UNIVERSITY of HOUSTON

UH ENERGY

Highlights from the Texas Industrial Energy Efficiency Program
Newsletter Volume 4, Number 3, June 2023

Greetings, from the Texas Industrial Energy Efficiency Program!

In this issue:

Upcoming TIEEP Events

Save These Dates!

Thursday, September 21, 2023: Symposium – Plastics Circularity. Co-presenting with UH Energy.

Tuesday-Thursday, November 28-30, 2023: TIEEP's Fall Energy Forum will be collocated with the ChemE Show in Galveston, Texas. Registration is now open at https://cheme-show.com/register/ . When prompted for a discount code, TIEEP participants can enter SPTC10off for a 10% discount.

Information subject to change. Details to be finalized.

Spring Program Recap

TIEEP's Spring 2023 program was extremely busy. In our last newsletter, we focused on our student outreach, both with K-12 students and university students. These new initiatives reflect the need to make the next generation of students more aware of the importance of energy and its role in industry – and the exciting career opportunities that are available. These new initiatives have been received very well, and we plan to build on them in our future programming.

In this current newsletter, we'll focus on our established events. These include TIEEP's Spring Energy Forum and Water Forum, and the annual Webinar organized by our sister organization, TIEEN. You can find recordings and presentation materials for all these events in the archive section of our webpage.

TIEEP Spring Energy Forum, Thursday March 16, 2023

TIEEP
TEXAS INDUSTRIAL ENERGY EFFICIENCY PROGRAM

Theme: *Energy Efficiency and Decarbonization for the Process Industries*
Venue: Silver Sycamore Event Venue, 5111 Pine Ave, Pasadena, TX 77503. Hybrid event.
Co-hosted by STS-AIChE

Forum Overview

Decarbonization has become an imperative for the process industries, and energy efficiency has long been recognized an essential strategy to help achieve this need. Unlike other approaches, energy efficiency inherently reduces operating costs while it decreases emissions, so it offers a positive return on investment, even without factoring in environmental benefits. The presentations in our Spring Energy Forum addressed three separate topics: a new DOE initiative to support energy efficiency and decarbonization in energy intensive industries, particularly in industrial systems such as steam and process heating; decarbonization through electrification; and use of hydrogen in gas turbines as another means of decarbonizing industrial processes.

Program

Presentation 1: Technical Assistance for Energy Intensive Manufacturers

The U.S. DOE's Industrial Energy and Decarbonization Office (IEDO) is launching a 2-year effort to support energy-intensive manufacturers in improving energy performance, decarbonization, and competitiveness in their plants and mills. Join us for a discussion about DOE resources that will be available to energy-intensive manufacturers and how they can leverage DOE resources to improve energy efficiency, decarbonization and competitiveness.

Zachary D. Pritchard, Ph.D., AAAS Science and Technology Policy Fellow, Industrial Efficiency and Decarbonization Office, U.S. Department of Energy

Senthil Kumar, Technical Account Manager for U.S. DOE's Better Plants Program

Presentation 2: Decarbonizing Energies & Chemical Plants with Electrification & Digitization

Decarbonizing hydrocarbons & chemicals production is one of the high priorities for operators addressing the regulatory environment, investor pressure, and their own sustainability goals. This is especially challenging in the petrochemical industry, where electricity accounts for only 4% of the total energy consumption. Explosive growth in low carbon electricity, and an array of innovative technologies, combined with digitization, is elevating process electrification as one of the key decarbonization levers. In this session, we discuss the opportunities, challenges, and technology breakthroughs in electrifying heavy process industries. This session also discusses how asset managers can prepare for a systematic transition to electrified operations.

Yasmine McColl, Global Business Development Leader for the Chemicals Segment, Schneider Electric

Shebin Jalal, Chief Solution Architect and Global Process Electrification Leader - Energies and Chemicals, Schneider Electric

Presentation 3: Hydrogen power with gas turbines

How can gas turbines help meet the World Energy Council's trilemma of secure, affordable, and environmentally sustainable energy? How can one's business ensure the future role of their existing assets as decarbonization agents that will support the energy transition? The presentation discusses details on the vital role that gas turbines burning hydrogen as a fuel will play in a world trending toward full decarbonization and an unfolding hydrogen economy. We shed light on the hydrogen combustion process, the capability and operational experience of Siemens gas turbines with hydrogen combustion, upgrade options, and our roadmap to 100% hydrogen capability.

Jorge Lopez, Power Systems Development Manager, Siemens Energy

Ricky Dharani, Business Development Director, Siemens Energy

The event recording and presentation materials are available here.

TIEEN Webinar, Wednesday April 12, 2023

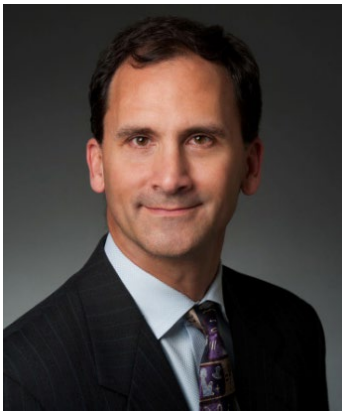
TIEEN
TEXAS INDUSTRIAL ENERGY EFFICIENCY NETWORK

Energy prices are notoriously volatile. This is due to a multitude of factors, both global and regional. In the past few years, we have seen whipsaw price action due the pandemic, Winter Storm Uri, and the war in Ukraine, to name just a few. How can a company make rational energy-efficiency investments in this environment? Experts and market participants shared their insights in TIEEN's engaging online panel discussion, *Industrial Energy Efficiency in a Volatile, High Price Energy Market*, on Wednesday, April 12, 2023. You can relive the experience us as we grappled with this challenging topic through the recording in our archive.

Panelists:

Jamie Brick, Expert Engagement Manager at McKinsey

Jeremy Keller, P.E., SVP of Business Development, Rondo Energy



Raoul LeBlanc, Vice President for North American Upstream, S&P Global

The Texas Industrial Energy Efficiency Network (TIEEN) is a network of publicly supported industrial energy-efficiency organizations. TIEEN is organized by UH Energy, at the University of Houston, and funded through a grant from the State Energy Conservation Office (SECO).

TIEEP Water Forum, Thursday May 4, 2023

TIEEP
TEXAS INDUSTRIAL ENERGY EFFICIENCY PROGRAM

Date & Time: Thursday, May 4, 2023, 4:00-6:00 pm
Theme: *Energy Efficiency and Decarbonization in the Industrial Use of Water*
Venue: San Jacinto College Center for Petrochemical, Energy and Technology, 7901 Fairmont Parkway, Pasadena, TX 77507. Hybrid event.
Co-hosted by STS-AIChE.

Forum Overview

Water, energy, and carbon emissions are inextricably linked, and opportunities abound to improve energy efficiency while saving water and decarbonizing. In this hybrid event, industry experts and suppliers present cutting edge tools, strategies, and examples for attaining these integrated objectives, both in existing manufacturing facilities and in new plants with emerging technologies. The recording and presentation materials are available here.

Program

***Presentation 1:* Streamlining the Search for Energy Savings in Utilities**

Industrial utilities are the giant, "Frankensteined," site-spanning monsters that keep the proverbial lights on for the processes at a refinery or chemical plant. Years of expansion, increasing demands, and tighter budgets have left utility systems strained but abundant with opportunity for energy savings. This presentation discusses the cultural and technical foundation of a continuous improvement approach, and the tools, data, and expertise needed to streamline the search for saving energy and water.

Clayton Harris, PE, Engineering Manager, Hydrus Works, LLC

Presentation 2: Designing Pump Systems to reduce energy consumption toward greater sustainability

This presentation provides an overview of pump curves and how they can be used to identify efficiency improvement opportunities, including the Pump Savings Calculator and the HI Energy Rating, with examples. It also reviews the Pump Industry Fundamental Body of Knowledge and Pump System Fundamentals, Pump System Optimization and Assessment and Pump System Professional Assessment courses.

Matthew C. Derner, Manager, Business Development, Education & Training Resources, Hydraulic Institute / Pump Systems Matter

Presentation 3: Energy in Transition: Reverse Osmosis and the Economics of Green Hydrogen Production

Green hydrogen has become a promising alternative energy source as nations seek to address climate concerns through decarbonization as well as ensure flexibility and energy security in the face of geopolitical uncertainty. But without a clear economic advantage, industry stakeholders will be reluctant to invest in the required infrastructure until it is shown how green hydrogen can generate top-line growth and bottom-line efficiency. Both electrolysis and steam methane reformation require large amounts of fresh water, not to mention ethane cracking and other petrochemical refining processes. This presentation highlights how reverse osmosis and desalination can play a critical role in the economic efficiency of green hydrogen projects, as well as the transition through the intermediate steps of gray and blue hydrogen.

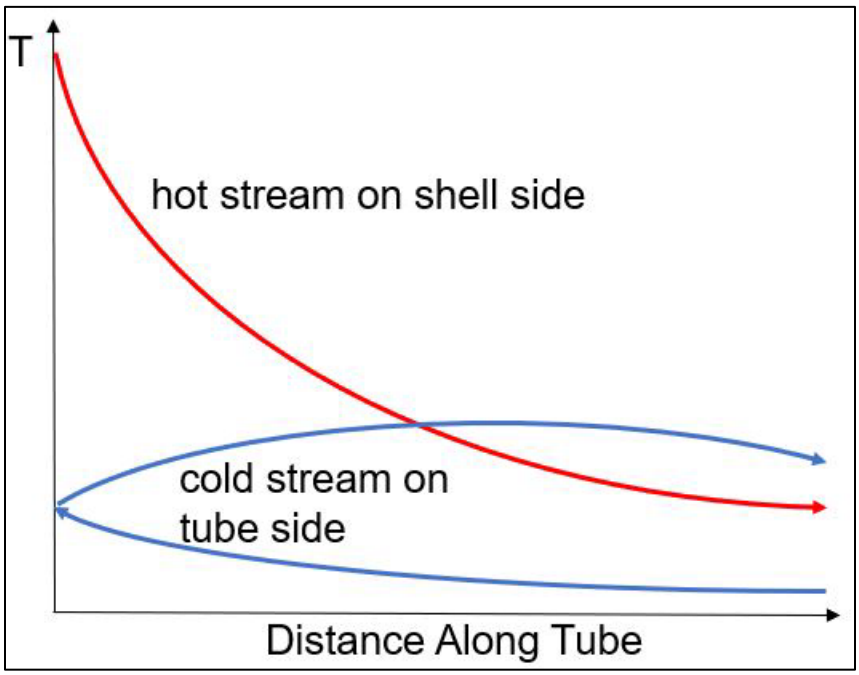
Jack Highberger, Managing Director, Hatenboer-Water Americas.

From the Casebook: Squeezing the Heat Out

Heat exchangers are used for heat recovery, and the heat exchanger system can have a huge impact on the overall energy efficiency of an industrial process. In most heat exchangers there is one “hot stream” at a relatively high temperature, which transfers heat to one “cold stream” at a lower temperature. The temperature of the hot stream falls, while that of the cold stream rises. Simple, right? Not always.

Shell and tube heat exchangers (STHEs) are the main workhorse in the process industries. They consist of metal shells (pressure vessels) with bundles of tubes inside. STHEs are relatively cheap and robust, and they can be fabricated from a wide variety of materials. They can also be designed for a wide range of sizes, operating temperatures, and pressures; and they are relatively easy to clean and maintain.

There are two flow paths through an STHE – the “tube side” (i.e., inside the tubes), and the “shell side” (i.e., inside the shell, but outside the tubes). Depending on various factors, such as flow rates, viscosities, and propensity to fouling, we can choose to route the cold stream through the shell side and the hot stream through the tube side, or vice versa. Below we assume the hot stream is on shell side.



Heat transfer is most efficient with countercurrent flow, and a uniform temperature difference between the hot and cold streams. In most STHEs, the shell-side flow path has just one pass – in at one end, and out at the other[†]. However, the tube-side flow path is usually multi-pass – from one end of the STHE to the other and back again, often several times. The tube-side flow therefore alternates between countercurrent and co-current relative to the shell-side flow. This can lead to "temperature cross," where the outlet temperature of the "hot" stream is lower than the outlet temperature of the "cold" stream. When this happens, the tube-side fluid heats up when flowing in the countercurrent direction, but it cools down in part of the co-current pass (see figure). This limits the achievable temperature approach. In this situation, adding heat transfer area does little to increase heat recovery.

We can achieve a closer temperature approach by combining several STHEs in series. The temperatures of both the hot and cold streams now change only a relatively small amount within each STHE, and temperature cross is thus avoided. However, adding STHEs is more expensive than simply increasing the heat transfer area in a single STHE. The additional cost can be significant, especially where close temperature approaches are needed.

Other options are sometimes possible. For examples, "F-shell" STHEs have two shell-side passes. If there are also two tube-side passes, this yields pure countercurrent flow. Plate heat exchangers (PHEs) and spiral heat exchangers (SHEs), and some other types, also offer countercurrent flow, and in some cases, they are a cost-effective option for achieving close temperature approaches.

[†]There are baffles in most shells perpendicular to the tubes, so the shell-side path also includes a crossflow component. This complication is ignored in the above discussion, but it does not change the overall conclusions.

Additional information:

Alan Rossiter & Beth Jones, 'Energy Management and Efficiency for the Process Industries,' AIChE/John Wiley & Sons, Inc., Hoboken, New Jersey, 2015, Chapter 10, *Enhanced Heat Transfer and Energy Efficiency*, by Thomas Lestina.

In Closing…

Thank you for taking the time to read along with us. We hope you found the information useful, and that you'll join us in our upcoming events.

If you would like to ensure that you receive all program updates and notices of upcoming events, please subscribe on our webpage. The subscribe button is at the bottom right-hand corner.

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