Energy Efficiency Training Webinar

Overview Session

***Acknowledgment*:** This material is based upon work supported by the U.S. Department of Energy through the Missouri Department of Natural Resources under Award Number DE-EE0000131.

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INDUSTRIAL Energy Efficiency

Agenda

- Introduction on ARRA and SEP
- Overview of Energy Assessments
  - Objectives
  - Types (Level I, II & III)
  - Energy Assessment Matrix
  - Energy System Breakdown
  - Summary of Benefits
- Overview of Energy Assessment Tool
  - Data input
  - Navigate
  - Reporting
- Q & A

American Recovery and Reinvestment Act (ARRA)

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Overview:

- The ARRA of 2009 was signed into law by President Obama on February 17th, 2009.
- An unprecedented effort to jumpstart our economy, create or save millions of jobs, and address long-neglected challenges.

Recovery Act Purpose

- Preserve and create jobs and promote economic recovery.
- Assist those most impacted by the recession.
- Spur technological advances in science and health via investment.
- Generate long-term economic benefits via investment.
- Stabilize state and local government budgets.

State Energy Program (SEP)

- Administered by the U.S. Department of Energy's (DOE) Office of Energy Efficiency and Renewable Energy (EERE).
- $3.1 billion for comprehensive state energy programs.
  - $57,393,000 for Missouri (June 2009)

Goals:

- Increase energy efficiency to reduce energy costs and consumption.
- Reduce reliance on imported energy.
- Improve the reliability of electricity and fuel supply and the delivery of energy services.
- Reduce the impacts of energy production and use on the environment.

Energy Assessments Objectives

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- PRIMARY GOAL:
  - To qualify and quantify how the building energy systems are performing now, and how that performance can be improved.
  - Identify what will be the outcomes of those improvements for the Owner in financial and non-financial terms.

Energy Assessments Objectives

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- Identify what types of energy are being used.
- Obtain a better understanding of how energy is being used, i.e. quantify energy usage to its discrete functions.
- Identify no-cost/low-cost measures to improve operation efficiency and enable a reduction in energy usage and costs.
- Complete economic analysis to highlight good investment opportunities .
- Assess the feasibility of renewable energy projects.

Types of Energy Assessments

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- ASHRAE Level I (simple audit) – a facility walk-through inspection that identifies most obvious no/low cost areas for energy savings and potential opportunities for capital investment.

- ASHRAE Level II – provides more detailed energy analysis including economic calculations, monitoring and metering to determine level of energy efficiency.

- ASHRAE Level III (comprehensive audit) – provides more rigorous computer modeling to determine year round energy consumption used to support major capital investment decisions.

Energy Assessment Matrix

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Type	Cost ($)	Timeframe	Level of Effort	Primarily used for	
				Commercial	Industrial
Level I	$7- 9 K*	1 month	Low-Medium	X	
Level II	$10 – 20 K*	1- 1.5 months	Medium	X	X
Level III	$ 20 – 40 K*	1.5 - 3 months	High		X

Energy Systems Breakdown

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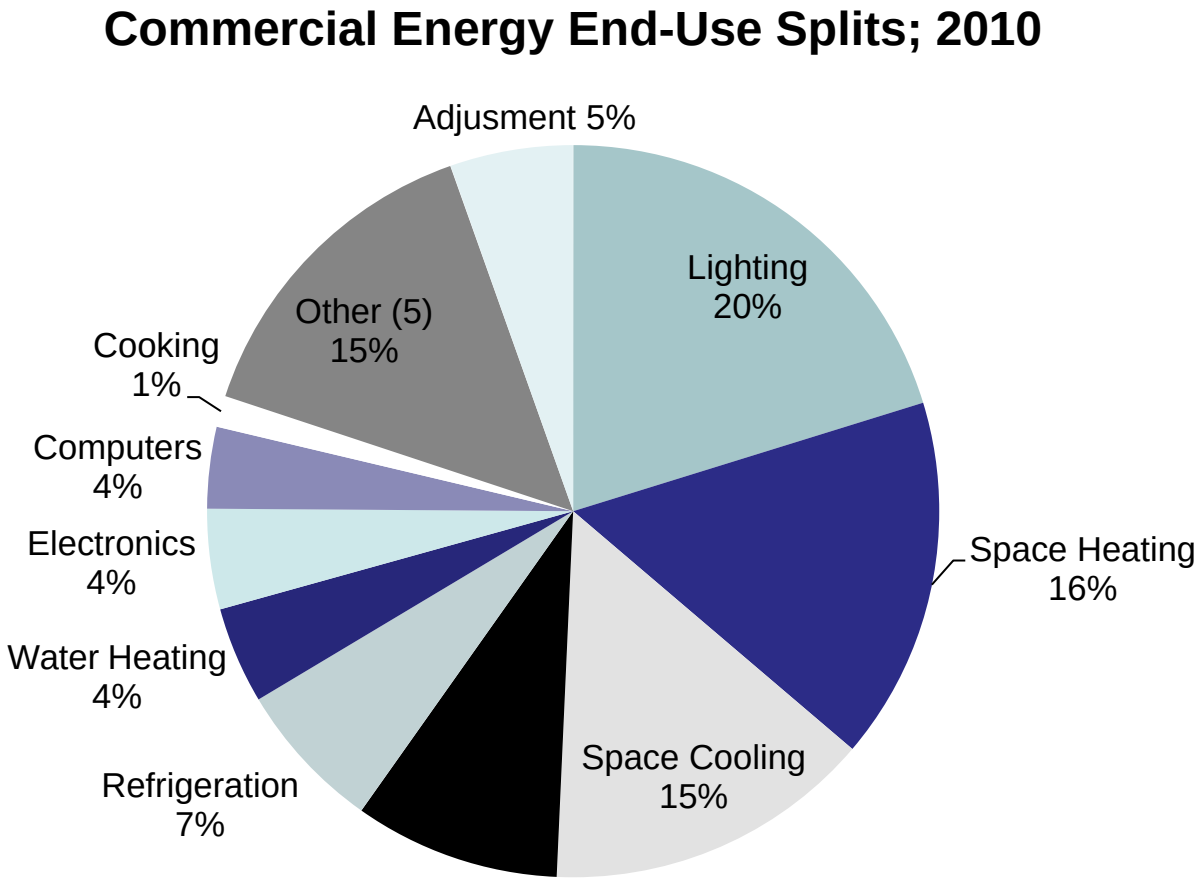

Source: EIA Energy Outlook 2011
http://buildingsdatabook.eren.doe.gov/TableView.aspx?table=3.1.4

Benefits of Energy Assessments

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- Identify opportunities for cost savings – generally larger opportunity in commercial and industrial sectors.
- Energy cost reduction measures (ECRM) that are implemented and maintained properly; provide long term sustainable cost savings.
- Provide more visibility of energy use and helps quantify ECRM opportunity.
- Allows for more informed decision making.

Conducting an Audit

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- **Steps:**
  - Planning.
  - Facility Information Data Collection.
  - Utility Bill Analysis.
  - Walk-through Audits.
  - Energy Audit Report.
  - Measurement & Verification.

Energy Utilization Index (EUI)

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- EUI is commonly used to compare like buildings and determine if further analysis is likely to produce significant cost savings.
- A unit of measurement that describes a building's energy use; it represents the energy consumed by a building relative to its size
- Total annual energy use (BTU) divided by total square feet of conditioned space (ft^2).

$$\text{EUI} = \frac{\text{Total annual energy use (BTU)}}{\text{Total square feet of conditioned space } (ft^2)}$$

Energy Cost Index (ECI)

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- ECI is used to track variation in economic expense of a facility throughout time.

- Used to indicate a building is consuming more energy than previously or more frequently to show the impact of increasing utility rates:

$$\text{ECI} = \frac{\textbf{Fully Loaded Annual Cost (\$)}}{\textbf{Total square feet of conditioned space (ft}^2\textbf{)}}$$

Benefits of EUI & ECI

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- Owners are always looking for opportunities to conserve energy and reduce operating costs.
- Helps management plan and prepare for future operational costs and capital investments.
- Understand potential for improvement by comparing the building to an array of data from similar buildings.
- Helps track and monitor energy consumption over time.

Energy Assessment Tool Overview

- Allows companies to identify and analyze potential energy savings opportunities.
- Assists building managers in conducting a quick assessment of their facility.
- Provides guidance with performing energy assessment measurements and calculations.
- Allows users to compare results against their own capital investment requirements.

Energy Assessment Tool

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MISSOURI DEPARTMENT OF NATURAL RESOURCES

Energy Assessment Tool

Version 1.0
Published: January 1, 2012

General Inputs	Use General Inputs to complete the required project information.
Project Selection	Use Project Selection to choose and analyze different energy efficiency projects.
Reports	Displays results from selected energy efficiency project, including estimated energy savings, cost savings, project cost and payback.
User's Guide	Use User's Guide to learn more about this tool.
Conversion Calculator	Convert units by using this Conversition Calculator.

This material is based upon work supported by the Department of Energy under Award Number DE-EE0000131 provided under the American Recovery and Reinvestment Act of 2009.

This energy assessment tool was created by Shaw Environmental & Infrastructure, Inc. for the Missouri Department of Natural Resources.

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Project Selection

Main Menu

Project Selection

Air Infiltration

- Insulate Door/Window

Boilers

- Improve Boiler Combustion Efficiency
- Insulate the Uninsulated Steam Pipes
- Minimize Boiler Blowdown
- Recover Heat from Boiler Blowdown
- Repair Steam Leaks
- Repair Steam Traps

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Compressed Air

- Compressed Air Leaks
- Recover Compressor Waste Heat
- Reduce Air Compressor Pressure
- Using Outside Ambient Air for Compressor Intake

Lighting

- Lighting Retrofits
- Occupancy Sensors on Lighting Fixtures

Motors

- Motor Power Factor Correction
- Install Variable Speed Drive (VSD) on Motors
- Motor Replacement
- Replace Motor's Standard Belts with Cogged Belts

Pumps

- Trim or Replace Impellers on Oversized Pumps

Vending Machine

- Vending Machines

Data Inputs – Basic Info

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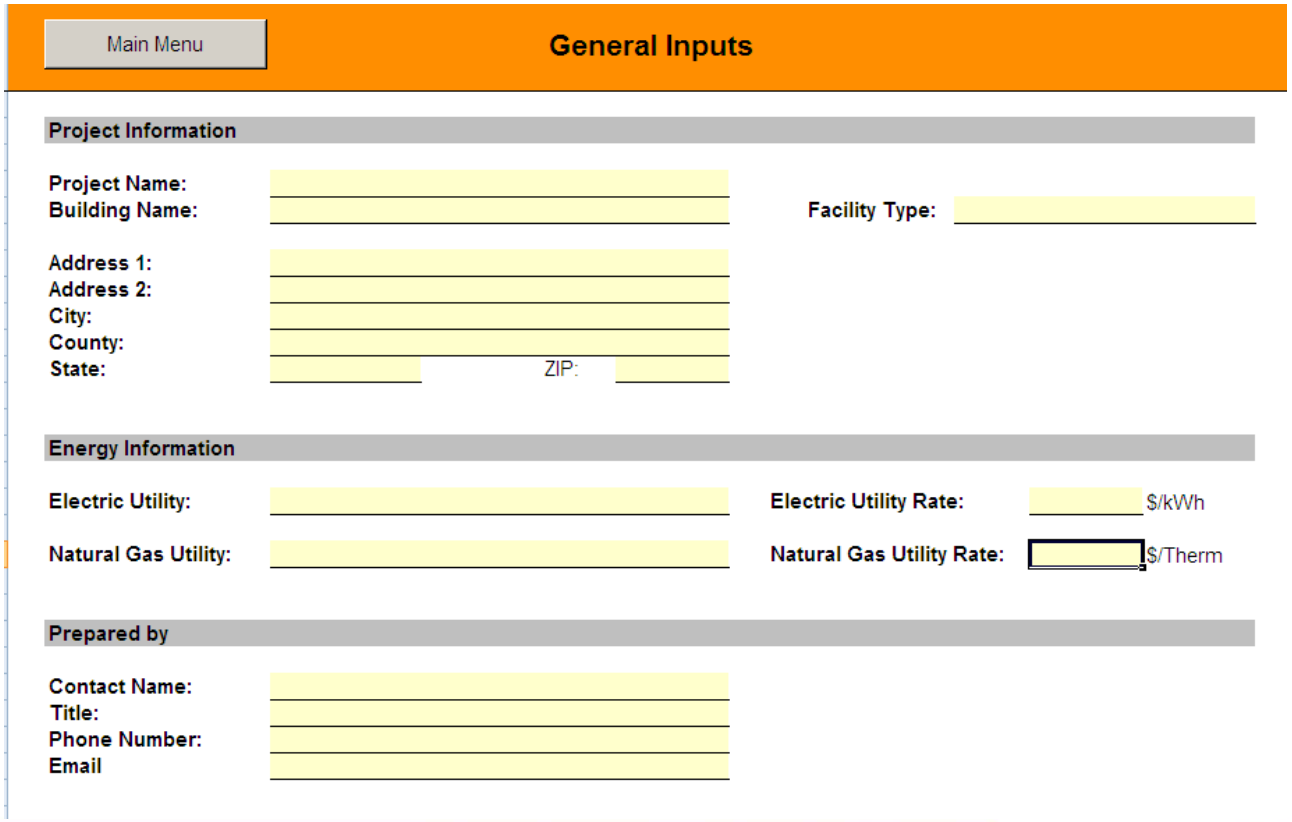
- Basic information – site address, type of facility, utility providers and current utility rates



Lighting Retrofits

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Main Menu | **Lighting Retrofit** | Project Selection

Project Overview: Lighting retrofits typically represent one of the most economical energy saving projects that can be implemented at a commercial or industrial facility, as well as one of the options with the quickest payback. Lighting retrofit projects consist of replacement of standard inefficient fixtures with fixtures that consumes less energy.

Input	Value	Value	Value	Units
Select the Existing Fixture type to be replaced	60W Incandescent	96W - 8' Ft Linea		type
Number of Fixtures		234.00	250.00	number
Number of Lamps/Fixture		2.00	1.00	number
Annual Lighting Hours		3,131.00	3,131.00	hrs/yr
Watts per Lamp		40.00	75.00	W
Total Project Cost		$5,000.00	$5,000.00	$
Additional Utility Incentives		$50.00	$50.00	$

60W Incandescent
40W Incandescent
75W Incandescent
100W Incandescent
34W - 4' Ft Linear T12
40W - 4' Ft Linear T12
96W - 8' Ft Linear T12
Standard Exit Sign

Select the type of lighting from the drop down menu

Manually entered values

Multiple columns allows to enter multiple types of lamps/fixtures

Output	Value	Value	Value	Units
Proposed Fixture Type	16W CFL	32W Linear T8	20W CFL	type
Annual Energy Savings	26,375.54	11,722.46	43,051.25	kWh
Annual Cost Savings	$2,637.55	$1,172.25	$4,305.13	$
Simple Payback Period	1.88	4.22	1.15	years
Annual CO_2 Savings	22.06	9.80	36.00	Metric Tons

Provides recommendations and cost savings estimates based on input values

Help

Lighting Help/Definitions

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Provides visual depiction of different types of light fixtures/lamps

Provides common lighting terminology

Go Back

Lighting Retrofit Help

Note: The calculator excludes demand savings (kW), maintenance, and cooling savings (Metal Halide, incandescent lamps releases thermal energy when they are lit) associated with the new fixtures.

Sample images of typical fixture types are included below for reference:

Metal Halide Fixture

Incandescent

34/40 W T12

Standard EXIT Sign

Inputs	Additional Instructions
Number of Fixtures	Quantity of fixtures of the type selected from the drop down list.
Number of Lamps/Fixture	The quantity of lamps per fixture typically ranges from 1 to 4. Metal Halides are always single lamp fixtures whereas T12 fixtures are usually 2-lamp fixtures. Incandescent light bulbs are also typically one-lamp fixtures.
Watts per Lamp	Quantity of fixtures of the type selected from the drop down list.  For example the displayed linear fluorescent bulb consumes 40 Watts(W) of energy. **Note:** Metal Halide's are high ceiling fixtures. Building Maintenance crew should know the existing bulb wattage. Contact the Fixture manufacturer to obtain the fixture wattage. Magnetic ballast are designed to drive this bulbs. Hence the bulb consumes extra energy than what is listed on the bulb. A typical 400W metal halide consumes 450W and a 250W metal halide consumes 275W of energy.
Annual lighting hours	Formula = (# of hours * 52 * # of days/week) Note: 52 is a constant(number of weeks in a typical year). For example if the incandescent bulb is lit for 5 hrs/day and five day/week than the annual lighting hours would equal = (5*52*5) = 1,300 hrs/yr.
Total Project Cost	Project cost varies depending on the existing fixture type. Incandescent bulb project cost includes only the bulb replacement and the environmental disposal cost. Metal Halide and T12 retrofit cost includes the existing fixture disposal cost, new ballast that will be compatible with the bulb type, electrician and contractor cost. Exit sign project cost is usually the retrofit kit (a typical LED Exit sign retrofit kit can be purchased online or from the lighting distributors).
Additional Incentives	Some electric utilities offer rebates incentives for commercial and industrial customers. Users should contact their utility program manager or utility account representatives to identify any available incentives.

Boiler Combustion Efficiency

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Main Menu | **Improve Boiler Combustion Efficiency** | Project Selection

Project Overview: Boiler combustion efficiency can be improved after a tune up service that adjusts the appropriate amount of air and oxygen during the combustion process. A combustion flue gas analysis test may be required to obtain all of the necessary inputs for this calculator.

Manually entered values

Input	Value	Units
Boiler Efficiency	80.00%	%
Boiler Burner Output Capacity	500,000.00	btu/hr
Boiler Annual Operating Hours	8,760.00	hrs/yr
Combustion Air Inlet Temperature	86.00	ºF
Exhaust Gas Stack Temperature	233.00	ºF
Current Flue Gas Oxygen %	6.50%	%
Proposed Flue Gas Oxygen %	3.50%	%
Current Combustion Efficiency	87.00%	%
Proposed Combustion Efficiency	87.50%	%
Boiler Load Factor	43.00%	%
Total Project Cost	$500.00	$

Estimated energy savings based on inputs provided above

Output	Value	Units
Annual Energy Savings	291.03	therms
Annual Cost Savings	$100.11	$
Simple Payback Period	4.99	years
Annual CO_2 Savings	1.46	Metric Tons

Provides definition of all inputs and where to locate the necessary input values

Help

Boiler Help/Definitions

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Go Back

Improve Boiler Combustion Efficiency

Most common boiler terms & definitions and information where to locate this information

Inputs	Additional Instructions
Boiler Efficiency	Efficiency is typically identified on the equipment name plate. If information is unavailable, contact the equipment manufacturer.
Boiler Burner Output Capacity	Boiler burner output capacity is typically identified on the equipment name plate. If information is unavailable, contact the equipment manufacturer.
Combustion Air Inlet Temperature	Obtained using a Gas Analyzer tool. There are permanent installations probe-type continuous oxygen analyzers available from various manufacturers which do not require external gas sampling systems. The main advantage of utilizing permanently mounted equipment is that the on-line indication via computer or recording allows continuous operation at optimum level. Computerized systems which allow safe control of excess air over the boiler load range have proven economic for large industrial and utility sized boiler systems.
Exhaust Gas Stack Temperature	Obtained using a Gas Analyzer tool. There are permanent installations probe-type continuous oxygen analyzers available from various manufacturers which do not require external gas sampling systems. The main advantage of utilizing permanently mounted equipment is that the on-line indication via computer or recording allows continuous operation at optimum level. Computerized systems which allow safe control of excess air over the boiler load range have proven economic for large industrial and utility sized boiler systems.
Current Oxygen %	Obtained using a Gas Analyzer tool. There are permanent installations probe-type continuous oxygen analyzers available from various manufacturers which do not require external gas sampling systems. The main advantage of utilizing permanently mounted equipment is that the on-line indication via computer or recording allows continuous operation at optimum level. Computerized systems which allow safe control of excess air over the boiler load range have proven economic for large industrial and utility sized boiler systems.
Proposed Oxygen %	Based on the mechanical tune-up contractor estimation.
Current Combustion	Refer to the example chart included below.
Proposed Combustion	Based on the mechanical tune-up contractor estimation.
Boiler Load Factor	Estimation at which the boiler runs at its design capacity.

Reporting

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Main Menu

Output Reports

Project Information

Project Name: Energy Audit
Building Name: Ray Research Center
Facility Type: Commercial

Address 1: 23 May st
Address 2: Po Box 780
City: St. Louis
County: Worth
State: Missouri
Zip Code: 12345

Project Name	Energy Savings (kWh)	Energy Savings (Therms)	Cost Savings ($)	Total Project Cost ($)	Payback Period (Years)
Repair Steam Traps	0.00	54,338.10	$43,470.48	$50,000.00	1.15
Repair Steam Leaks	0.00	26,405.97	$21,124.78	$6,000.00	0.28
Recover Heat from Boiler Blowdown	0.00	23,500.00	$18,800.00	$50,000.00	2.66
Insulate the Uninsulated Steam Pipes	0.00	2,846.69	$2,277.35	$2,500.00	1.10
Minimize Boiler Blowdown	0.00	1,273.62	$1,018.90	$7,000.00	6.87
Recover Compressor Waste Heat	0.00	294.89	$235.91	$500.00	2.12

What you will need to get started

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- Access to the following information:
  - Equipment name plates.
  - Technical equipment/maintenance manual.
  - Building/plant operation schedule, e.g. lighting, steam, etc.
  - Equipment mechanical tune-up reports.
  - Contact information for equipment manufacturers.
  - Access to building drawings/notes (CAD).
  - Information regarding utility incentive/rebate programs.

Tips for using the Energy Assessment Tool

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- Make sure you have the tools/information you need to start entering information into the energy assessment tool.
- Use the ‘help’ information for definitions and instructions, located at the bottom right of each project page.
- If you are unable to obtain the information needed, contact your equipment manufacturer.

Next Steps

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1. Determine your capital availability/requirements (e.g. payback) for energy efficiency projects.

2. Do a quick pre-assessment and ensure you have all the information you need to start using the energy assessment tool (e.g. energy instrumentation, utility bills, etc).

3. Using the energy assessment tool determine whether or not there is opportunity for energy savings.

4. Prior to implementing any changes get an auditor to verify your findings. Contact your local utility company, often they may offer discounts for energy assessment or may have recommendations on a particular auditor.

Additional Resources

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- **US DOE Software Tools**
  - http://www1.eere.energy.gov/manufacturing/tech_deployment/software.html
    - Plant-wide
    - Steam
    - Motor-Driven
    - Process Heating
    - Data Centers

- **ENERGY STAR®– Portfolio Manager**
  - http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager

- **Missouri Industrial Assessment Center**
  - http://iac.missouri.edu .
  - Contact person: Dr. Bin Wu wubi@missouri.edu Tel: 573-882-5540.

Questions?

- Questions can be submitted via email to EMI.efficiency@shawgrp.com
- Website: http://www.energizemissouri.org