



BestPractices

BestPractices Steam Overview

December 2002

INDUSTRIAL TECHNOLOGIES PROGRAM

ENERGY EFFICIENCY AND RENEWABLE ENERGY, U.S. DEPARTMENT OF ENERGY

BESTPRACTICES STEAM PARTNERS

3M
 American Boiler Manufacturers Association
 Armstrong International, Inc.
 Association of Energy Engineers
 BASF Corporation
 Bethlehem Steel Corporation
 CERL – U.S. Army Corps of Engineers
 Council of Industrial Boiler Owners
 Enbridge Consumers Gas
 Enercheck Systems
 Industrial Interactions, Inc.
 Institute of Textile Technology
 Iowa Energy Center
 Johns Manville Corporation
 Millennium Chemicals*
 N.Y. State Energy Research and Development
 National Board of Boiler and Pressure Vessel Inspectors
 National Insulation Association*
 North American Insulation Manufacturers Association
 ONDEO Nalco
 Plant Support & Evaluations, Inc.
 Rock Wool Manufacturing, Inc.
 Rohm and Haas
 Shannon Enterprises
 Spirax Sarco, Inc.*
 Steam Economies Company
 Sunoco Refining
 Swagelok
 TurboSteam Corp.
 Washington State University
 Yarway Corp.

*Indicates OIT Allied Partner

OIT Web site:
www.oit.doe.gov

BestPractices Web site:
www.oit.doe.gov/bestpractices

For more information please
contact the OIT Clearinghouse at
800-862-2086



Achieve Steam System Excellence

The U.S. Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy (EERE) encourages the energy-intensive sectors of the economy (including buildings, industrial, transportation and power generation) to work together to: 1) create broad, sector/industry-wide goals for the future, 2) identify specific needs and priorities through sector/industry-led roadmaps, and 3) form cooperative alliances to help attain those goals through public-private partnerships. BestPractices is an EERE initiative to work with private sector partners (see sidebar), national organizations, States, and other entities to improve energy efficiency in the U.S. economy.

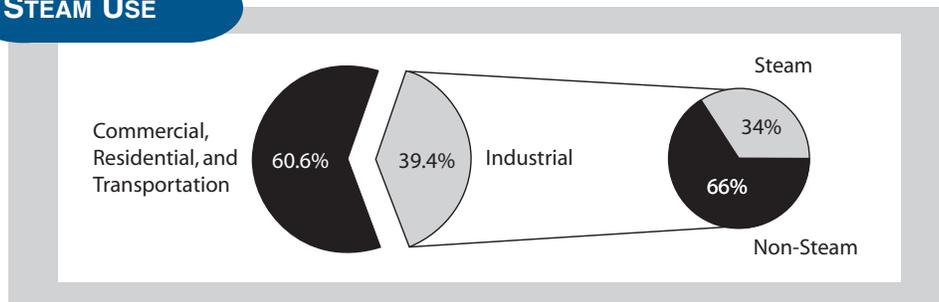
BestPractices Steam promotes a systems approach to help companies operate and maintain their industrial steam plants and thermal manufacturing processes more efficiently. Broadening attention to all the components in a steam system—boiler water treatment, generation, distribution, end-use equipment, and steam and condensate recovery—creates much larger opportunities for savings, even as high as 20 to 30% of energy costs.

Steam Is Important

The industrial sector consumes more than 39% of the energy used in the United States. In 1994, industrial consumption was composed of 5,676 trillion Btu (Tbtu) of steam (34%); 7,708 TBtu of fuel (47%); and 3,127 TBtu of electricity (19%).

Industry converts about 70% of the fuel it purchases for energy into steam. Of all forms of energy (including feedstocks and electricity) that industry purchases, 34% produces steam. Consequently, steam efficiency offers companies significant energy conservation and environmental benefits. Cost-conscious production managers will find that their plant steam system directly affects their production unit costs much more than they realize.

STEAM USE



Steam System Excellence in Action

DOE has documented many industrial steam efficiency projects that have payback periods shorter than 12 months.



Case Study #1—Chemical Company

“Improved Steam Trap Maintenance Increases System Performance And Decreases Operating Costs”

- Reduced annual CO₂ emissions by 2.4 tons and annual consumption of treatment chemicals by 1,000 pounds, saving more than \$20,000 per year
- Reduced make-up water use by 56%, and decreased worker exposure to treatment chemicals
- Implementing cost of \$22,000
- Payback period of 2.5 months



Case Study #2—Chemical Company

“Reducing Steam Pressure Saves \$42,000 Annually”

- Reduced average specific steam demand (reboiler) per unit of product by almost 6%
- Saved \$42,000 annually
- Saved 22,000 million Btu annually (in steam demand)
- Implementing cost: this project required no capital investment and resulted in the above mentioned reductions and cost savings



Case Study #3—Forest Products Company

“Insulation Upgrade Leads to Reduced Fuel Costs and Increased Process Efficiency”

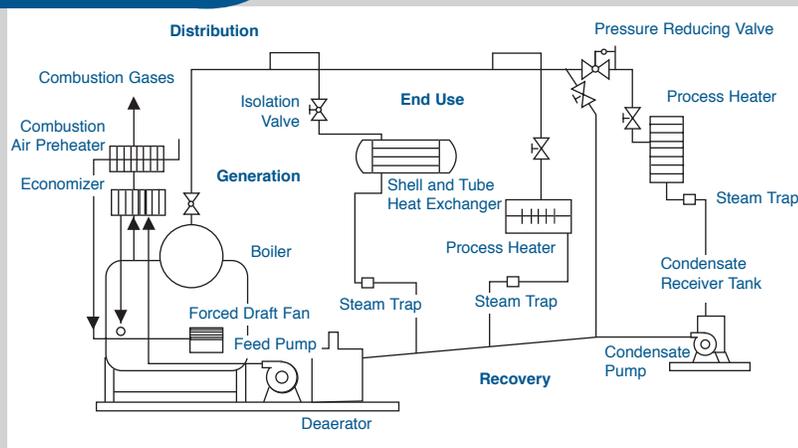
- Eliminated purchased fuel (by insulating steam lines and replacing 70 steam traps)
- Reduced CO₂ emissions, and better personnel protection
- Saved \$138,560 in energy costs
- Implementation costs of \$69,280
- Payback period was only six months

We probably have the information and tools to answer your questions about making your steam system more efficient. If not, we will connect you to someone who does. Contact our clearinghouse at: (800) 862-2086, or visit our web site: www.oit.doe.gov/bestpractices/steam.

What BestPractices Steam Can Do for You

In addition to providing planning support and funding for advanced industrial research and development related to energy, the Industrial Technologies Program manages an energy management best practices program to help

STEAM SYSTEM SCHEMATIC



Running a steam system efficiently requires much more than tuning boilers because many cost-saving opportunities exist downstream from the boiler.

industry improve energy efficiency and competitiveness in the near-term. In conjunction with the overall BestPractices Program, the part of energy management devoted to steam offers a substantial array of products and assistance to industry and to organizations that promote industrial energy efficiency.

Documentation and References

- **Improving Steam System Performance** is a preliminary sourcebook for plant managers that contains steam system improvement opportunities, program resources, contacts, and references.
- **Steam tip sheets** describe specific technical steam improvement opportunities.
- **Case studies** document real-world experiences in plant improvement projects.
- **Steam System Opportunity Assessment for the Pulp and Paper, Chemical Manufacturing, and Petroleum Refining Industries** (1) defines the volume and scope of industrial steam usage; (2) identifies major classes of system improvement opportunities; and (3) estimates potential steam efficiency impacts on aggregate energy consumption.
- The **Steam Digest** annual compiles scholarly articles on steam system technology improvements, case studies, and management techniques.
- The **Steam System Survey Guide** provides technical information to help steam system operational personnel and plant energy managers find major opportunities to improve energy efficiency and productivity.
- The **Guide to Low-Emission Boiler and Combustion Equipment Selection** helps plant managers evaluate and select low-emission boilers and combustion equipment.
- The **IAC Steam Tool Benchmarking Report** project tested and validated the Steam Scoping Tool in 18 plants. The results of this study include a list of steam efficiency options along with the annual cost savings, implementation costs, and payback period of those options.

Diagnostic Software

- The **Steam Scoping Tool** guides an evaluation of your steam system against well-documented industry best practices.
- **3E Plus** software evaluates and specifies insulation thickness for steam distribution systems.
- The **Steam System Assessment Tool** (available late 2002) helps analyze steam system “what-ifs” for calculating energy savings and cost implications of system improvements.
- Other commercially available analysis software is referenced via the program Web site and sourcebook.

Training and Plant Assessment Opportunities

- **Training** is offered on a limited basis. These sessions are conducted as part of a larger agreement between solicited participating plants and DOE.
- **Plant-Wide Energy Assessments** are open on a competitive cost-share basis annually. DOE covers 50% of assessment costs up to a statutory limit (currently \$100,000).
- One-day plant assessments are made available at no cost to eligible *small- and medium-sized plants* via DOE-funded **Industrial Assessment Centers** (IACs). See the IAC Web site at: www.oit.doe.gov/iac.

Peer Networking and Awareness Events

- Steam efficiency awareness workshops benefit plant managers in a specific region or industry. These one-day forums introduce efficiency improvement concepts, provide an introduction of program resources, illustrate success stories, and allow attendees to network with peers and solution providers.
- Program presentations are given at the invitation of other organizations that conduct their own industry events. Trade associations, professional societies, and vendor groups are a few examples of hosts.
- Booth and display activities are conducted at industry trade shows to further promote program resources.

Program-to-Industry Communications

- **Energy Matters** is a DOE periodical circulated to industry. It provides informational articles on energy management, including BestPractices Steam.
- The **Steaming Ahead** electronic newsletter is dedicated specifically to the steam systems audience. An accompanying Web site (www.steamingahead.org) provides additional detail to news briefs in the e-mailed newsletter, document downloads, and links.
- **Articles** related to steam system optimization are written for trade journals. Articles target plant managers.

Industry Networking

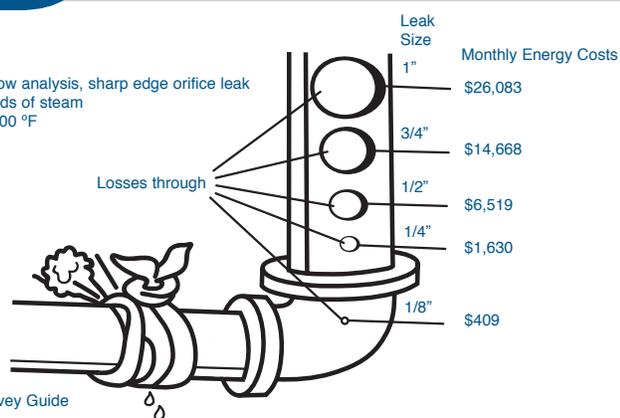
Aside from its reference products, BestPractices Steam represents a network of industry professionals that can potentially assist with a wide variety of program initiatives and cooperative ventures. The program steering committee contains professionals from manufacturing, energy services, universities, national laboratories, trade associations, government, and non-profit advocacy organizations. These are valuable contacts for:

- Seeking partners or participants in new technology research, development, and deployment;
- Collaborating in the planning and presentation of industry forums;
- Extending communication through sales and distribution networks to a wider industry audience; and
- Seeking industry contacts for “champions” or first movers who can influence their industry peers.

CUMULATIVE LEAKS

Assumptions:

Model=Compressible flow analysis, sharp edge orifice leak
Cost=\$9.50/1,000 pounds of steam
Pressure=150 psig at 500 °F



Cumulative leaks in a steam distribution and condensate recovery system can add up to tens of thousands of dollars in losses per year.

EERE Industrial Technologies Program

EERE covers a broad spectrum of energy efficiency and renewable energy technologies and offers an array of resources, tools, and information for the buildings, industrial, power generation, and transportation sectors. The Industrial Technologies Program in EERE provides resources in the areas of current and emerging energy efficiency and renewable technologies and energy management best practices. These resources include printed materials, software, awareness workshops, Web sites, training, and the Energy Efficiency and Renewable Energy Clearinghouse.

BestPractices energy management is an integral part of EERE Industries of the Future strategy that helps the most energy intensive industries in the U.S. improve their competitiveness. BestPractices introduces best available and emerging technologies from a number of EERE programs plus energy management practices to help companies, large and small, improve energy efficiency, environmental performance, and productivity.

The energy management component of BestPractices highlights the energy savings potential in five plant systems—motors, steam, compressed air, pumping and process heat. The program informs industry about near- and long-term energy efficiency options for these systems through a wide variety of program resources. These include unbiased technical information and access to technology implementation experts as well as energy management and assessment professionals.



BestPractices is part of the Office of Industrial Technologies Program's (OIT's) Industries of the Future strategy, which helps the country's most energy-intensive industries improve their competitiveness. BestPractices brings together emerging technologies and energy management practices to help companies begin improving energy efficiency, environmental performance, and productivity right now.

Industry gains easy access to near-term and long-term solutions for improving the performance of motor, steam, compressed air, and process heating systems. In addition, Industrial Assessment Centers provide comprehensive industrial energy evaluations to small-and medium-size manufacturers.

DOE STEAM PROGRAM PARTNERS:

Alliance to Save Energy

Oak Ridge National Laboratory

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Please send any comments, questions, or suggestions to webmaster.oit@ee.doe.gov

Visit our home page at:
www.oit.doe.gov/bestpractices/steam

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