Energy Efficiency Training Workshop

Overview Session

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INDUSTRIAL Energy Efficiency

Agenda

- Introduction on ARRA and SEP
- Energy Codes & Standards
- Overview of Energy Assessments
  - Objectives
  - Types (Level I, II & III)
  - Case Studies
  - Summary of Benefits
- Overview of Energy Assessment Tool
  - Data input
  - Navigate
  - Reporting

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 Codes & Standards

Energy Codes

- Describes how a building must be constructed.
- State and local governments.
- International Energy Conservation Code (IECC).
- I0 Code of Federal Regulation(CFR) 433-435.

Energy Standards

- Describes how a building should be constructed.
- American Society of Heating, Refrigerating & Air Conditioning Engineers (ASHRAE).
- ISO 50001 Energy Management Standard.

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 additional projects, such as renewable energy.

Types of Energy Assessments

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ASHRAE Level I (Simple Audit)

- Basic facility walk-through inspection.
- Identifies very visible inefficiencies and operational faults.
- Highlights potential capital investment opportunity for further consideration.
- Used primarily by commercial industries when looking for a high level overview of facility energy use and efficiency.

Types of Energy Assessments

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ASHRAE Level II

- Detailed energy analysis including economic calculations and monitoring of all building energy systems.
- Provides a clear and concise report of all energy cost reduction measures (ECRMs).
- ECRMs identified in Level II audit can be implemented quickly and generally provide rapid or immediate savings.
- Used by commercial and industrial facilities to provide a more detailed description of operational/energy efficiency.

Types of Energy Assessments

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ASHRAE Level III (Investment grade audit)

- Rigorous computer modeling and analysis used to support major capital investment decisions.
- Involves more detailed data collection, focusing on ‘whole-building’ computer simulation.
- Provides accurate modeling of ECRMs and power/energy response.
- Used primarily by industrial facilities to help evaluate large capital investment projects.

Conducting an Audit

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

Conducting an Audit

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- Planning:
  - Develop your safety plan & checklist
  - Identify required information and contacts
  - Collect the right tools:
    - Tape, camera, flashlight, light meter, thermometers, voltmeter, wattmeter, combustion analyzer, leak detector, airflow measurements, safety equipment

Conducting an Audit

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- <u>Occupancy Information- Understand your facility</u>
  - Utility providers & Information
  - Occupancy hours
  - Number of Occupants/Tenants
  - Building information: size, square footage, above/below ground, year built
  - HVAC and Mechanical systems
  - Lighting Systems
  - Building Envelope: wall & roof construction, fenestration
  - Water & Irrigation
  - Other: vending machines, elevators etc

Conducting an Audit

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- Utility Analysis
  - Utility analysis is an integral part of all energy assessments.
  - Typically includes analysis of 12 to 36 months of utility bills.
  - Includes an evaluation of energy consumption and cost.
  - Helps establish baseline, which can be used to measure future energy savings.

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.

Conducting an Audit

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- Walk-through Audits
  - Schedule meetings with building owner, facility maintenance personnel, building operators, and other affected parties.
  - Ensure common goals are established and that necessary building personnel will be available during the audit.
  - Conduct interviews related to facility operations.
    - Discuss operations, identifiable building problems, equipment failures, recent renovations, future capital improvements and construction projects.
  - Conduct a tour of the facility.

Conducting an Audit

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- Energy Audit Report
  - Overview of facility operations.
  - Identification of energy efficiency reduction measures (ECRMs).
    - Energy Saving.
    - Cost.
    - ROI.
    - Available Incentives.
  - Implementation Plan.
  - Monitoring program.

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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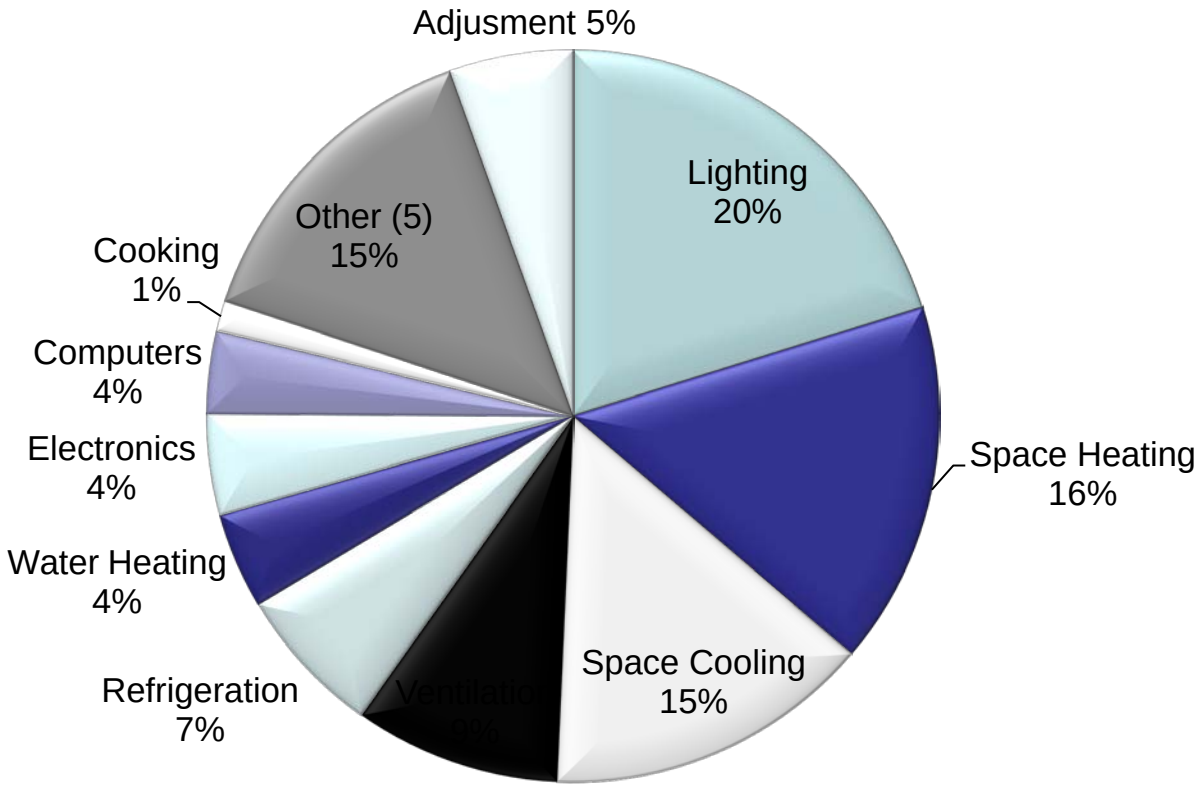
Commercial Energy End-Use Splits; 2010



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

Utilities - Commercial Sector

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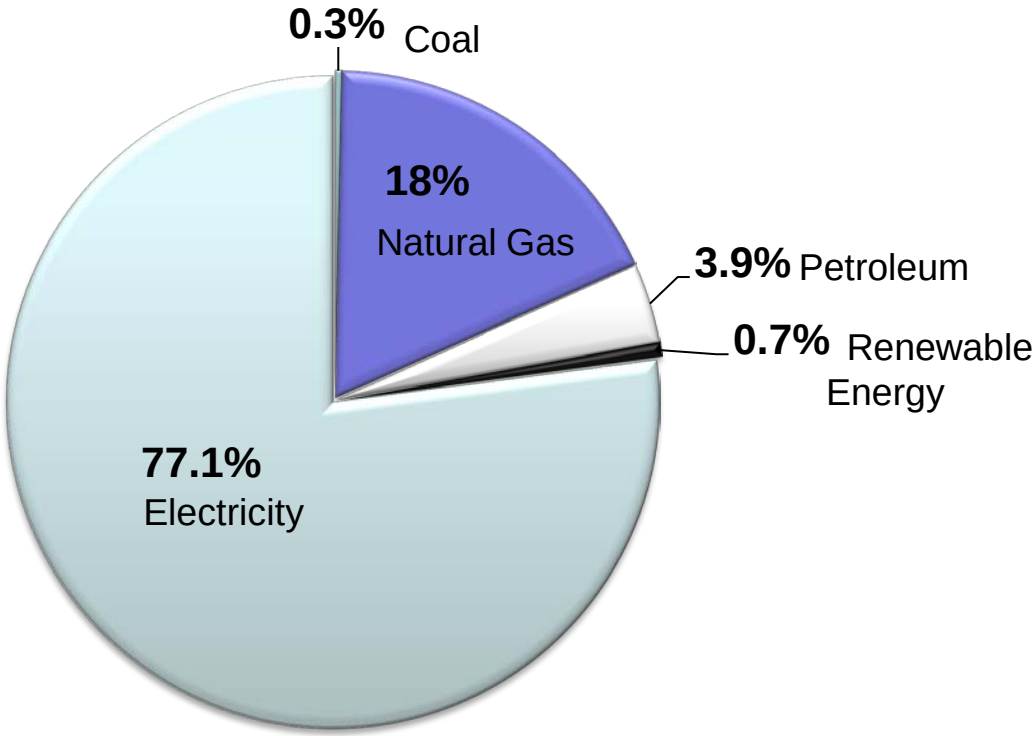
Commercial Sector Consumption Estimates (2010)



Source: U.S. EIA Annual Energy Review 2010

Utilities - Industrial Sector

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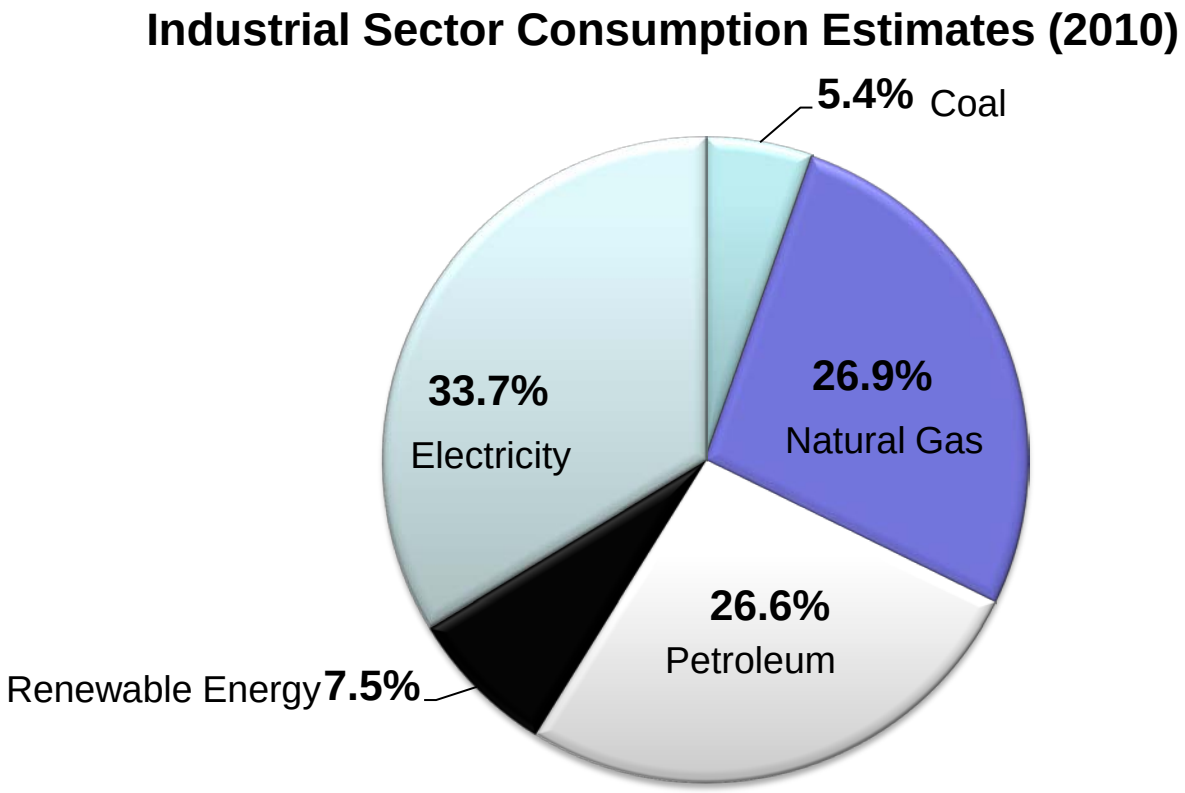

Source: U.S. EIA Annual Energy Review 2010

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.

Case Studies Examples

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- **Commercial Audit** –
  - Identified 29 actionable utility cost reduction opportunities.
  - Initial investment $70K equivalent to $24.8 million potential annual utility savings.

- **Industrial Audit –**
  - Identified 12 actionable utility cost reduction opportunities.
  - Initial investment of $5.3 million equivalent to $6.3 million potential annual utility savings.

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.

Data Inputs – Basic Info

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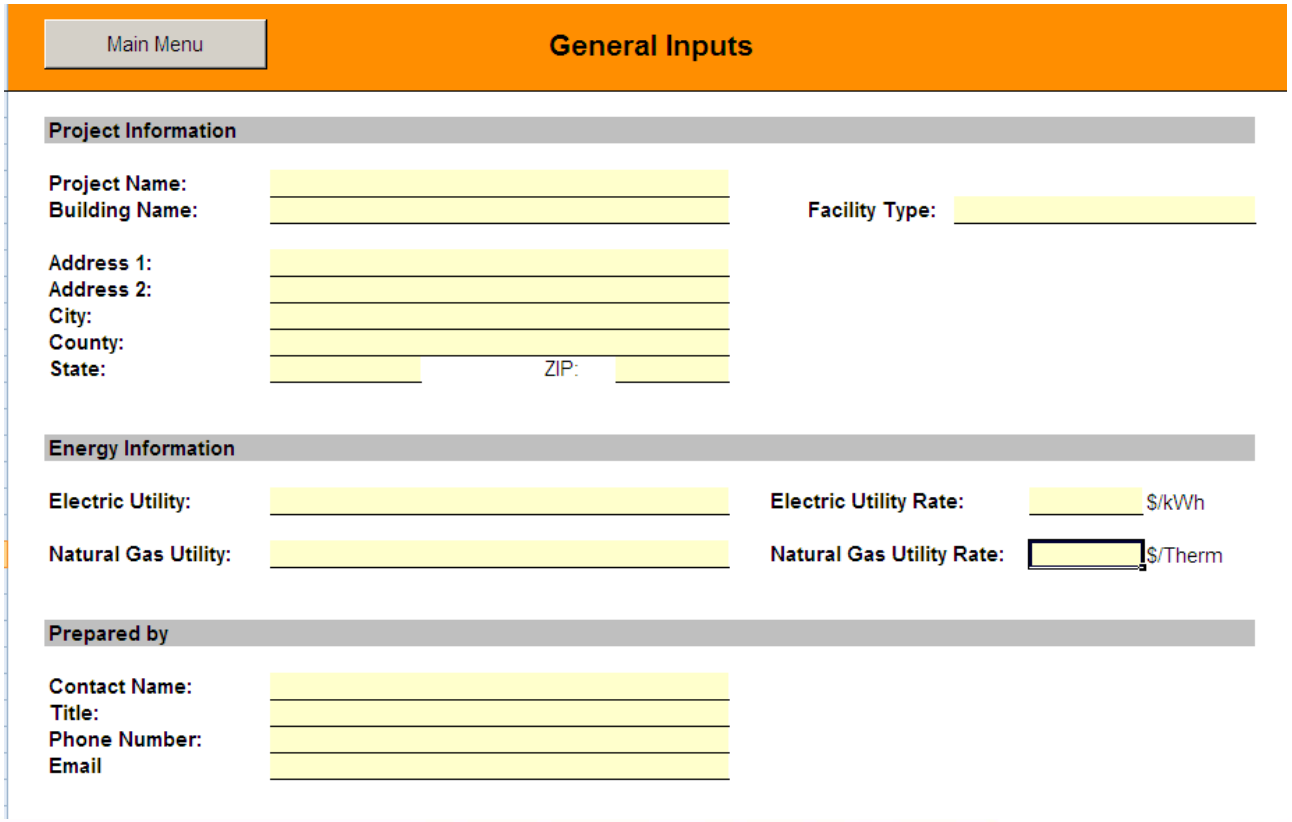
- Basic information – site address, type of facility, utility providers and current utility rates.



Data Inputs - Project Categories

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- Different measurements/inputs required depending on the type of project (e.g. temperature/pressure readings, etc.)

- Project categories include:

Air filtration	Lighting
Boilers	Motors
Compressed Air	Pumps
Vending Machine	

Navigate - Specific 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

MDNR2012

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

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

INDUSTRIAL Energy Efficiency

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

INDUSTRIAL Energy Efficiency

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

INDUSTRIAL Energy Efficiency

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.

Motor Power Factor

INDUSTRIAL Energy Efficiency

Main Menu

Motor Power Factor Correction

Project Selection

Project Overview: For Industrial customers many utilities have a penalty for power factors below a certain value. Power factor should be measured continuously to avoid demand charges.

Input	Value	Value	Value	Units
Current Motor Horse Power	50.00	27.00		hp
Current Motor Efficiency	90.00%	90.00		%
Current Motor Voltage	480.00	480.0		v
Select Power Factor of Current Motor	70	60		
t New/Corrected Power Factor		88	88	
nly kW Demand Charge		$12.00	$12.00	$
Project Cost		$500.00	$500.00	$

70
71
72
73
74
75
76
77

Manually entered values from equipment name plate

Select power factor values from the drop down menu

Output	Value	Value	Value	Units
Annual Cost Savings	$971.51	$740.03	$211.44	$
Simple Payback Period	0.51	0.68	2.36	years

Estimated energy savings based on inputs provided above

Help

Motors Help/Definitions

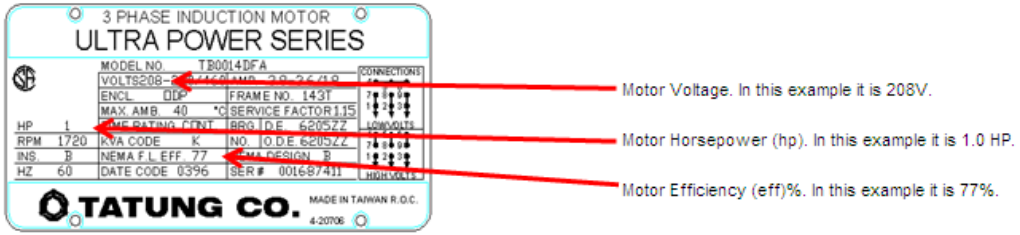
INDUSTRIAL Energy Efficiency

Go Back

Motor Power Factor Correction Help

Note: Energy and cost savings are calculated based on the assumption that motor load is 75%.

Inputs	Additional Instructions
Current Motor Horse Power	Typically identified on the equipment name plate data tag. If information is unavailable, contact the equipment manufacturer. Refer to example below.
Current Motor Efficiency	Typically identified on the equipment name plate data tag. If information is unavailable, contact the equipment manufacturer. Refer to example below.
Current Motor Voltage	Typically identified on the equipment name plate data tag. If information is unavailable, contact the equipment manufacturer. Refer to example below.



Select Power Factor of Current Motor	Power factor is measured with the means of digital multimeter. Refer to the image of a multimeter below.

Select the New/Corrected Power Factor	New/Corrected Power factor should match the motor nameplate power factor. If the information is unavailable contact the motor manufacturer.

Compressed Air Leaks

INDUSTRIAL Energy Efficiency

Main Menu | **Compressed Air Leaks** | Project Selection

Project Overview: This calculator estimates energy saving that can be achieved by addressing compressed air leaks. The amount of air loss depends on several factors, including line pressure, size (area) of the leak, and air temperature at the leak and compressor inlet. The calculator provides two methods to estimate energy savings associated with sealing air leaks based on the availability of parameters (inputs) available to analyze the energy savings.

The diameter of the compressed air leak can be selected from the drop down menu. If you need help with converting units visit the conversion calculator.

Annual energy and cost savings calculated based on input values

Input	Value	Valu		
Average Compressed Air Leak Diameter	1/16	1/8		
Compressor Operating Pressure		125		
flow rate		100.0		
y Compressor		25.00	25.00	hp
nual Operating Hours		7,000.00	7,000.00	hrs/yr
eaks	1.00	1.00	1.00	number
ost	$10.00	$10,000.00	$10,000.00	$

1/64
1/16
1/8
1/4
3/8

Output	Value	Value	Value	Units
Annual Energy Savings	5,176.31	25,164.82	61,080.43	kWh
Annual Cost Savings	$517.63	$2,516.48	$6,108.04	$
Simple Payback Period	0.02	3.97	1.64	years
Annual CO_2 Savings	4.33	21.04	51.08	Metric Tons

Help

Compressed Air Help/Definitions

INDUSTRIAL Energy Efficiency

Go Back

Compressed Air Leaks

Note: The best way to detect leaks is to use an ultrasonic acoustic detector. Consult a compressed air systems specialist for additional details.

Inputs	Additional Instructions
Select Average Leak Size Diameter	Select the leaks size diameter(Inches) from drown menu where 0.15625 = 1/64, 0.03125 = 1/32, 0.0625 = 1/16, 0.125 = 1/8, 0.25 = 1/4, and 0.375 = 3/8.
Compressor Operating	Operating pressure can be obtained from the gauge mounted on the air compressor.
Compressor Air flow rate (cfm)	This information is typically provided in the equipment manual, or air compressor name plate. If information is unavailable, contact the equipment manufacturer.
Power Drawn by Compressor	A trained maintenance personnel/electrician should connect the power meter to read out true kW. If power meter is unavailable, information may be available on the equipment name plate data tag.
Project Cost	If the facility uses significant compressed air, it will be a goo idea to purchase a ultrasonic air leak detector that cost anywhere from $200-300. Addition to that on average each leak can be fixed under $50 (including labor) by inserting pneumatic quick connects. If the size of the leak is large than the cost of fixing the leak will be higher.

By estimating the size of the hole and determining the line pressure either from the pressure gauge or the name plate, the amount of energy loss can be determined.

INDUSTRIAL Energy Efficiency

Pump Trim or Impeller Replacement

Main Menu | **Trim or Replace Impellers on Oversized Pumps** | Project Selection

Project Overview: Centrifugal pumps are often oversized during the design phase to account for a potential future growth of the facility and the equipment. Oversized pumps produce excess pressure and therefore are ideal candidates for trimming or replacing the impeller to save energy and reduce operating costs. Pump engineer/manufacturers need to determine whether the existing pump is trimmable as well as specify the limit on the how much the impeller can be trimmed.

Manually entered values

Input	Value	Value	Value	Units
Pump Fluid Flow Rate	2,000.00	1,000.00	500.00	gpm
Pump Head	132.00	150.00	100.00	ft
Annual Pump Operating Hours	8,760.00	8,760.00	5,000.00	hrs/yr
Pump Efficiency	95.00%	90.00%	90.00%	%
Diameter of Existing Pump Impeller	16.00	16.00	20.00	in
Diameter of Proposed Pump Impeller	15.00	14.00	18.00	in
Pump Efficiency after Trimming	92.00%	91.00%	91.00%	%
Total Project Cost	$20,000.00	$20,000.00	$20,000.00	$

Multiple columns allows to enter multiple pumps

Output	Value	Value	Value	Units
Annual Energy Savings	68,402.30	92,809.61	14,600.32	kWh
Annual Cost Savings	$6,840.23	$9,280.96	$1,460.03	$
Simple Payback Period	2.92	2.15	13.70	years
Annual CO_2 Savings	57.20	77.61	12.21	Metric Tons

Estimated energy savings based on inputs provided above

Help

Pump Help/Definitions

INDUSTRIAL Energy Efficiency

Go Back

Trim or Replace Impellers on Oversized Pumps Help

Notes: When the diameter of a pump is trimmed, the rate of flow, head, and power for a point on the pump curve vary approximately with the pump affinity rules. Also, this tool assumes water as the type of the fluid that is pumped.

Inputs	Additional Instructions
Pump Efficiency	Pump efficiency is typically read from the pump system curve provided by the equipment manufacturer.
Diameter of the Existing Pump Impeller	If unavailable from installing contractor, Pump System curve graph can be used to estimate size of the impeller.
Diameter of the Proposed Pump Impeller	Proposed impeller diameter size can be obtained from the contractor. Note: Impeller should not be trimmed beyond the manufacturer's recommended size. Furthermore, the proposed diameter of impeller should meet the required design flow of the existing beyond the manufacturer system. Contact the manufacturer/refer the pump design and performance curve given by the pump manufacturers.
Pump Efficiency after	Pump efficiency is typically read from the pump system curve provided by the equipment manufacturer.

Many industrial pumps are oversized for their process requirements. Oversized pumps are ideal candidates for impeller replacement or ‘trimming’ to save energy and reduce cost.

Vending Machines

INDUSTRIAL Energy Efficiency

Main Menu | **Vending Machines** | Project Selection

Project Overview: Occupancy controls on vending machines are designed to shut off lights and cycling of the compressor pump during unoccupied hours thereby reducing total energy consumption. Additional cost savings for this project typically result from lowered maintenance costs.

Manually entered values

Select type of vending machine

Input	Value	Value	Value	Units
Vending Machine Type	Drink (Drink / Snack)	Snack	Drink	type
Number of Vending Machines		1	1	#
Annual Occupied Hours	[illegible]	5,000.00	3,000.00	hrs/yr
Total Project Cost	$100.00	$100.00	$100.00	$
Additional Incentives	$10.00	$10.00	$10.00	$

Multiple columns allows for multiple vending machines

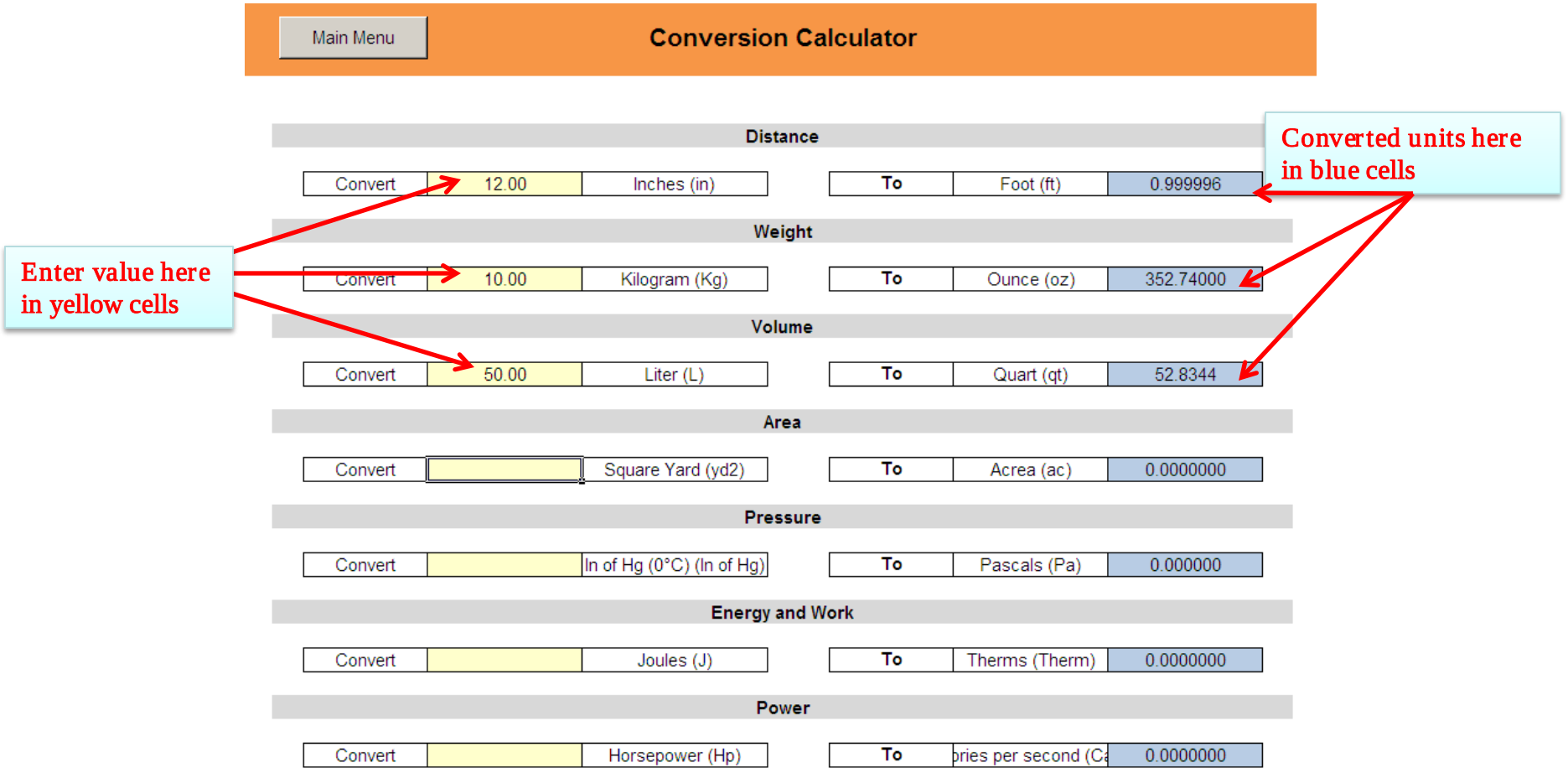
Output	Value	Value	Value	Units
Annual Energy Savings	1,128.00	225.60	1,728.00	kWh
Annual Cost Savings	$112.80	$22.56	$172.80	$
Simple Payback Period	0.80	3.99	0.52	years
Annual CO_2 Savings	0.94	0.19	1.44	Metric Tons

Estimated energy savings based on inputs provided above

Help

Need help converting units?

INDUSTRIAL Energy Efficiency



Reporting

INDUSTRIAL Energy Efficiency

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

Things you will need to start your assessment

INDUSTRIAL Energy Efficiency

- Basic tools including a standard measuring tape, gas analyzer tool and a digital multimeter.

- 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

INDUSTRIAL Energy Efficiency

- Ensure 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 manufactures.

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

INDUSTRIAL Energy Efficiency

- **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

- Web site: http://www.energizemissouri.org