PROFITABLE GROWTH
A New Story for U.S. Manufacturing

Save Energy Now Tools and Resources

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U.S. Department of Energy

Save ENERGY Now ®

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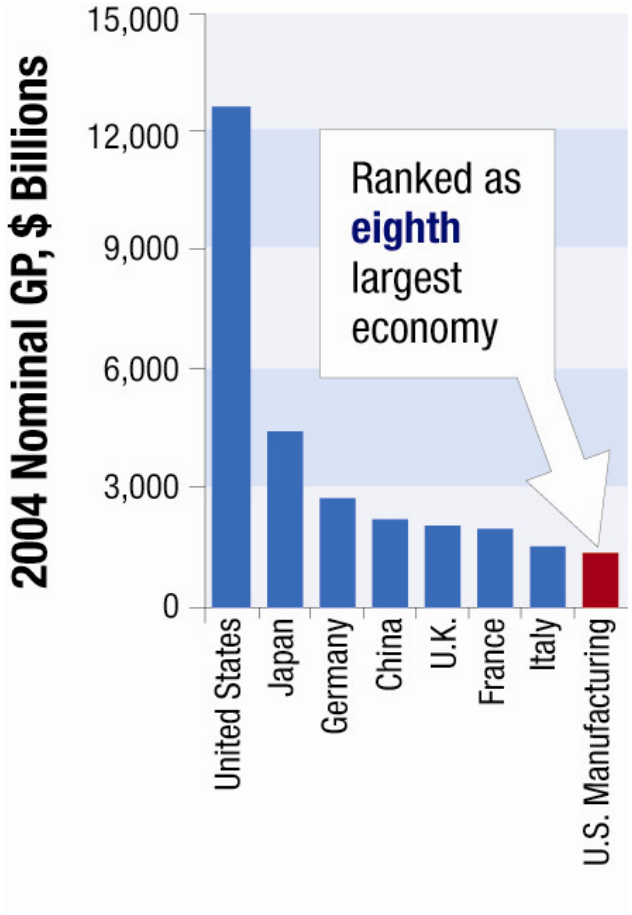
Did You Know…?

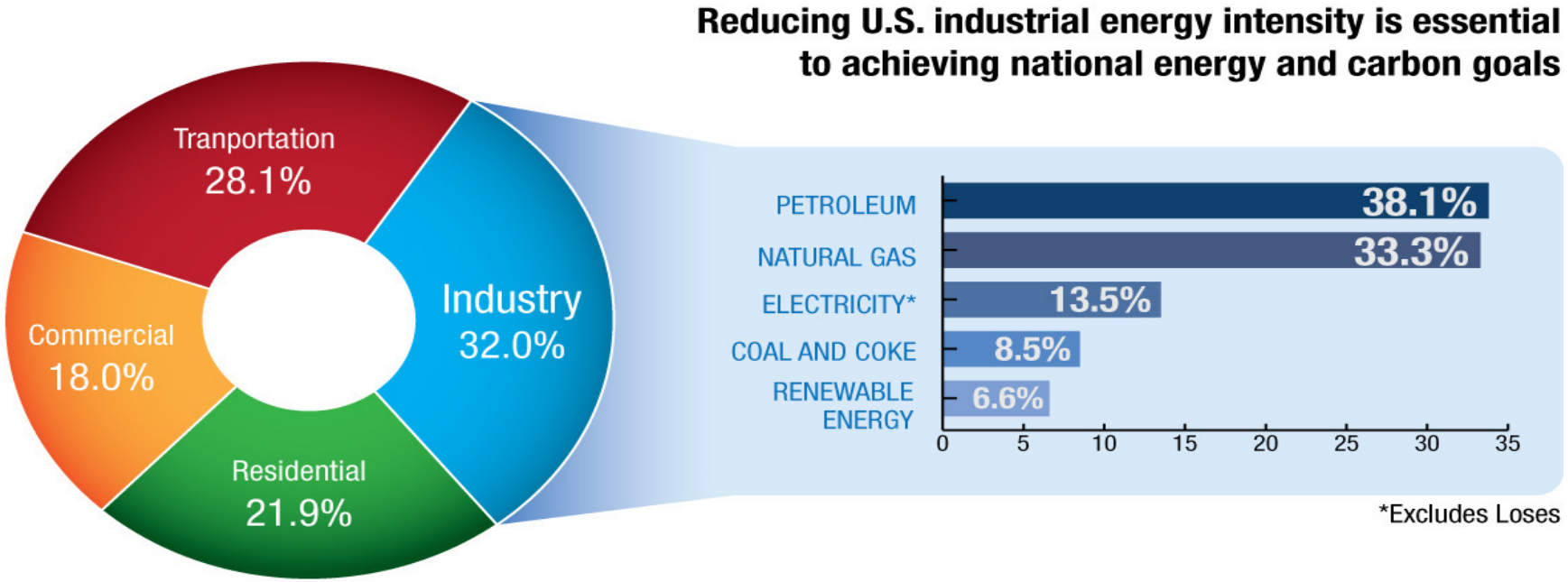
The U.S. manufacturing sector:

- Employs 12 million people
- Makes the highest contribution to GDP (12%)
- Supplies ~60% of U.S. exports, worth $50 billion/month
- Spurs job creation and investment
- Every million dollars in energy cost savings has the potential to create approximately 16 – 17 new jobs.



Industry and Energy Use

- The U.S. manufacturing sector consumes ***more energy*** than any other portion of the economy. Industry represents approximately 32% of total U.S. energy consumption.



Progress Is Achievable: Energy Efficiency is the Simplest Approach

- Existing technologies *with an attractive internal rate of return* can cut the growth in global energy demand by half or more within 15 years.

  -- *Curbing Global Energy Demand Growth*, McKinsey & Co., May 2007

- More than 10% of U.S. industry's energy use could be saved by more broadly adopting existing technologies that yield an internal rate of return greater than 10%.

  -- McKinsey, 2007

- Industries around the globe can cut CO_2 emissions 19 to 31% using *proven* technologies and practices.

  -- International Energy Agency, 2007

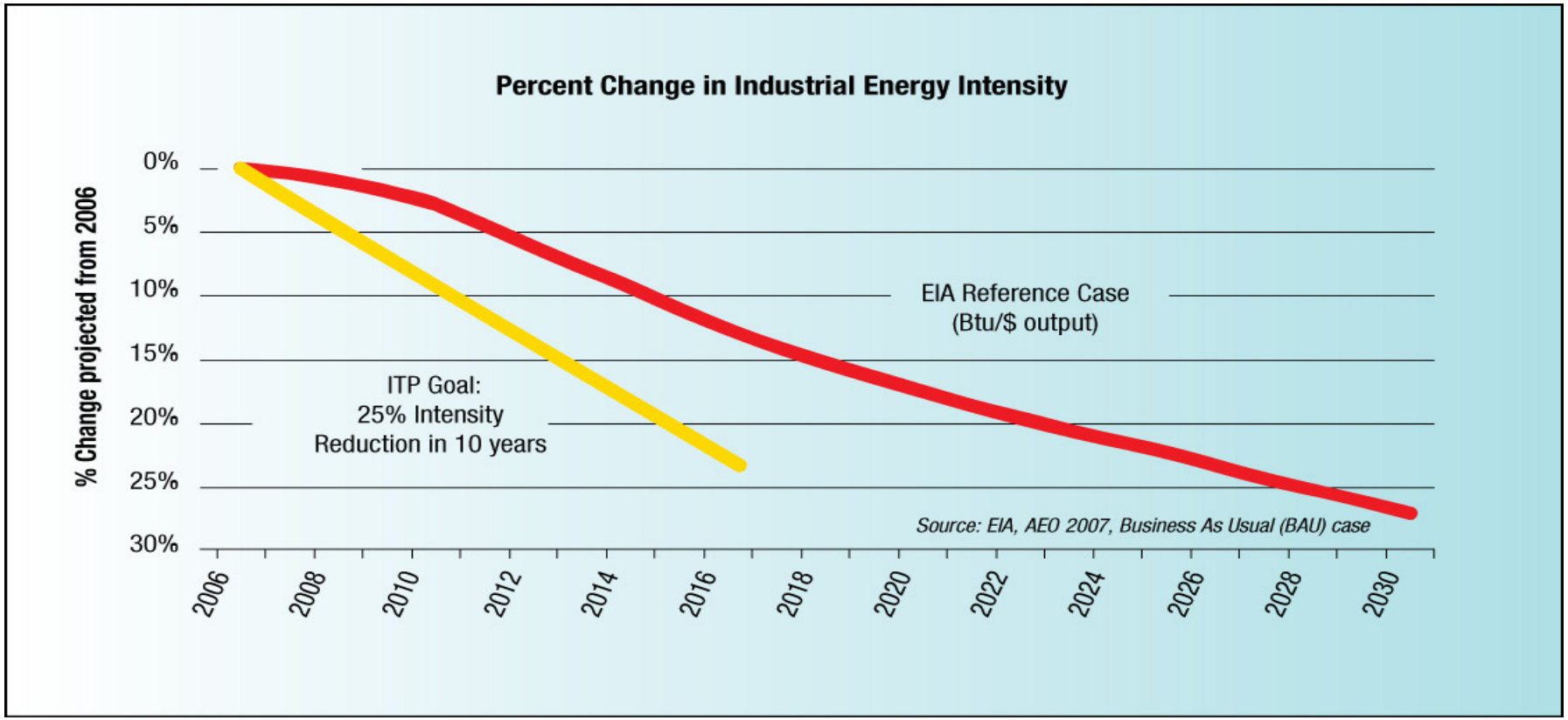
National Initiative to Reduce Energy Use

Save Energy Now: An Industrial Sector National Initiative

GOAL: Drive a 25% reduction in industrial energy intensity by 2020

- The *Energy Policy Act of 2005* (EPAct) has mandated that 25 percent of energy be saved in 10 years. The *Save Energy Now* program was established to achieve these goals.
- Encourages industry to voluntarily reduce its energy usage in a period of volatile energy prices and uncertain supplies by partnering with all U.S. manufacturing facilities.
- Creates momentum to significantly improve energy efficiency practices throughout the industrial sector.
- Utilizes interagency collaborations and relationship with industry partners to fulfill this goal.

Energy Intensity Reduction



ITP's goal to reduce energy intensity by 25% in 10 years would reduce energy intensity more quickly and efficiently than business as usual.

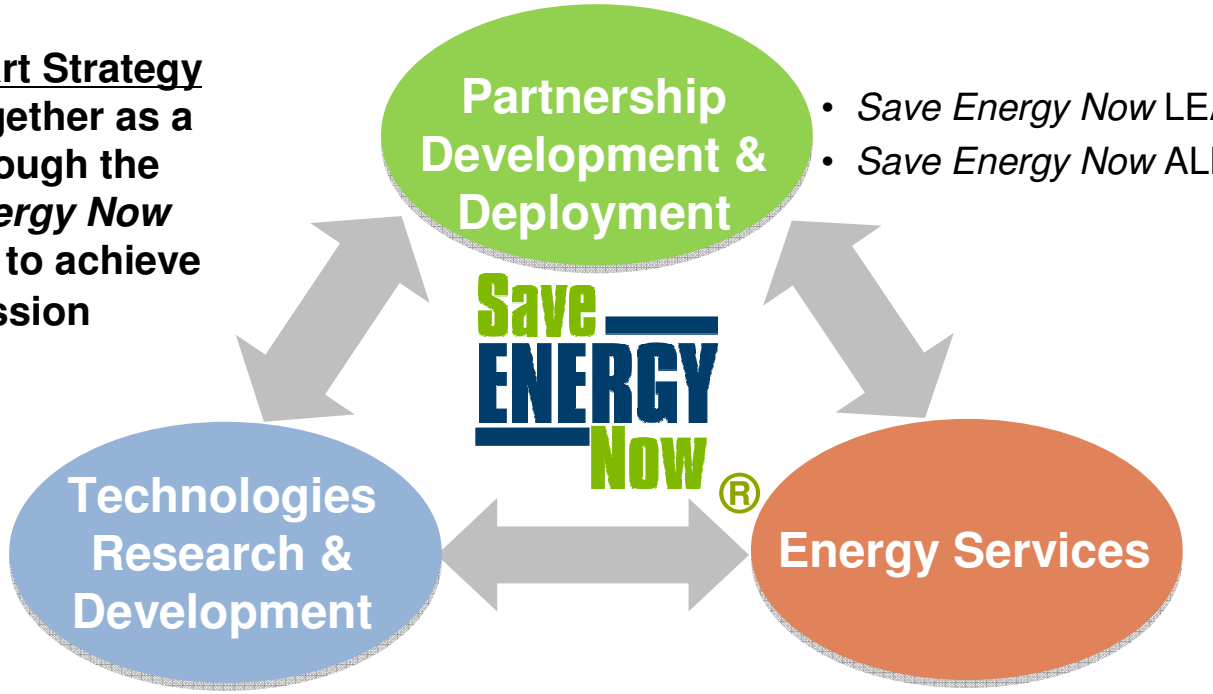
Save Energy Now Strategy

Partner with U.S. industry, utilities, states, universities and other stakeholders to help manufacturers save energy and money, increase productivity, and reduce environmental impacts by:

- Accelerating the adoption of energy-efficient technologies and practices
- Conducting vigorous technology R&D
- Supporting commercialization of emerging technologies
- Providing plants with access to proven technologies, energy assessments, software tools, and other resources
- Promoting energy and carbon management throughout industry

Industrial Technologies Program (ITP)

Three Part Strategy
Work together as a team through the *Save Energy Now* initiative to achieve ITP's mission



- *Save Energy Now* LEADER Companies
- *Save Energy Now* ALLY Organizations

- Industry-specific
- Crosscutting

- Industry Standards
- Training

- Tool Development
- Assessments

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ITP R&D Program Areas

Industry Specific Applications

- Aluminum
- Chemicals
- Forest and Paper Products
- Metal Casting
- Steel
- Information Technology

Advanced technologies for specific, energy-intensive industries

Crosscutting Technologies

- Materials, Sensors, and Combustion
- Energy-Intensive Process R&D
- Nanomanufacturing & Other Interagency Manufacturing R&D
- Fuel and Feedstock Flexibility
- Distributed Energy (CHP and Reciprocating Engines)
- Inventions & Innovations

Crosscutting technologies for diverse, energy-intensive manufacturing processes

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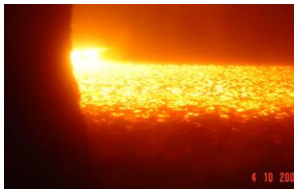
Technology R&D: Focus on Energy Efficiency

Industrial Reaction & Separation

Develop technologies for efficient reaction and separation processes

High-Temperature Processing

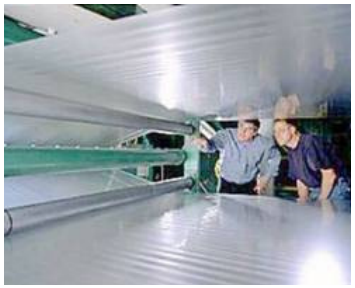


Develop energy-efficient, high-temperature process technologies for producing metals and non-metallic minerals

Energy Conversion Systems

Develop high-efficiency steam generation and combustion technologies and improved energy recovery technologies

Fabrication & Infrastructure



Develop energy-efficient technologies for making near net-shape finished products from basic materials

ITP Technology Highlights

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Modular equipment that enables more flexible operations while achieving enormous energy savings

Isothermal Melting (ITM) Process

- **Continuous flow system with immersion heaters that convert electricity to melting energy with 98% efficiency**
  - 50% less energy consumption than traditional furnace
  - Zero in-plant emissions
  - April 2006 ribbon-cutting ceremony highlighted scale-up demonstration at a General Motors fac

SuperBoiler

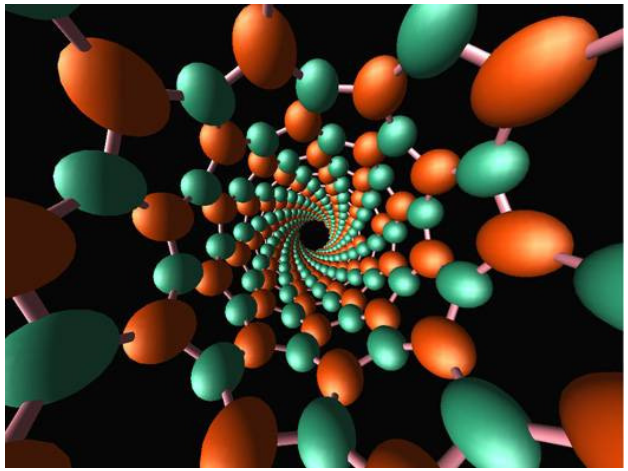
- **Gas-fired package boiler incorporating innovative concepts in combustion, heat transfer, heat recovery, and control components**
  - Capable of achieving energy efficiencies ≥94%
  - Field evaluation of firetube boiler initiated in 2006

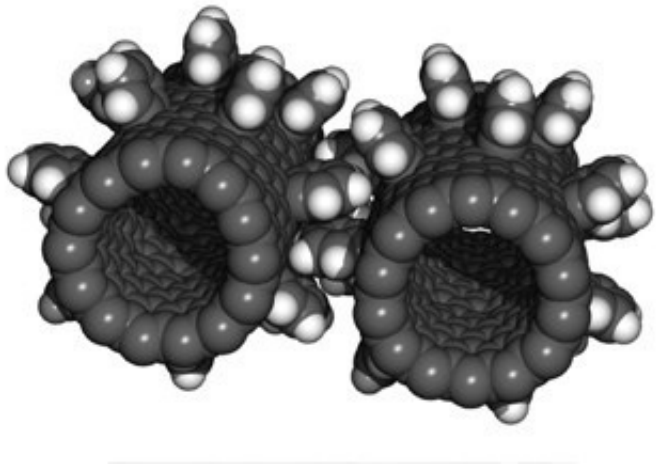
Next-Generation Manufacturing

Nanomanufacturing:

Develop efficient techniques and manufacturing processes for **nano-enabled products**

Enable mass production and application of **nanotechnologies that could transform industrial processes**





Next-Generation Manufacturing Concepts:

Improve yield

Reduce waste

Improve energy efficiency throughout the supply chain

Reduce environmental impacts

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Save Energy Now Services

Save ENERGY Now

Goal: Drive a 25% reduction in industrial energy intensity in 10 years

Tools
- Process Heating
- Steam Systems
- Plant Energy Profiler
- Motors & Pumps
- Fans

Information
- Website
- Information Center
- Tip Sheets
- Case studies
- Webcasts
- Emerging Technologies

Standards
- Plant Certification

Training
- Basic
- Advanced
- Qualified Specialist

Assessments
- Energy Savings Assessments
- Industrial Assessment Centers

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DOE Power Based Software Decision Support Tools Available via the Website

- **Motor Master +** Assists in energy-efficient motor selection and management. (International)
- **Pumping System Assessment Tool** Assesses the efficiency of pumping system operations.
- **Fan System Assessment Tool** quantifies potential benefits of a more optimally configured fan system
- **Air Master+** Provides comprehensive information on assessing compressed air systems.
- **Industrial Facilities Tool** Assesses HVAC, Lighting .. upgrade opportunities.
- **Chilled Water System Assessment Tool** Assesses the efficiency of a chilled water system.

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DOE Fuel Based Software Decision Support Tools Available via the Website

- **Steam System Scoping Tool** Profiles and grades large steam system operations/management.
- **Steam System Assessment Tool** Assesses potential benefits of specific steam-system improvements.
- **3EPlus Insulation Assessment Tool** Calculates most economical thickness of insulation for a variety of operating conditions.
- **Plant Energy Profiler** profiles plant energy supply along consumption streams and identifies energy savings opportunities
- **Process Heating Assessment and Survey Tool** Assesses energy use in furnaces, ovens and kilns along with performance improvements
- **Energy Management Tool Suite** integrates ITP's technical solutions system based tools along with additional Energy Management Best Practice support capabilities

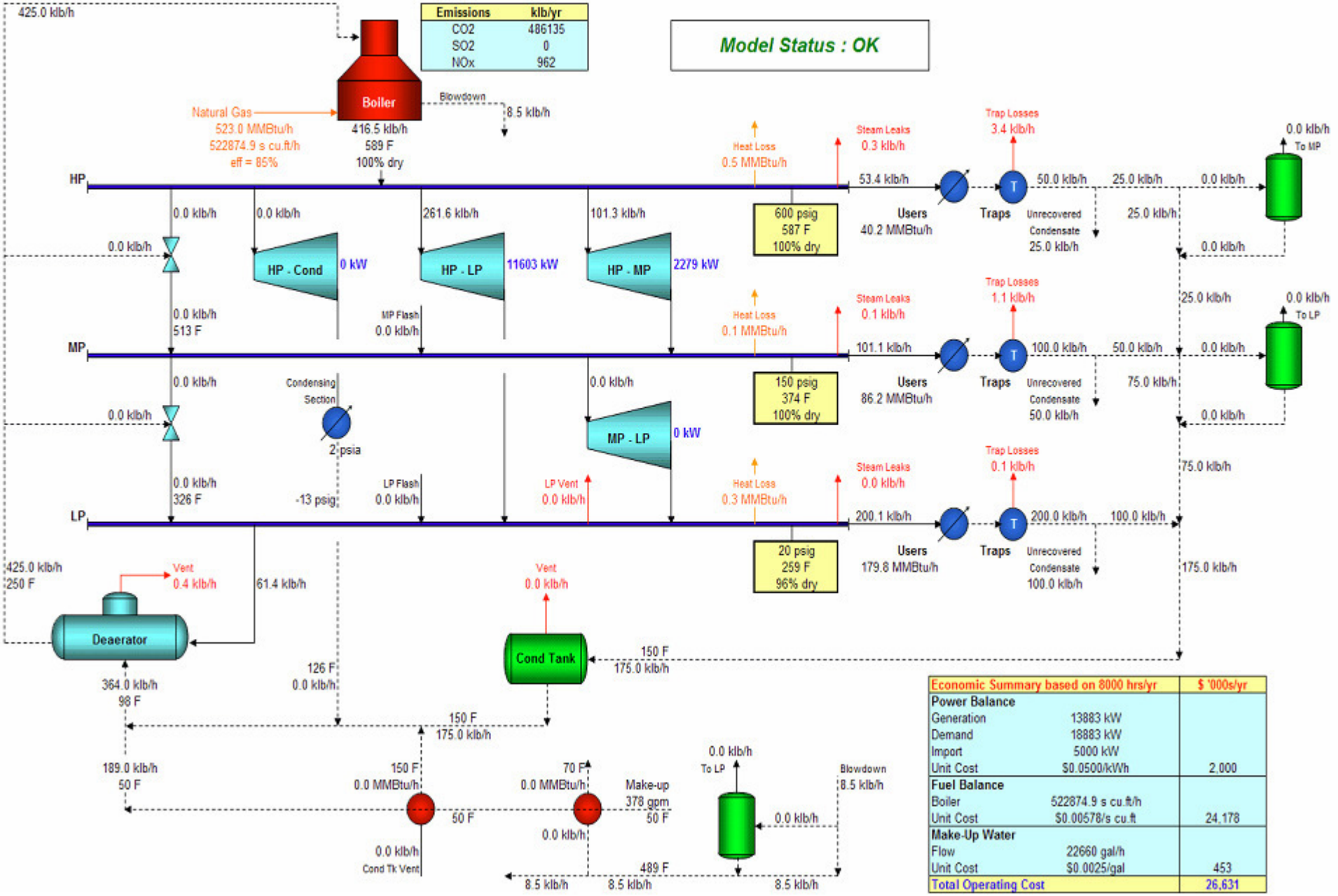
Steam System Assessment Tool (SSAT)

- PURPOSE:
  - Demonstrate the magnitude of energy, cost, and emission savings related to specific steam system improvement opportunities
- AUDIENCE:
  - Engineers involved with operation and/or improvement of steam systems

Steam System Assessment Tool

SSAT Default 3 Header Model

Current Operation



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

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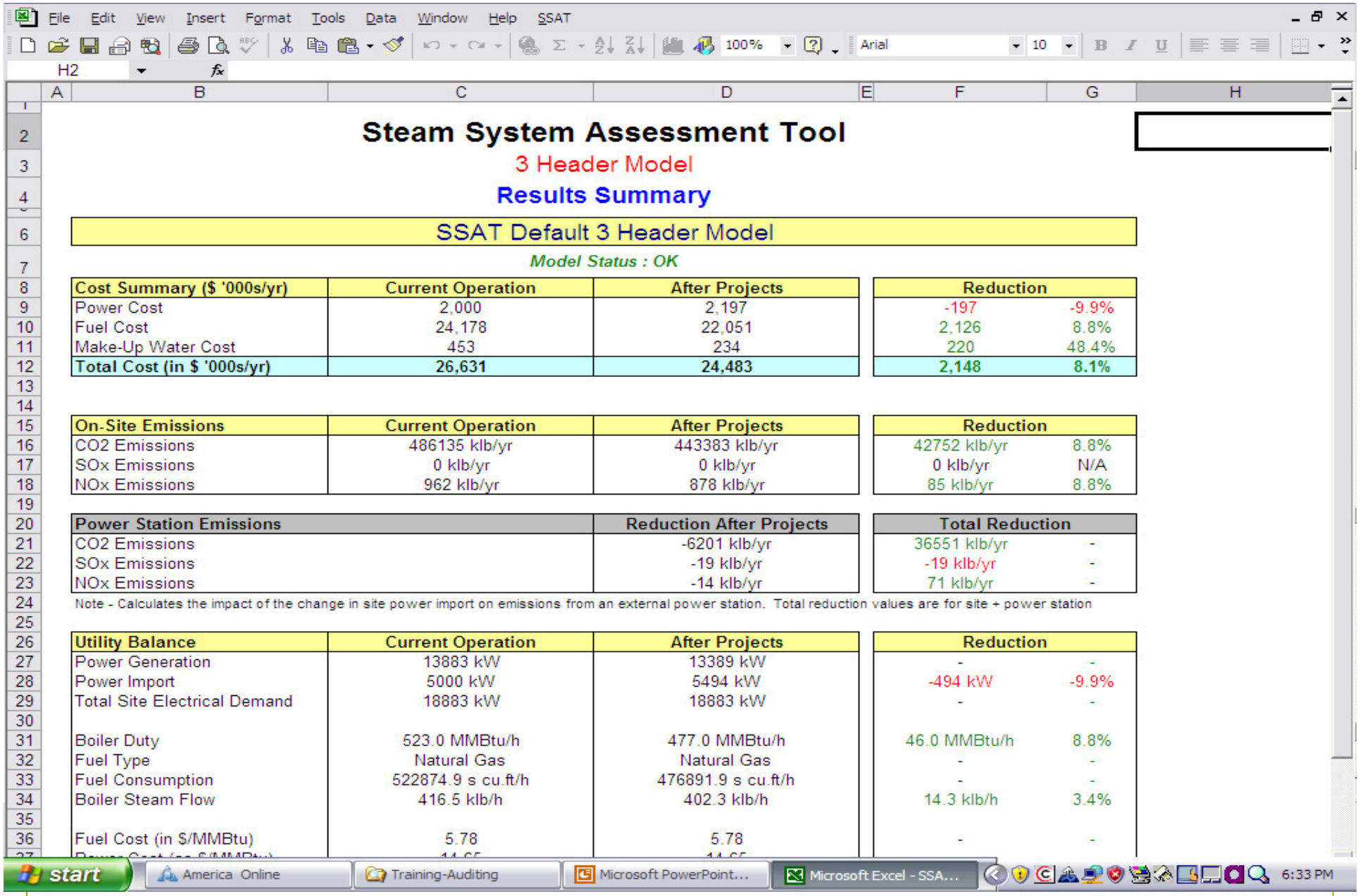
You Can Use SSAT To Evaluate These Key Steam Improvement Initiatives

- 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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100% Arial 10
H2
Steam System Assessment Tool
3 Header Model
Results Summary
SSAT Default 3 Header Model
Model Status : OK
Cost Summary ($ '000s/yr) | Current Operation | After Projects | Reduction
Power Cost | 2,000 | 2,197 | -197 | -9.9%
Fuel Cost | 24,178 | 22,051 | 2,126 | 8.8%
Make-Up Water Cost | 453 | 234 | 220 | 48.4%
Total Cost (in $ '000s/yr) | 26,631 | 24,483 | 2,148 | 8.1%
On-Site Emissions | Current Operation | After Projects | Reduction
CO2 Emissions | 486135 klb/yr | 443383 klb/yr | 42752 klb/yr | 8.8%
SOx Emissions | 0 klb/yr | 0 klb/yr | 0 klb/yr | N/A
NOx Emissions | 962 klb/yr | 878 klb/yr | 85 klb/yr | 8.8%
Power Station Emissions | Reduction After Projects | Total Reduction
CO2 Emissions | -6201 klb/yr | 36551 klb/yr | -
SOx Emissions | -19 klb/yr | -19 klb/yr | -
NOx Emissions | -14 klb/yr | 71 klb/yr | -
Note - Calculates the impact of the change in site power import on emissions from an external power station. Total reduction values are for site + power station
Utility Balance | Current Operation | After Projects | Reduction
Power Generation | 13883 kW | 13389 kW | - | -
Power Import | 5000 kW | 5494 kW | -494 kW | -9.9%
Total Site Electrical Demand | 18883 kW | 18883 kW | - | -
Boiler Duty | 523.0 MMBtu/h | 477.0 MMBtu/h | 46.0 MMBtu/h | 8.8%
Fuel Type | Natural Gas | Natural Gas | - | -
Fuel Consumption | 522874.9 s cu.ft/h | 476891.9 s cu.ft/h | - | -
Boiler Steam Flow | 416.5 klb/h | 402.3 klb/h | 14.3 klb/h | 3.4%
Fuel Cost (in $/MMBtu) | 5.78 | 5.78 | - | -
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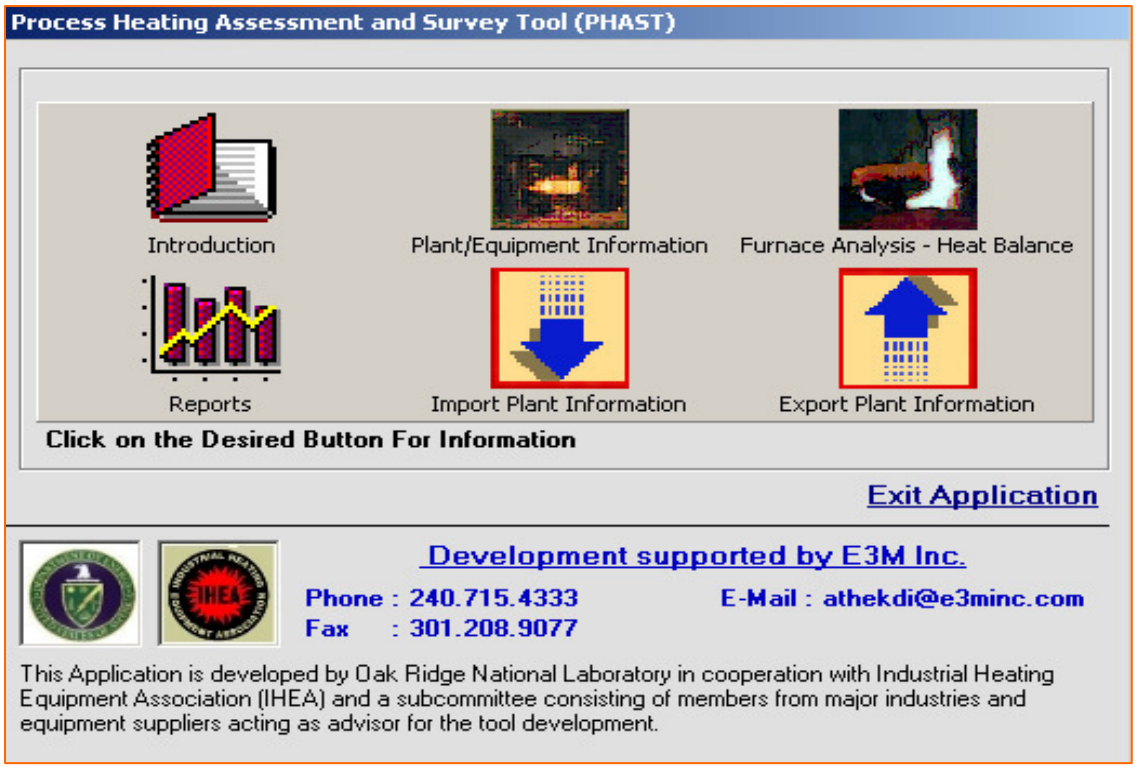
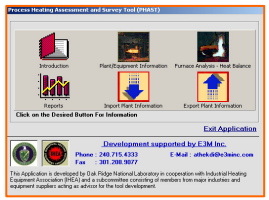
Process Heating Assessment and Survey Tool (PHAST)





Process Heating Assessment and Survey Tool (PHAST)

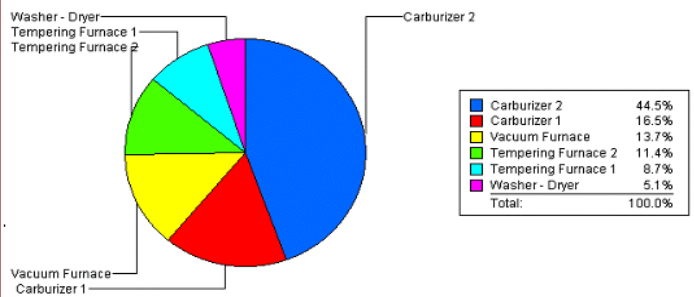
What is PHAST?

- A tool that can be used to:
- Estimate annual energy use and energy cost for furnaces and boilers in a plant
- Perform detail heat balance and energy use analysis that identifies areas of energy use, efficiency and energy losses for a furnace
- Perform “what-if” analysis for possible energy reduction and efficiency improvements through changes in operation, maintenance and retrofits of components/systems
- Obtain information on energy saving methods and identify additional resources

Plant Energy Use and Cost Distribution Report*

Plant Furnace Summary

Process Heating Equipment - Cost Distribution



Process Heating Equipment-Energy Used and Cost Distribution

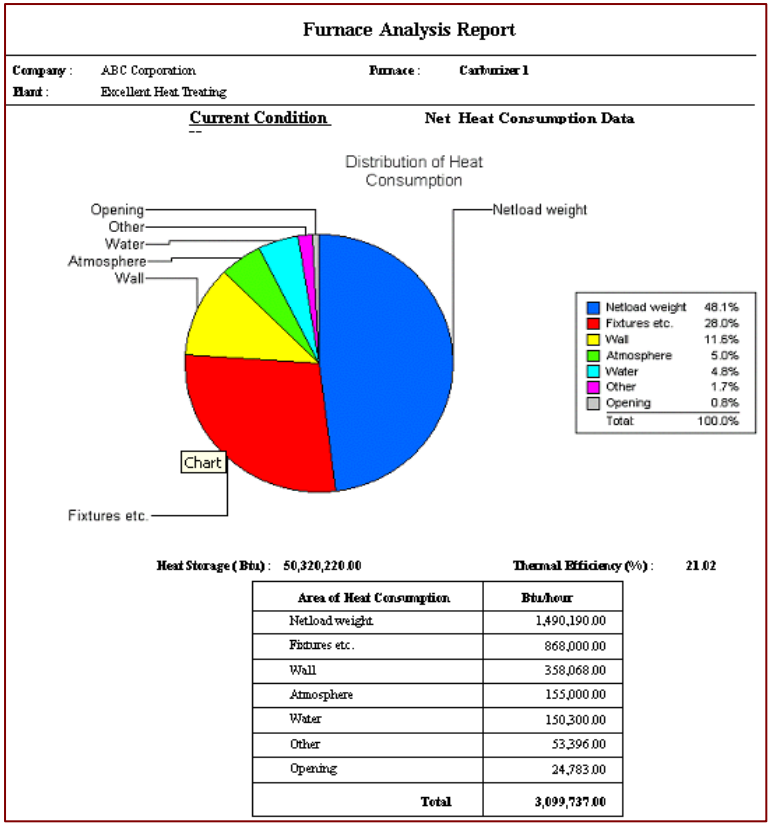
Heating Equipment	Fuel Energy Use Million Btu/Year	Electric Energy Use - Thousand KWh/Year	Steam Energy Use Million Btu/Year	Annual Cost ($/Year)	% of Total Cost	Cumult. % of Cost
Carburizer 2	60,480.00	8,820.00	0.00	832,860.00	44.54	44.54
Carburizer 1	51,840.00	192.00	0.00	308,640.00	16.50	61.04
Vacuum 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**	

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 Heat Balance
Energy Use – Losses Distribution



Furnace Analysis Report

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

Current Condition **Net Heat Consumption Data**

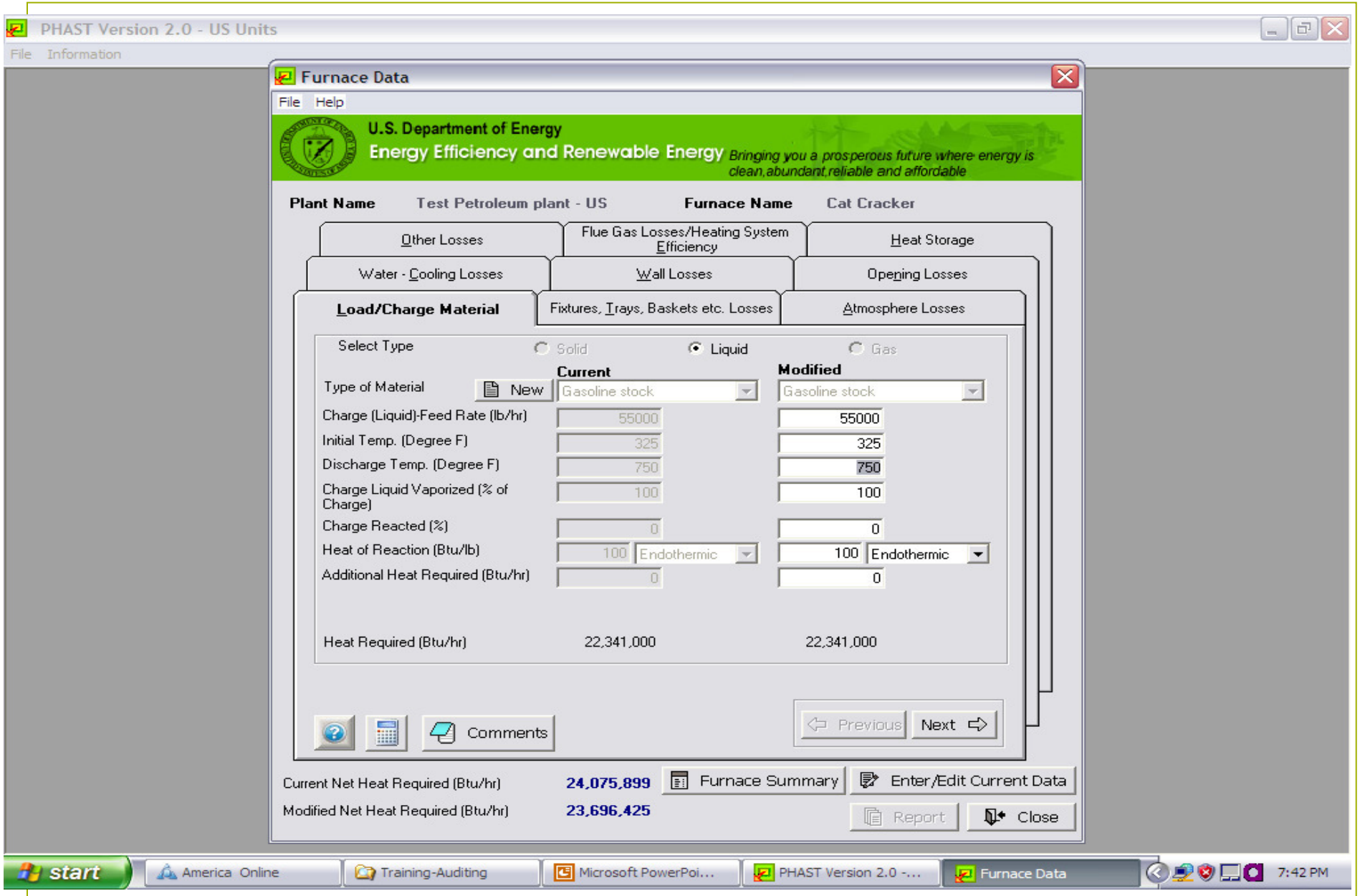
Distribution of Heat Consumption

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**

The report shows

Analysis of energy used in various parts of a furnace under a given operating condition.


PHAST Version 2.0 - US Units
File Information
Furnace Data
File Help
U.S. Department of Energy
Energy Efficiency and Renewable Energy
Bringing you a prosperous future where energy is clean, abundant, reliable and affordable
Plant Name
Test Petroleum plant - US
Furnace Name
Cat Cracker
Other Losses
Flue Gas Losses/Heating System Efficiency
Heat Storage
Water - Cooling Losses
Wall Losses
Opening Losses
Load/Charge Material
Fixtures, Trays, Baskets etc. Losses
Atmosphere Losses
Select Type
Solid
Liquid
Gas
Current
Modified
Type of Material
New
Gasoline stock
Gasoline stock
Charge (Liquid)-Feed Rate (lb/hr)
55000
55000
Initial Temp. (Degree F)
325
325
Discharge Temp. (Degree F)
750
750
Charge Liquid Vaporized (% of Charge)
100
100
Charge Reacted (%)
0
0
Heat of Reaction (Btu/lb)
100
Endothermic
100
Endothermic
Additional Heat Required (Btu/hr)
0
0
Heat Required (Btu/hr)
22,341,000
22,341,000
Comments
Previous
Next
Current Net Heat Required (Btu/hr)
24,075,899
Modified Net Heat Required (Btu/hr)
23,696,425
Furnace Summary
Enter/Edit Current Data
Report
Close
start
America Online
Training-Auditing
Microsoft PowerPoi...
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Furnace Data
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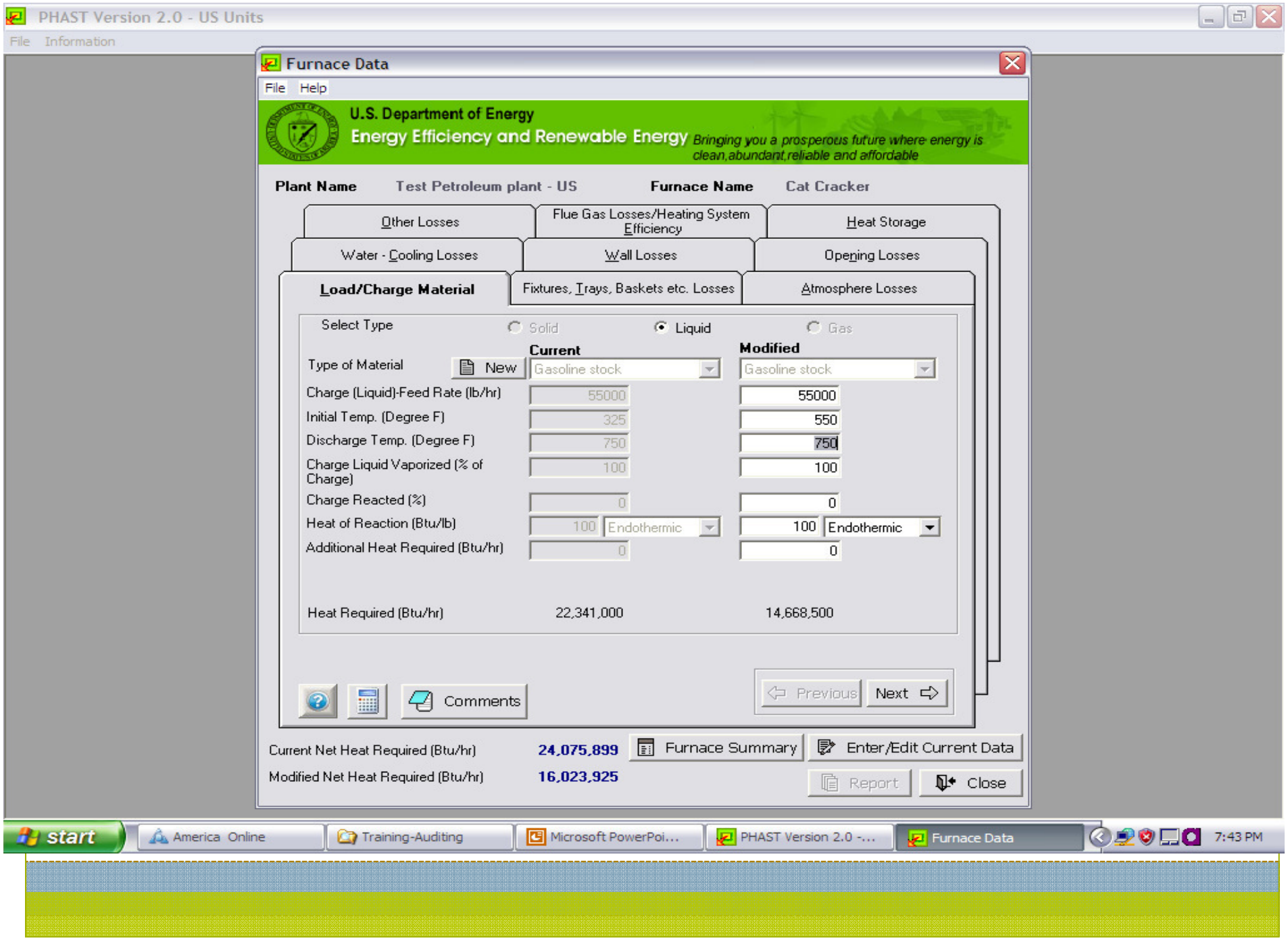
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Plant Name
Test Petroleum plant - US
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Other Losses
Flue Gas Losses/Heating System Efficiency
Heat Storage
Water - Cooling Losses
Wall Losses
Opening Losses
Load/Charge Material
Fixtures, Trays, Baskets etc. Losses
Atmosphere Losses
Select Type
Solid
Liquid
Gas
Current
Modified
Type of Material
New
Gasoline stock
Gasoline stock
Charge (Liquid)-Feed Rate (lb/hr)
55000
55000
Initial Temp. (Degree F)
325
550
Discharge Temp. (Degree F)
750
750
Charge Liquid Vaporized (% of Charge)
100
100
Charge Reacted (%)
0
0
Heat of Reaction (Btu/lb)
100
Endothermic
100
Endothermic
Additional Heat Required (Btu/hr)
0
0
Heat Required (Btu/hr)
22,341,000
14,668,500
Comments
Previous
Next
Current Net Heat Required (Btu/hr)
24,075,899
Furnace Summary
Enter/Edit Current Data
Modified Net Heat Required (Btu/hr)
16,023,925
Report
Close
start
America Online
Training-Auditing
Microsoft PowerPoi...
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Furnace Data
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Tool Metrics

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2006, 2007, 2008 and 2009 Annual Saving Opportunities						
System Area	Identified Annual Savings			Implemented Annual Savings		
	# of completed ESA's	Identified Source Energy Savings Upgrades (TBtu)	Identified Cost Savings ($)	Implemented Source Energy Savings (TBtu)	Implemented Cost Savings ($)	Implemented CO2 Savings (metric tons)
Compressed Air	160	3.84	$23,196,826	0.95	$4,933,793	55,448
Fans	43	7.93	$46,561,260	0.09	$498,984	5,001
Process Heating	241	49.74	$336,449,703	5.6	$42,882,228	300,240
Pumps	88	3.23	$17,518,946	0.17	$936,696	9,768
Steam	329	80.49	$649,726,971	21.01	$113,819,232	1,566,705
Multi System Paper	21	7.98	$55,637,900	0.47	$2,172,294	8,739
Total	***882***	***153.2***	***$1,129,091,607***	***28.3***	***$165,243,227***	***1,945,901***