UNIVERSITY of HOUSTON

UH ENERGY

Highlights from the Texas Industrial Energy Efficiency Program
Newsletter Volume 6, Number 3, July 2025

Greetings, from the Texas Industrial Energy Efficiency Program!

In this issue:

Upcoming Events

Please check "Upcoming Events" on the Energy and Innovation Event Calendar for updates as they become available.

Southwest Process Technology Conference

September 22-23, 2025
University of Houston
Call for Abstracts: Please contact Session Chairs for openings.
Sponsorships: Sponsorship Opportunities
Register here: 2025 Southwest Process Technology Conference

SPTC features several energy efficiency and water conservation sessions including:

- Energy Efficiency 1
- Energy Efficiency 2
- Efficient Water Use

The event will open with a keynote address by Dean Foreman, Chief Economist of the Texas Oil & Gas Association. The Leadership & Management Forum will feature prominent leaders across the energy sector. Additionally, many sessions throughout the conference will highlight strategies for energy savings through process improvements.

Energy Day

Saturday, October 18, 2025, 11:00 am-6:00 pm
Sam Houston Park | Downtown Houston

TIEEP will host a table in the UH Energy tent at this citywide STEM outreach event. Stop by and explore our interactive exhibit—we'd love to see you there!

Industrial Energy Efficiency Podcast

Stay tuned for our upcoming new podcast launching this September!

Event Recaps

TIEEP Refinery & Chemical Plant Steam System Workshop

Thursday, May 8-9, 2025, 8:00am - 3:30pm
University of Houston Technology Bridge

Steam systems are an integral part of almost all oil refineries and chemical plants, and opportunities abound to improve both their efficiency and their reliability. Mr. Jim Risko has 47 years of experience with steam and condensate systems, and in that time he has participated, in various roles, in over 10,000 improvement applications. In this course he shared this wealth of experience with the new generation of energy managers and steam system specialists.

STS AIChE Monthly Dinner Meeting

Thursday, May 8, 2025, 6:00pm - 8:30pm
University of Houston Technology Bridge
The First Step to Efficiency: How Real-Time Monitoring Prevents Equipment Failures and Reduces Energy Waste
Keynote Speaker: **Yve Hunt**, founder of Terra Viva Energy

Energy efficiency isn't just about using less power—it's about using energy smarter. In industrial environments, unnoticed inefficiencies and equipment failures lead to skyrocketing costs, unplanned downtime, and increased carbon footprints. The first step to tackling these challenges is real-time energy monitoring. Yve explored how real-time energy data enables businesses to proactively manage equipment performance, detect early signs of failure, and optimize maintenance schedules before costly breakdowns occur. By leveraging IoT-powered monitoring solutions, companies can gain actionable insights into their energy consumption, reduce waste, and extend the lifespan of critical machinery.

A recording of the presentation is available in our Presentation Library here: [The First Step to Energy Efficiency: How Real Time Monitoring Prevents Equipment Failures and Reduces Energy Waste | University of Houston]

TIEEP Spring Energy Forum

Thursday, May 8, 2025, 4:00pm - 6:00pm
University of Houston Technology Bridge

Presentation 1: *Back to PRACTICAL Energy Optimization,*
Grant Jacobson, BECHT

Becht's Practical Energy Assessment Kit offers a structured, site-wide evaluation of energy management practices and system performance to identify low-capital opportunities for improvement. Grant focused on a recent assessment at a major North American fuels refinery revealed actionable gaps across operations, monitoring, and organizational alignment.

A recording of the presentation is available in our Presentation Library here: Back To Practical Energy Optimization | University of Houston

Presentation 2: *The Role of Steam-Generating Heat Pumps in Boosting Energy Efficiency While Reducing Operating Costs in Industrial Manufacturing,*
Chris Barnhill, Skyven Technologies.

Industrial manufacturing requires high-temperature, high-pressure steam for on-site production processes. For the past 100+ years, fossil-fuel powered boilers have been the only cost-effective way to generate steam. Chris, filling in for Jim Saccone, introduced us to innovative technologies such as steam-generating heat pumps (SGHP) that electrify steam production with greater efficiency than legacy boilers, thereby reducing energy costs for manufacturers of energy-intensive facilities.

A recording of the presentation is available in our Presentation Library here: Role of Steam Generating Heat Pumps | University of Houston

Presentation 3: *Enterprise-wide Energy Efficiency Fleet Monitoring Tool*
Angel Lanza, ExxonMobil

In the pursuit of sustainable operations and reduced carbon footprints, refining companies are increasingly adopting digital tools to monitor and enhance energy efficiency. In this presentation, Angel introduced an enterprise-wide energy efficiency fleet monitoring tool designed to provide real-time insights into energy consumption across multiple refinery units.

This was a Live Experience Only.

Case Study

Getting All Steamed Up
Alan Rossiter

Steam systems provide the core energy conduit in most process plants. At many plants the operating parameters of individual equipment items (e.g., stack temperatures and excess air in boilers) are monitored closely, and they can have a big impact on operating costs. However, steam header balances are often ignored. This is unfortunate, as steam balances can have an even larger impact on overall energy efficiency (1).

Steam systems produce and distribute heat in the form of steam, and in many cases they also generate and distribute power. The combined production of heat and power is called cogeneration, and it is an effective way of both increasing overall energy efficiency and reducing the total cost of providing energy for many process facilities. Typical equipment includes boilers, steam turbines, pressure reduction ("letdown") valves, vents, and deaerators. Some larger systems also incorporate gas turbines and heat recovery steam generators (HRSGs). Figure 1 and Figure 2 are simplified diagrams showing the interconnection of the main equipment items in two variants of a common steam system configuration. There are many different types of steam turbines, but in this discussion we consider one of the simplest: a backpressure turbine, where there is a single steam inlet and a single outlet, and the steam leaves the turbine above atmospheric pressure.

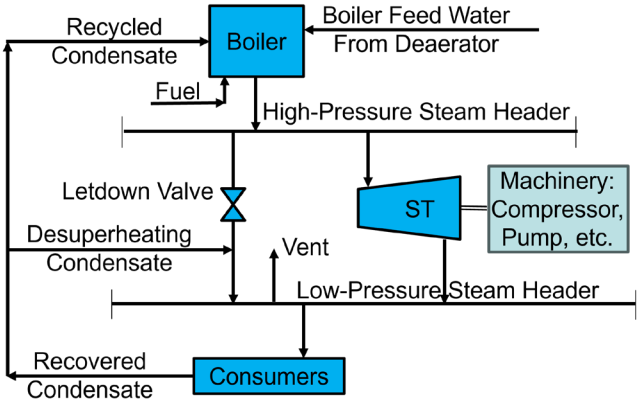

Figure 1- Steam System with Backpressure Steam Turbine Used to Drive Plant Equipment

Steam is produced in the boiler, using heat provided by burning fuel. Steam turbines are often used to drive process machinery (typically pumps or compressors), as shown in Figure 1. The steam flow through the turbine is dictated by the power requirement of the driven equipment. This also affects to amount of steam that has to be produced in the boiler, and hence also the fuel firing rate.

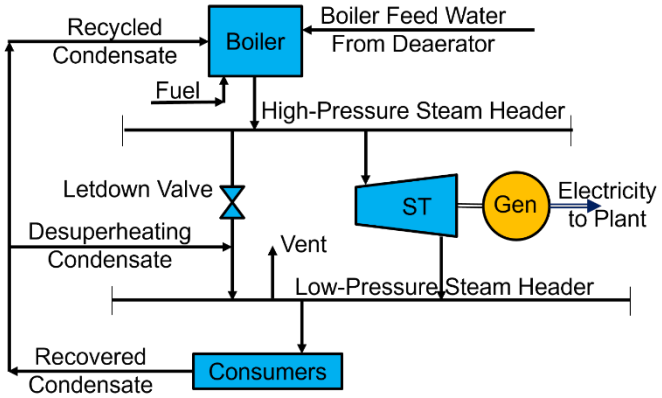

Figure 2 - Steam System with Backpressure Steam Turbine Used to Drive Plant Equipment

Alternatively, steam turbines can be coupled to electric generators, as shown in Figure 2. In this configuration, the steam flow through the turbine can be adjusted to balance the steam system, subject to maximum and minimum flow constraints. This affects the power output from the generator, so the amount of electricity that has to be imported from the grid – or in some cases exported to the grid – will also change.

Changes in the amount of fuel fired in the boiler and in the amount of electric power imported from or exported to the grid can have a significant impact on net operating costs, so there are strong reasons to optimize these parameters.

There are three very common inefficiencies in steam balances:

Steam Venting

In many steam systems, too much steam reaches the lowest-pressure header. The excess has to be vented, which wastes both energy and water. Common causes include:

a. too much flow through backpressure steam turbines and/or letdown valves, which creates more low-pressure (LP) steam than the system can accommodate;
b. excessive amounts of LP steam produced in waste heat boilers, or by flashing vapor from condensate collection tanks;
c. inadequate turndown capability in boilers; and
d. control problems and hydraulic limitations.

Steam Letdowns vs. Steam Turbines

When steam passes through a turbine, its pressure goes down, and some of its heat content is converted to power. When it passes through a letdown valve, its pressure goes down, but its heat content (enthalpy) does not change[1]. In most cases, the cost of the incremental fuel required to produce electric power in a steam system is much less than the value of the electricity it produces, so there is a financial incentive to maximize the use of steam turbines within the steam system, and minimize the use of letdown valves. However, in applying this concept we must be careful to respect all of the equipment constraints (e.g., maximum turbine steam flow, maximum and minimum boiler load, etc.), and also overall system constraints. In particular, if increasing the flow through a steam turbine results in a steam vent, this usually means that we are no longer saving money or energy. In practice, many steam systems do not run close to their optimum steam turbine loading.

Deaerator Steam

Most steam systems use thermal deaerators to drive off oxygen and other dissolved gases from boiler feed water. In principle, only a small amount of steam is needed to do this. However, as the incoming water is often far cooler than the saturation temperature in the deaerator, a substantial amount of additional steam is often used in preheating the water. It is not uncommon to consume 10% or even 15% of the total steam from boilers to preheat water as it enters the deaerator.

Solutions

You need to understand your steam balance if you want to improve it, and the first step is to develop a good steam balance model. This can be a simple spreadsheet, but online tools and commercial modeling systems and optimizers are also available.

Some of the inefficiencies discussed above can be solved by simple operating changes, like adjusting steam flows through letdown valves or steam turbine-generator sets or changing deaerator pressure. However, it is often necessary to add equipment to achieve significant savings. For example, boiler feed water preheaters can sometimes be added to capture surplus (waste) heat from the plant to heat the boiler feed water before it enters the boiler and thereby reduce the fuel requirement. Some interesting and cost-effective improvements can also be obtained using thermocompressors (2).

1. Alan Rossiter & Beth Jones, 'Energy Management and Efficiency for the Process Industries,' AIChE/John Wiley & Sons, Inc., Hoboken, New Jersey, 2015, Chapter 18.
2. Alan Rossiter, "Consider a Thermocompressor," Chemical Processing, Vol. 81, No. 4, p. 12, April 2019.

[1] This neglects heat losses from the surfaces, and other minor parasitic losses.

If you have any questions or difficulties with registration, or to request removal from this distribution list, please contact Gary Gildert, grgilder@cougarnet.uh.edu or 713-743-0747.

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