

## Boost Process Heating Efficiency

### Process Heating Assessment and Survey Tool (PHAST) Identifies Opportunities for Saving Energy

#### Benefits of PHAST

- Estimate annual energy use and energy cost for process heating equipment such as furnaces, ovens, heaters, kilns, boilers etc., in an industrial plant
- Perform detail heat balance and energy use analysis that identifies areas of energy use and energy losses for a furnace or a boiler
- Perform “what-if” analysis for possible energy reduction and efficiency improvements through changes in operation, maintenance, and retrofits of components/systems

#### PHAST Gets Results

Process heating accounts for more direct energy use than any other process in U.S. manufacturing. The thermal efficiency of process heating equipment currently varies from 15% to 80%. At the lower efficiency levels, in particular, PHAST technology offers the potential for significant energy savings.

#### Resources

To download PHAST and other free software tools and learn more about DOE Qualified Specialists and training opportunities, visit the ITP Web site, [www.eere.energy.gov/industry/bestpractices](http://www.eere.energy.gov/industry/bestpractices)

Additionally, you can contact the EERE Information Center at 1-877-EERE-INF (1-877-337-3463), or via the Web at [www.eere.energy.gov/informationcenter](http://www.eere.energy.gov/informationcenter).

#### PHAST Functions

The U.S. Department of Energy (DOE) Industrial Technologies Program (ITP) has developed a tool to survey all process heating equipment within a facility, select the equipment that uses the most energy, and identify ways to increase efficiency. The Process Heating Assessment and Survey Tool (PHAST) can also be used to assess equipment performance under various operating conditions and “what-if” scenarios. The software provides instructions on how to obtain the data for each step with commonly available instruments—without affecting production. It also supplies data on the thermal properties of commonly processed materials.

PHAST serves three specific purposes:

1. Provides easy-to-use tools to calculate the potential savings that a plant can achieve by applying various energy-saving measures. Based on user-supplied equipment parameters, the tools, or “calculators,” compare the energy performance of individual pieces of equipment under various operating conditions.
2. Surveys all equipment that uses fuel, steam, or electricity for heating. Based on facility-specific heat input and furnace operating data, the tool reports how much fuel, electricity, and steam each piece of equipment uses annually—plus the estimated annual energy costs. Energy-efficiency improvements can thus focus on the pieces of equipment that use the most energy.
3. Constructs a detailed heat balance for selected pieces of process heating equipment. The process considers all areas of the equipment in which energy is used, lost, or wasted. Results of the heat balance pinpoint areas of the equipment in which energy is wasted or used unproductively.

PHAST produces a summary report on energy use in specific pieces of equipment and throughout the process heating system. The tool suggests methods to save energy in each area where energy is used or wasted and offers a list of additional resources. The report is valuable in identifying and prioritizing major opportunities for energy savings.

#### PHAST Calculators

##### • Energy Equivalency

Calculates heat requirements when the heat source is changed from fuel firing (Btu/hr) to electricity (kWh) or from electricity to fossil fuel firing.



### • Efficiency Improvement

Calculates available heat for fuel-fired furnaces and expected energy savings when burner operating conditions are enhanced.

### • Oxygen Enrichment

Calculates available heat for fuel-fired furnaces and expected energy savings when oxygen in combustion “air” is increased from the standard (21%) value.

## Steel Reheating Furnace Example

At one steel mill, PHAST identified significant potential savings in a steel reheating furnace. The furnace had a firing capacity of 135 million (MM) Btu per hour for the heating zone and 32 MMBtu per hour for the soak zone. PHAST indicated that the furnace’s fuel use could be reduced by approximately 30 MMBtu per hour for the heating zone and 5 MMBtu per hour for the soak zone. Another 2 MMBtu per hour could be saved by reducing losses through openings. Total potential savings identified for the unit were 37 MMBtu per hour, or 22% of all energy used by the furnace.

Suggested low-cost improvements included better control of the air-fuel ratio and installation of radiation shields (curtains that eliminate radiation heat loss).

## Aluminum Extrusions Example

PHAST software was used to identify several strong opportunities to save energy and boost productivity at the Alcoa North American Extrusions facility in Plant City, Florida.

The PHAST assessment identified the pieces of process heating equipment that were the largest energy consumers, collectively consuming more than 80% of all process heating energy at the facility. PHAST analysis revealed that recovery of waste heat from flue gases in both melters offered one of the best opportunities for reducing energy use. Potential annual savings totaled over \$300,000 with a payback period of 6 to 24 months.

## Process Heating System Savings Identified by Industry\*

Industry (No. of Assessments)	Average Energy Savings (Million Btu/year)	Average \$ Savings (Annual)
Aerospace (1)	67,905	\$933,377
Aluminum (13)	248,160	\$2,062,774
Automotive (8)	71,026	\$622,146
Cement (6)	943,196	\$2,396,531
Chemical (21)	148,118	\$1,040,378
Electronics (2)	20,123	\$174,158
Food Processing (12)	44,263	\$431,289
Forest Products (11)	184,133	\$1,133,788
General Manufacturing (39)	56,961	\$421,919
Glass (15)	209,802	\$1,731,211
Metal Casting (8)	165,656	\$1,672,339
Mining (4)	543,150	\$3,718,014
Petroleum (3)	325,997	\$2,502,034
Plastics (3)	144,320	\$1,105,770
Steel (36)	541,051	\$4,271,895
Textiles (1)	69,325	\$943,200

\*As of September 2008.

## Support and Training

ITP offers a 1-day workshop that provides an introduction to process heating and process heating equipment used by industry, such as furnaces, dryers, ovens, heaters, and kilns. The session includes information on process heating and maintenance, how to improve energy efficiency and reduce emissions from furnaces, and how to use the PHAST software. DOE has developed a PHAST Specialist Qualification as an additional level of training for industry professionals who are interested in becoming proficient in using the software tool. In addition, ITP offers a 2-hour introductory Webcast on how to use PHAST to identify energy savings opportunities. Visit ITP’s online Training Calendar for a list of upcoming sessions: [www.eere.energy.gov/industry/bestpractices/events\\_calendar.asp](http://www.eere.energy.gov/industry/bestpractices/events_calendar.asp).

## A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy’s Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.

### For More Information, please contact:

Industrial Technologies Program (ITP)  
[www.industry.energy.gov](http://www.industry.energy.gov)

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