The Process Heating Assessment and Survey Tool (PHAST)

The U.S. Department of Energy's (DOE's) Industrial Technologies Program (ITP) offers a collection of software tools to help you identify and analyze energy system savings opportunities within your plant or facility. As part of ITP's Tool Suite, the Process Heating Assessment and Survey Tool (PHAST) enables you to evaluate the energy efficiency opportunities of your process heating system using an unbiased approach. This, in turn, could lead to further private sector detailed engineering analyses and design specifications with the goal of implementing identified energy-saving opportunities.

Benefits of PHAST

- Estimate annual energy use and costs for process heating equipment, such as furnaces, ovens, heaters, kilns, and boilers
- Perform detailed 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, other free software tools, or to learn more about DOE Qualified Specialists and training opportunities, visit www.eere.energy.gov/industry/bestpractices.

Improve Process Heating System Performance with PHAST

PHAST is an online software tool that helps users survey all process heating equipment within a facility, select the equipment that uses the most energy, and identify ways to increase efficiency.

PHAST Functions

PHAST 3.0 includes a major update with the addition of a new electrotechnology section that allows users to choose between electrotechnology or fuel-fired systems. 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.
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.
3. Constructs a detailed heat balance for selected pieces of process heating equipment. 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 (British thermal units [Btu] per hour) to electricity (kilowatt hours [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.

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PHAST Gets Results

At one steel mill, PHAST identified 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).

PHAST software was also 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.

As of September 2008, ITP conducted 183 targeted process heating assessments. The table below summarizes the results of these assessments.

Process Heating System Savings Identified by Industry*

Industry (No. of Assessments)	Average Energy Savings (kWh/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

PHAST will be a part of the upcoming Energy Management Toolkit, which will act as the primary delivery mechanism for additional tool access from the Energy Management Portal.

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 equipment maintenance, how to improve energy efficiency and reduce emissions from furnaces, and how to use 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.

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, DOE's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.

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