requirements track Save Energy Now

Success to Date

- *Save Energy Now* LEADER (SENL) was officially launched in December of 2009
- 108 companies signed the DOE Pledge to reduce energy intensity by 25% or more in 10 years
- As of November 1, 2011, SENL companies representing over 1,300 facilities have submitted annual reports documenting their energy intensity improvements, energy use data, and achievements
  - Total energy use (most updated baseline source energy consumption) represented by these companies is over 1 quadrillion Btu
  - The share of total U.S. manufacturing energy use represented by these companies is 4.8% (MECS 2006)
- Over two-thirds of reporting companies are on track to meet their 25% improvement goal
  - Six companies have met their 10-year targets
  - Several firms are making multi-million dollar EE investment commitments
  - Many SENL companies are pursuing Superior Energy Performance certification

Better Buildings, Better Plants Program

- DOE will continue partnering with SENL companies through the Better Buildings, Better Plants Program. Key program requirements will stay the same. Companies:
  - Keep their 10-year, 25% energy intensity improvement target
  - Maintain their baseline year and any progress made toward the target
  - Report annually on their progress
  - Receive national recognition for their achievements
- Official name change occurs December 1, 2011

DOE will transition all SENL companies to the Better Buildings, Better Plants Program, although any company may opt-out

Better Buildings Challenge

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

The Better Buildings Challenge: The Better Buildings Challenge is a Presidential leadership initiative which calls on Chief Executive Officers, University Presidents, and State and local leaders to create American jobs through energy efficiency. These leaders make public commitments to action and share their successful strategies with other organizations and are recognized for their leadership.

Different kinds of organizations can be part of this vanguard:

PARTNERS:

- Commercial
- Industrial
- Universities
- Communities

ALLIES

- Financial

Challenge Milestones

- President Obama announced the Better Buildings Initiative, including the Better Buildings Challenge, in February
- DOE Secretary Chu highlighted the Better Buildings Challenge at the Clinton Global Initiative in June; DOE and White House profiled inaugural partners
- Official launch of the program in Fall 2011, including industrial partners

Better Buildings, Better Plants Challenge

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

Commit

- Assign Senior Executive
- Set public energy goal for next 2-5 years; can retain 25%, 10-year goal already established
- Announce market innovations, e.g., energy efficiency capital set aside programs, scalable models for Superior Energy Performance certification, supply chain engagement, emerging technology deployment, etc.

Take Action

- Showcase project within 9 months. Can include:
  - Whole building improvement
  - Project over $1 million
  - Project to reduce energy intensity by 10% or more within a single facility
- Organization-wide energy management plan within 9 months

Report Results

- Share information and marketplace blueprints
- Share portfolio-wide, facility-level energy performance; flexibility provided for proprietary information
- Quarterly updates on progress

Recognizing Leadership

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

Company Milestone	Type of DOE Recognition
Taking the Challenge	Letter from DOE Secretary to CEO, detailed on-line profile on web site, participation in Challenge launch (for founding partners); press release
Announcing market innovations and showcase projects	Exposure through web profile, DOE-initiated media outreach
Quarterly and Annual Achievements	Leadership press releases
Successfully completing market innovations and showcase projects	DOE-initiated media outreach; web profile; DOE press releases
Achieving goals	Public event, DOE-initiated media outreach, letter from DOE Secretary
Joining program	Letter signed by AMO Program Manager (PM), basic on-line profile on AMO web site
Achieving >2.5% energy intensity improvement in a single year	Letter signed by AMO PM; press release
Achieving 10-year, 25% target	Letter and plaque signed by DOE Secretary; press release

Better Buildings, Better Plants Challenge

Better Buildings, Better Plants Program

Next Steps

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

- Better Buildings Challenge Launch in Fall of 2011
- SENL officially transitions to Better Buildings, Better Plants Program Dec. 1, 2011
- Recruitment ongoing for both program tiers (contact BetterPlants@ee.doe.gov)
- Revised tools ready by end of year

New Resources

- To help all partners meet their goals, AMO is revamping its suite of on-line tools and resources and organizing them through a more dynamic, user-friendly portal to:
  - Support continuous improvement in energy management through ISO 50001 and SEP
  - Enable Program Partners to more easily track energy intensity improvement and report annually
  - Accommodate plants and companies at different levels of maturity in energy management

Technology Deployment Resources

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

AMO supports manufacturers in rapidly adopting energy efficient technologies, practices, and management approaches by providing:

Software Tools

- Process heating, steam, motors and pumps, fans
- Plant Energy Profiler
- Energy and carbon baselining
- Energy management

Information

- Technical knowledge
- Fact and tip sheets
- Case studies
- Sourcebooks
- Design and retrofit guidelines

Training

- Introductory courses via webinars
- Advanced/Qualified Specialist
- Certified Practitioners

Audience

- ISO 50001
- SEP plant certification
- Better Plants
- Other Plant

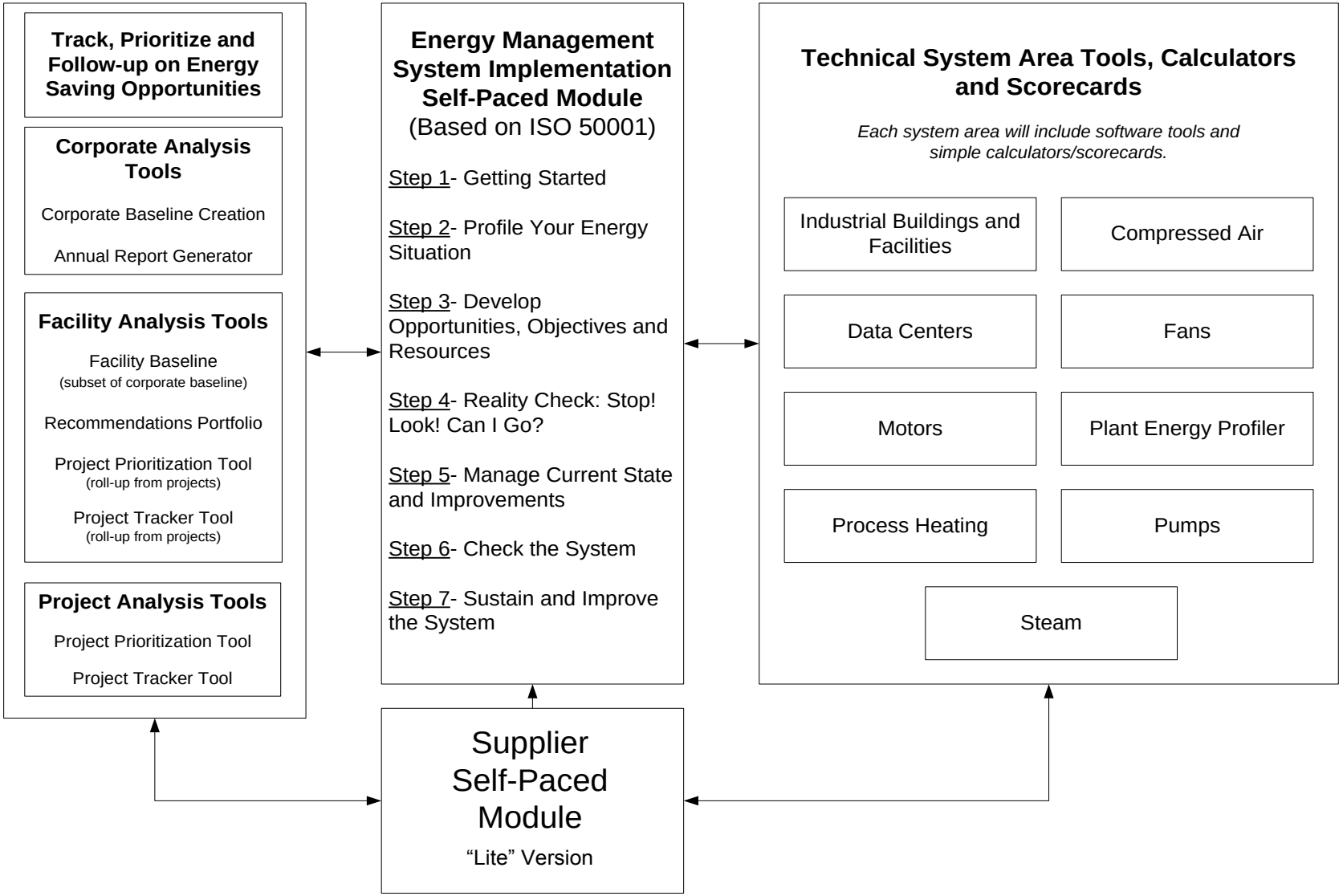
Savings Assessments

- In-plant, peer-to-peer
- Industrial Assessment Centers (IACs)

http://www1.eere.energy.gov/industry/saveenergynow/resources.html

Energy Management Toolkit Structure

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



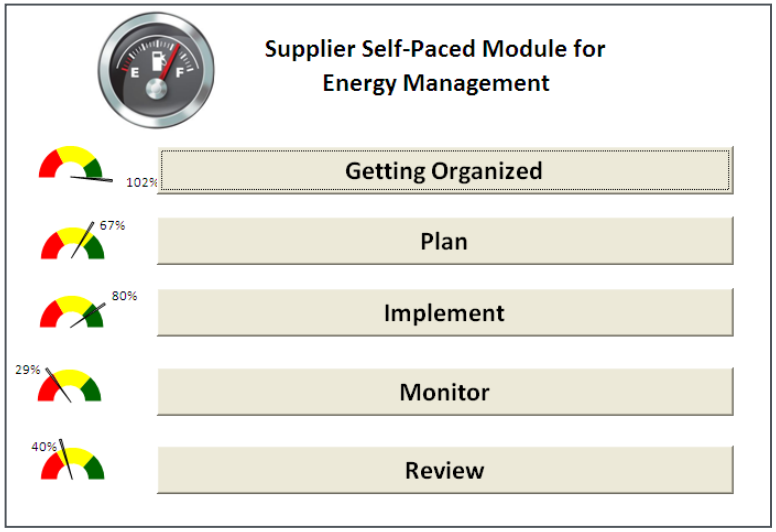
Self-Paced Module

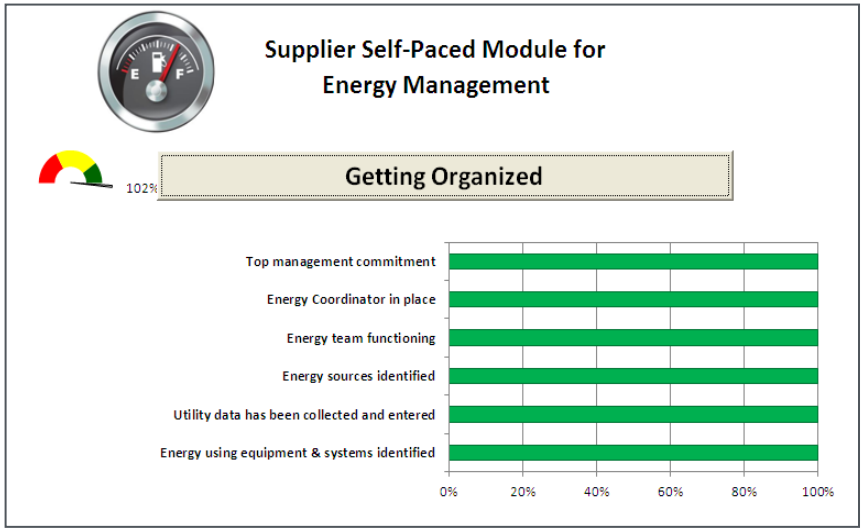
- Based on the International Energy Management Standard ISO 50001
- 7 step process for developing an Energy Management System (EnMS) and improving energy performance
- Guides the user through the entire process- from the decision to implement an EnMS to successful implementation and beyond
- Focuses on continual improvement
- Designed to help the organization realize the benefits of implementing an energy management system:
  - Improved operational efficiencies
  - Decreased energy intensity
  - Energy data for fact based decisions
  - Support for organizational and cultural change
  - Drivers for organizational integration
  - Reduced environmental impacts
  - Competitive advantages over firms that neglect resources management
  - Visible demonstration of corporate social responsibility
  - Positioning for carbon accounting

Supply Chain Energy Management Tool

AMO is developing tools that industry partners can distribute to suppliers

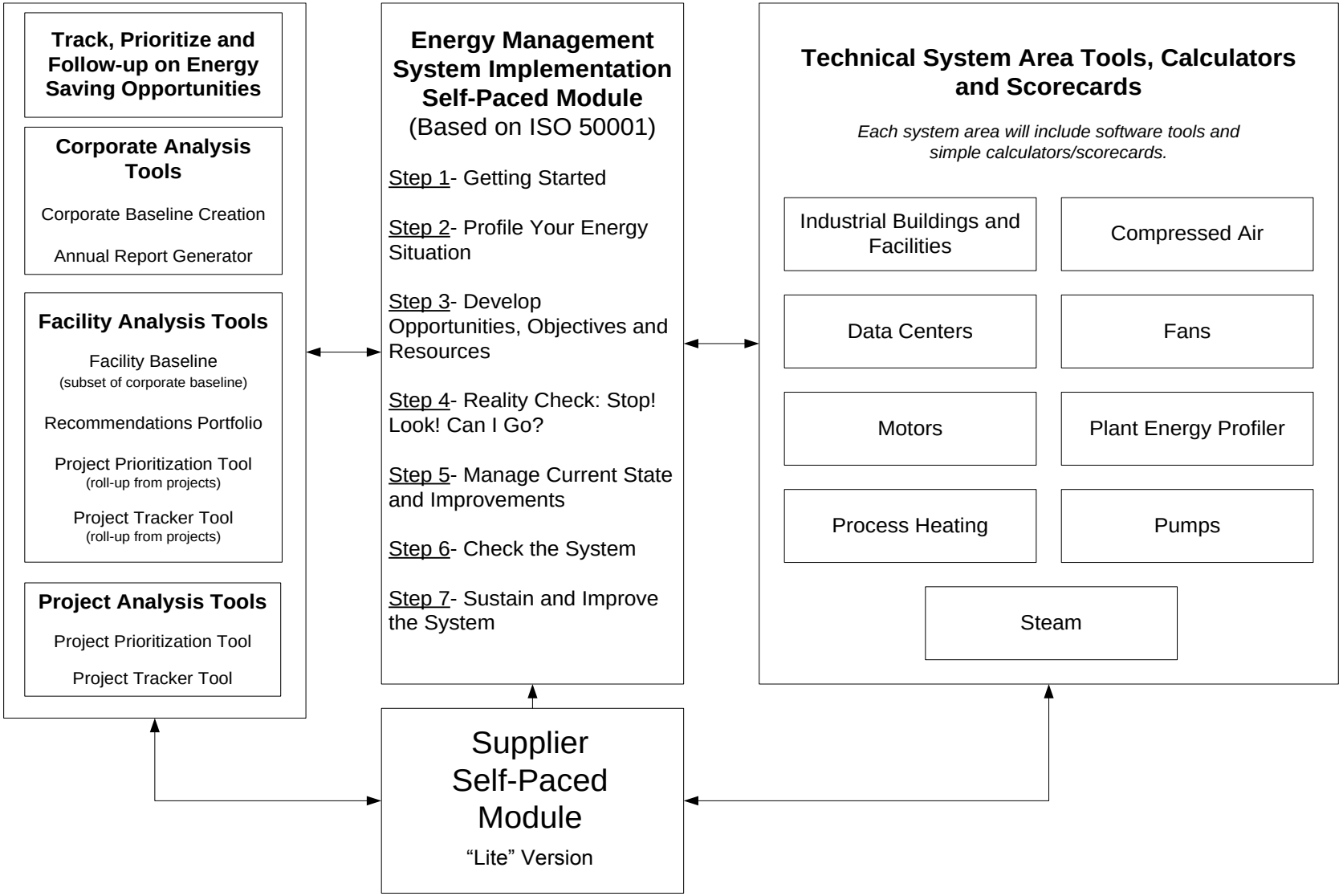
- Supply chain energy management tool is designed to help companies new to the issue develop basic energy management systems
- Describes simple steps companies can take to improve energy management and links to additional templates, worksheets, and guidance to help companies work through the steps





Energy Management Toolkit Structure

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



Plant Energy Profiler (PEP)

INPUTS

- Plant description
- Utility supply data
- Energy use information

- Overview of plant energy
- Energy cost distributions
- Preliminary assessment
- Areas for improvement
- Energy reduction potential

OUTPUTS

http://www1.eere.energy.gov/industry/quickpep_ml

Small Tools Currently Being Developed

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

- Upgraded Industrial Facilities Scorecard
- Daylighting tool
- Fans VSD Calculator
- Pumps VSD Calculator
- Boiler Excess Air Tune-up
- Solar Photovoltaic Array
- Outside Air Intake Calculator
- Air Pressure Reduction Calculator
- Air Leak Loss Calculator
- Synthetic Lubricant Savings
- Waste Heat Recovery Calculator
- Vortex Nozzles for Cleaning
- Energy Savings for Low Demand Periods
- Solar Thermal Heating (Flat-Plate)
- Solar Thermal Heating (Parabolic-Trough)
- Notched V-Belt

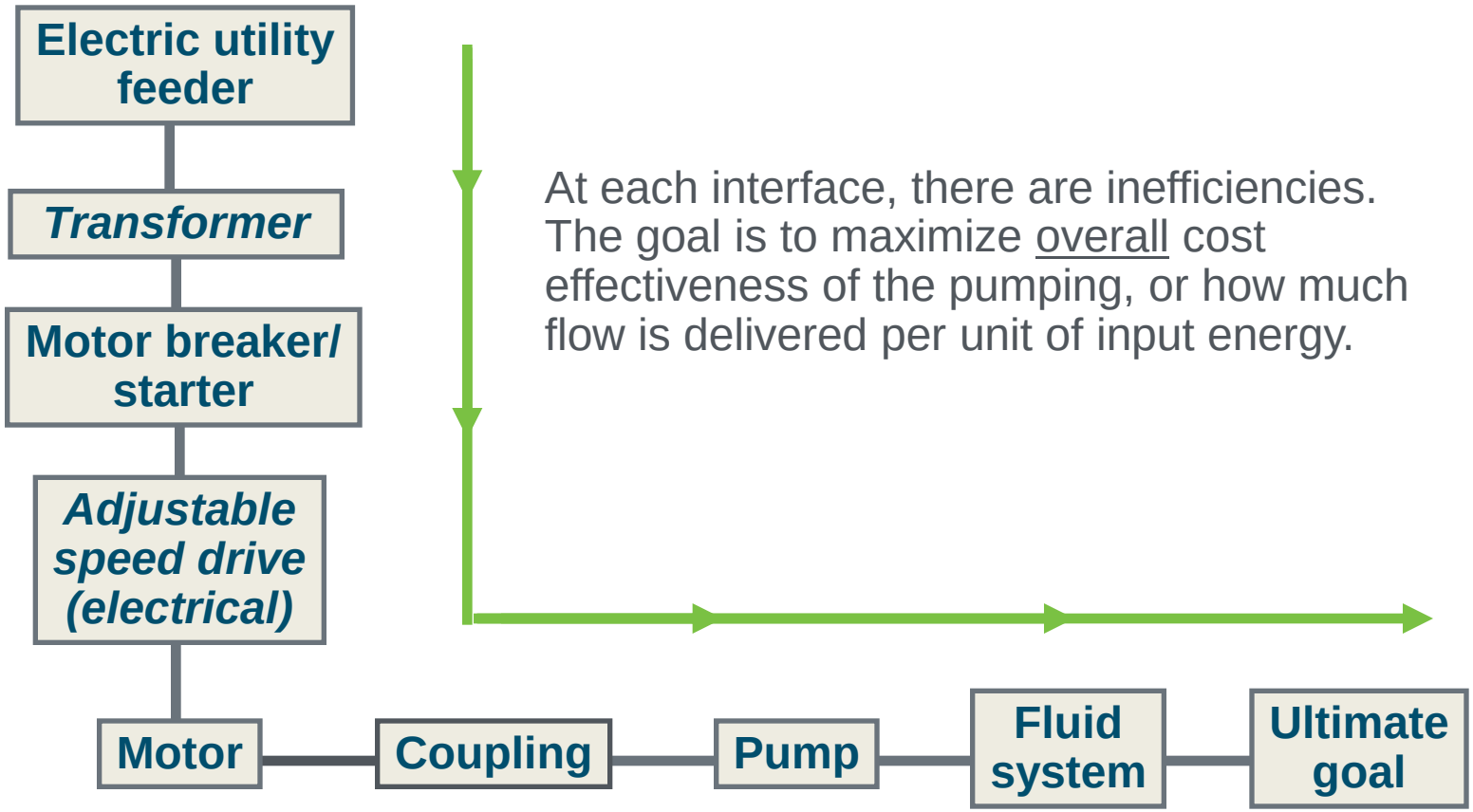
Motor Decisions Are Made Easier with **MotorMaster+**

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

Decide correctly with a motor systems management plan.

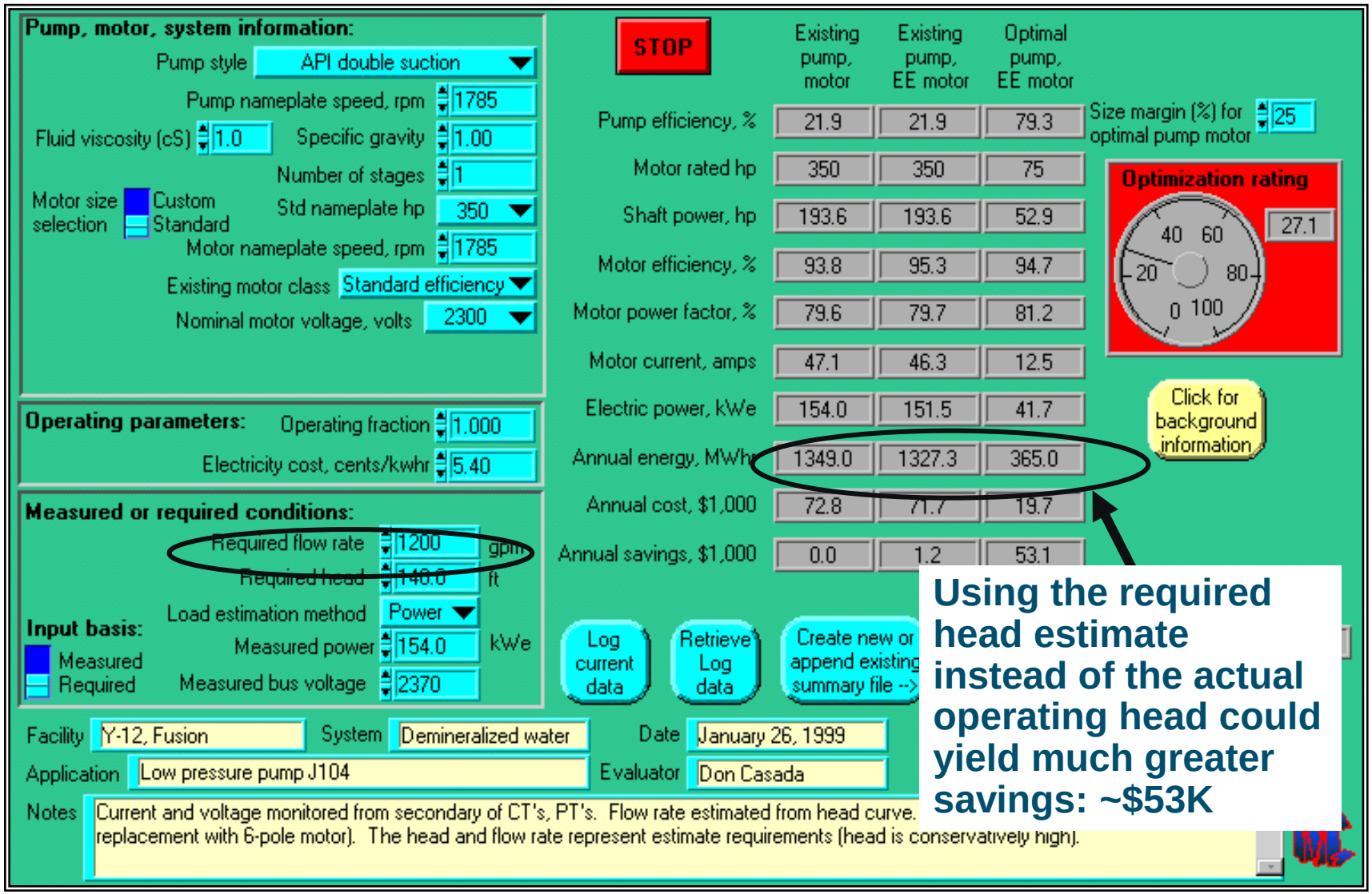
Pumping System Assessment Tool (PSAT)

Energy Flow for Pumping Systems



At each interface, there are inefficiencies. The goal is to maximize overall cost effectiveness of the pumping, or how much flow is delivered per unit of input energy.

PSAT Tool: Identify Significant Potential Energy Savings



Using the required head estimate instead of the actual operating head could yield much greater savings: ~$53K

AirMaster Plus

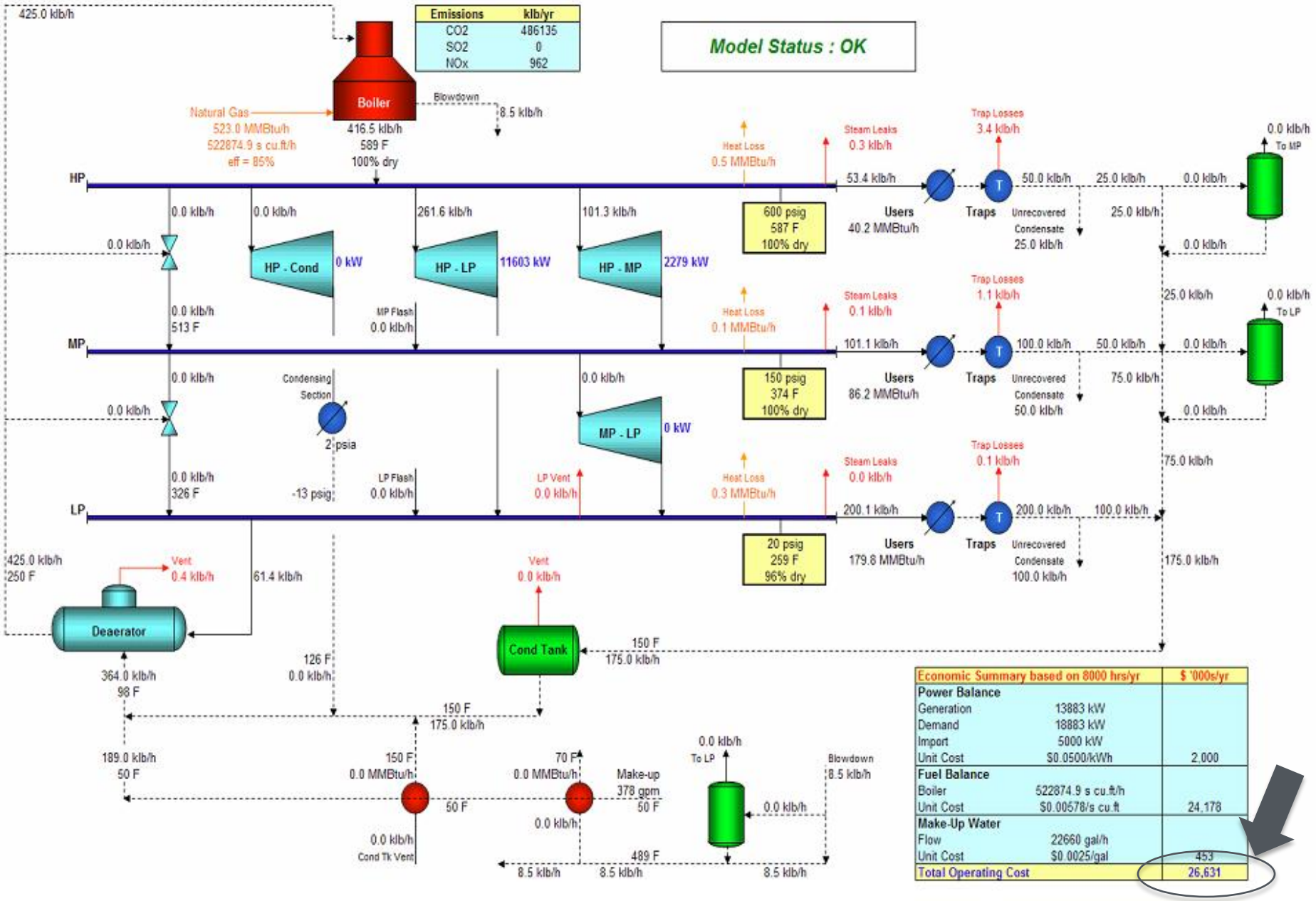
AirMaster+ can be used to baseline a compressed air system and then evaluate the energy savings from seven energy efficiency measures:

- Reduce Plant Air Leaks
- Adjust Manual Staging
- Use Unloading Controls
- Reduce System Pressure
- Sequence Compressors
- Reduce Run Time
- Add Primary Storage

AIRMaster+ provides a systematic approach to assessing the supply-side performance of compressed air systems.

http://www1.eere.energy.gov/industry/bestpractices/software_airmaster.html

Steam System Assessment Tool (SSAT)



Economic Summary based on 8000 hrs/yr		$ '000s/yr
Power Balance		
Generation	13883 kW	
Demand	18883 kW	
Import	5000 kW	
Unit Cost	$0.0500/kWh	2,000
Fuel Balance		
Boiler	522874.9 s cu.ft/h	
Unit Cost	$0.00578/s cu.ft	24,178
Make-Up Water		
Flow	22660 gal/h	
Unit Cost	$0.0025/gal	453
Total Operating Cost		26,631

Application of SSAT

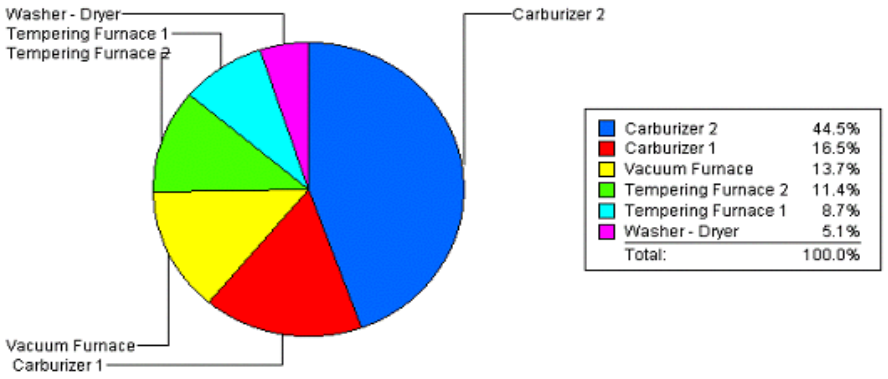
Facilities can use SSAT to evaluate these key areas for energy performance improvements:

- Real cost of steam
- Steam quality
- **Boiler efficiency**
- Alternative fuels
- Cogeneration opportunities
- Steam turbines vs. PRVs
- Boiler blowdown
- **Condensate recovery**
- **Steam trap operating efficiency**
- Heat recovery
- Vent steam
- Steam leaks
- Insulation efficiency
- Emissions calculations

PROCESS HEATING ASSESSMENT SOFTWARE Tool (PHAST)

Plant Furnace Summary

Process Heating Equipment - Cost Distribution



Process Heating Equipment-Energy Used and Cost Distribution

Heating Equipment	Fuel Energy Use Million Btu/Year	Electric Energy Use - Thousand KWh/Year	Steam Energy Use Million Btu/Year	Annual Cost ($/Year)	% of Total Cost	Cumult. % of Cost
Carburizer 2	60,480.00	8,820.00	0.00	832,860.00	44.54	44.54
Carburizer 1	51,840.00	192.00	0.00	308,640.00	16.50	61.04
Vacuum Furnace	0.00	4,669.00	0.00	256,795.00	13.73	74.78
Tempering Furnace 2	28,080.00	52.00	0.00	213,460.00	11.42	86.19
Tempering Furnace 1	21,240.00	52.00	0.00	162,160.00	8.67	94.86
Washer - Dryer	6,300.00	1,088.00	15,552.00	96,065.00	5.14	100.00
Total	**167,940.00**	**14,873.00**	**15,552.00**	**1,869,980.00**	**100.00**	

Plant Energy Use and Cost Distribution Report*

The report shows:

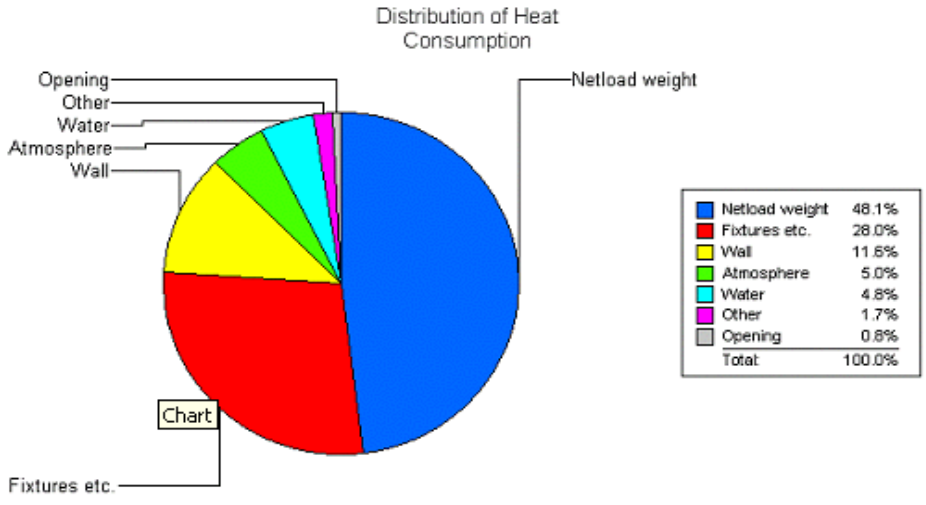
- Estimated annual energy use and estimate annual cost of energy for heating equipment (furnaces, ovens etc.)
- List of heating equipment and % of total energy cost used for each equipment in order of annual cost of energy used.

* for the Surveyed Process Heating Equipment

Furnace Analysis Report

Company : ABC Corporation **Furnace :** Carburizer 1
Plant : Excellent Heat Treating

Current Condition **Net Heat Consumption Data**



Heat Storage (Btu) : 50,320,220.00 **Thermal Efficiency (%) :** 21.02

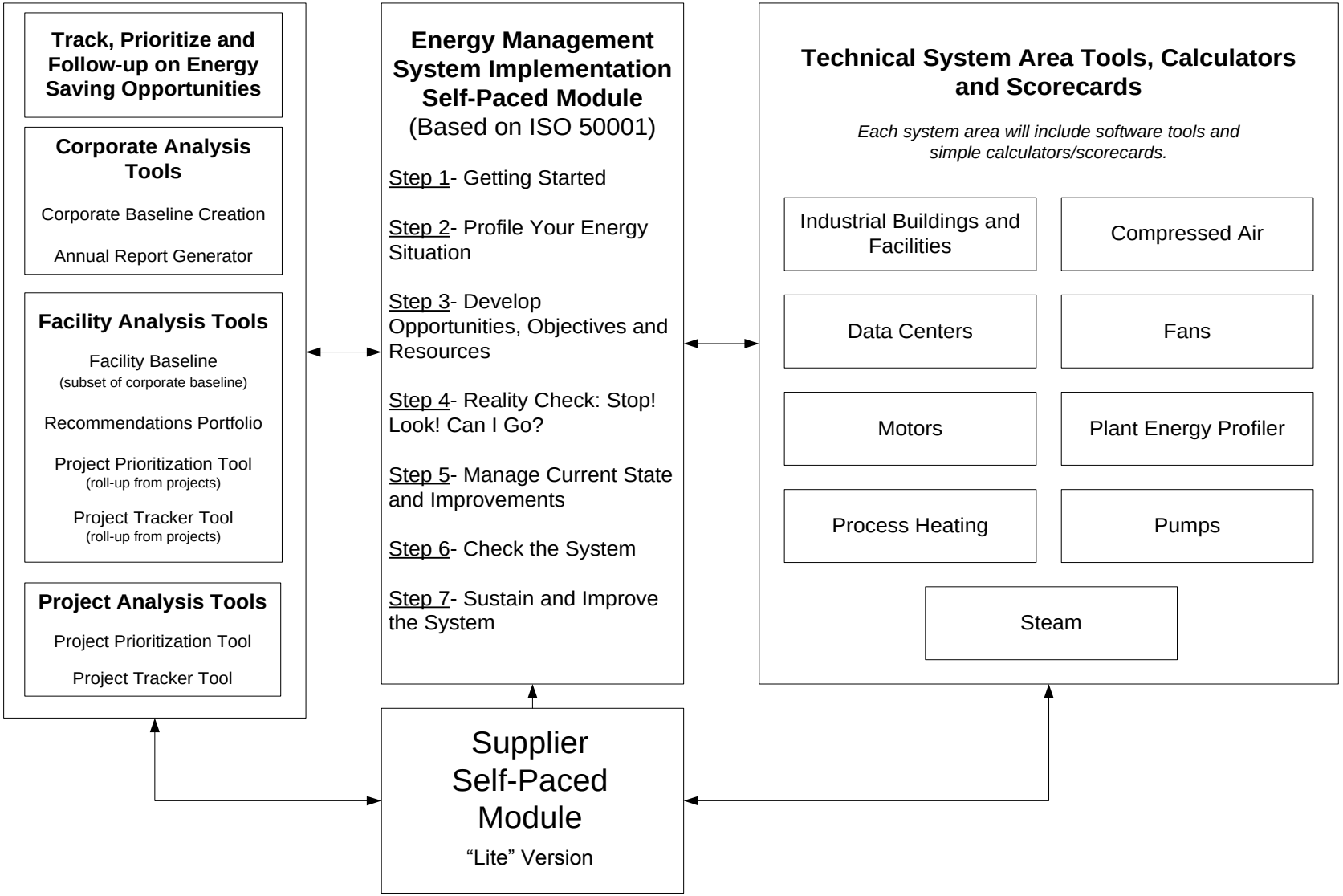
Area of Heat Consumption	Btu/hour
Netload weight	1,490,190.00
Fixtures etc.	868,000.00
Wall	358,068.00
Atmosphere	155,000.00
Water	150,300.00
Other	53,396.00
Opening	24,783.00
Total	**3,099,737.00**

Furnace Heat Balance Energy Use—Losses Distribution

The report shows analysis of energy used in various parts of a furnace under a given operating condition.

Energy Management Toolkit Structure

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



Portfolio Tool

- Provide Portal users a central location for viewing, comparing and prioritizing energy saving opportunities and projects
- Planning tool, not a tracking tool
  - Designed to *provide data to* tools that support verification for DOE's pledge programs
  - Will not include verification and validation components
  - Designed to support the *export of projects* into management software for tracking purposes
- Currently in development- release date is December 31, 2011

Software Tool-Related Training

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

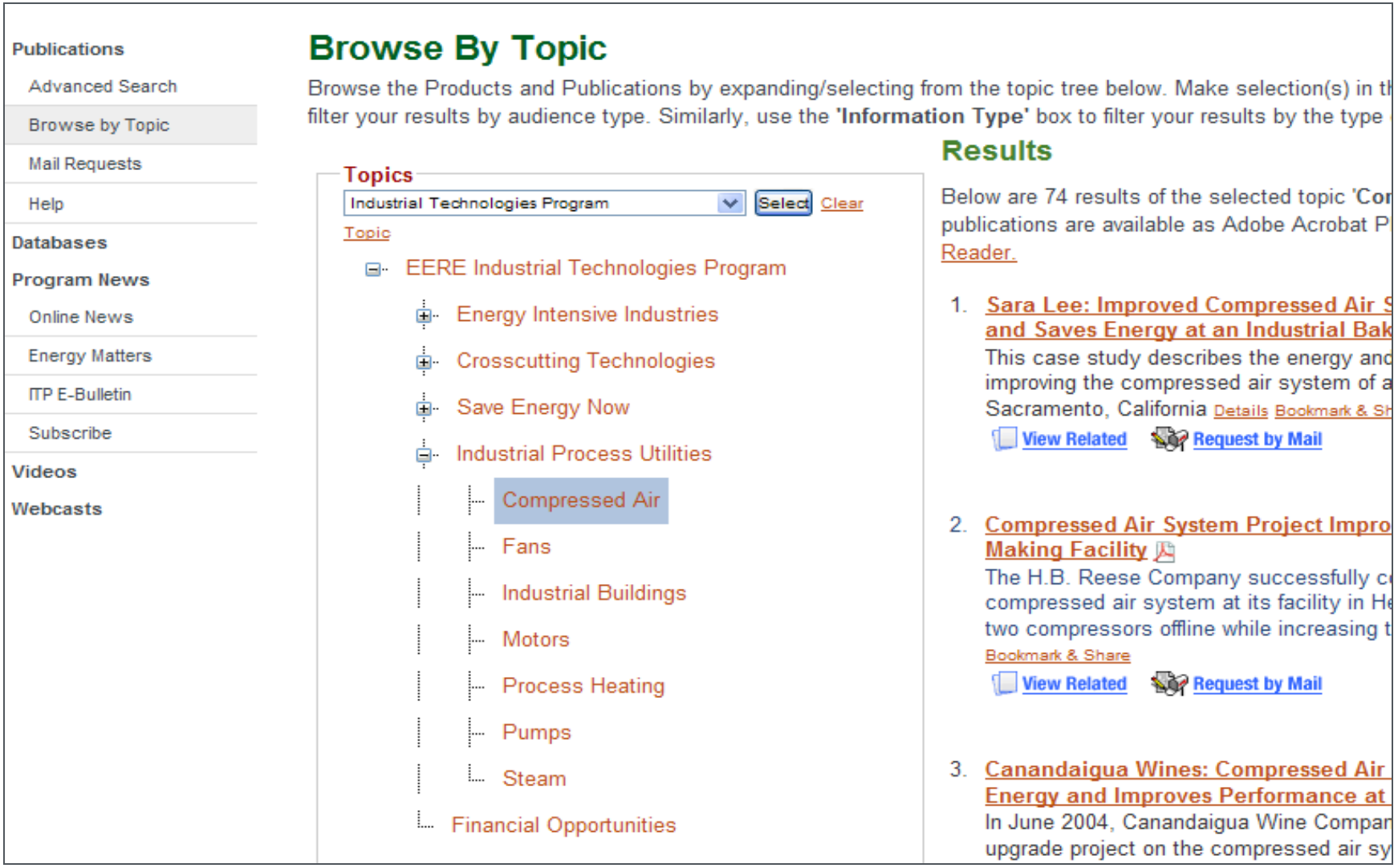
Training at several levels for:

- Awareness webcasts *(1-2 hours)*
  - Four-part energy management series
  - Tool specific
- Online, self-paced end-user training
- Qualified Specialist training and certification*(2 days)*
- Certified Practitioner training and credentialing *(2-3 days)*
  - Energy Management
  - Systems
- Data Center Energy Practitioner training and certification *(1-3 days)*

See www.eere.energy.gov/industry for details

ITP's Publication and Product Catalog Allows Searching or Browsing by Topic

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



http://www1.eere.energy.gov/library/browsebytopic.aspx?Page=6

How Can I Contact AMO?

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

- Bill Orthwein, Tool Development
  (202) 586-3807
- Paul Scheihing, Tech Deployment team lead and Superior Energy Performance
  (202) 586-7234
- Andre de Fontaine, *Save Energy Now* LEADER (Better Plants) and Supply Chain
  (202) 586-6585
- John Smegal, Workforce Development: Certified Practitioner and IAC programs
  (202) 287-6225
- Scott Hutchins, National Partnership Development
  (202) 586-0670
- Sandy Glatt, States and Utilities
  (303) 275-4857

http://www1.eere.energy.gov/industry/