UH Energy
UNIVERSITY OF HOUSTON

Texas Industrial Energy Efficiency Program

Highlights from the Texas Industrial Energy Efficiency Program Newsletter Volume 5, Number 2, February 2024

Greetings from the Texas Industrial Energy Efficiency Program!

In This Issue:

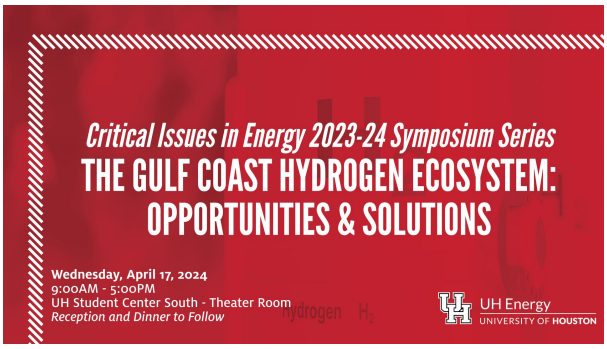
UPCOMING TIEEP EVENTS

Save These Dates

Thursday, March 7 2024, 4-6 PM
TIEEP Water Forum
Theme: *Water: The Big Picture*.
Venue: Hybrid event. You can join us in-person at Silver Sycamore Event Venue, 5111 Pine Ave, Pasadena, TX 77503, Map, or online.
PDH certificates available.
In-person | Virtual

BONUS EVENTS

Hydrogen Symposium, April 17



The TIEEP community is invited to join UH Energy for the timely symposium, The Gulf Coast Hydrogen Ecosystem: Opportunities & Solutions, April 17. Complimentary registration HERE.

Wednesday, May 1, 2024, 4:00-6:00
TIEEP Spring Energy Forum
Theme: *Energy and Decarbonization: The Big Picture*.
Venue: Hybrid event. You can join us in-person at the University of Houston's Elizabeth D. Rockwell Pavilion, or online.
PDH certificates available.
In-person | Virtual

Energy Careers and Leadership Webinar Series, Multiple Dates

TIEEP is co-presenting UH Energy's Energy Careers and Leadership webinar series. This program brings established energy leaders to the virtual platform to share their insights and experience. The main target audience is university students, but the webinars are open to all

experience. The main target audience is university students, but the webinars are open to all, at no charge. The webinars are scheduled 10:00-11:00 am Central, Fridays February 9, 16 & 23 and March 1, 22 & 29, 2024. If you or someone you know would like to attend, please register here.

EVENT RECAP

TIEEP
TEXAS INDUSTRIAL ENERGY EFFICIENCY PROGRAM

TIEEP's Fall Energy Forum took place at the ChemE Show at Moody Gardens in Galveston. The TIEEP Energy Forum consisted of two technical sessions, the afternoon of Wednesday, November 29. Speaker profiles and presentation pdfs are available in the TIEEP archive at: 2023 TIEEP Fall Energy Forum - University of Houston (uh.edu)

EVENT PREVIEWS

TIEEP Water Forum: Thursday, March 7, 2024, 4:00-6:00 pm
Theme: *Water: The Big Picture*.
Venue: Hybrid event. You can join us in-person at Silver Sycamore Event Venue, 5111 Pine Ave, Pasadena, TX 77503, Map, or online.
This event is co-hosted by STS-AIChE
PDH certificates available.
Attendance at the Water Forum, both online and in-person, is free. However, registration is required: In-person | Virtual

Overview
The water that we use inside our chemical plants and oil refineries is part of a massive system that includes both natural and manmade elements. In this year's TIEEP Water Forum, we will explore the macro water system in the Houston/Gulf Coast area, and how this impacts water usage in the process industries. This includes ways to improve the efficiency of water use, issues of equity and sustainability, and a discussion of a strategic approach to industrial water management.

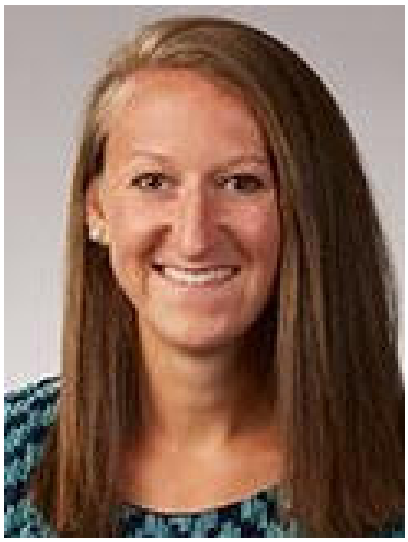
Confirmed Speakers and Topics

Philip Taucer, PE

Associate, Water Resources Planning, Freese and Nichols, Inc.
Topic - *Hitting the Trail: The Long Path for Future Water Management*

Margaret Cook

Senior Research Associate, Energy-Water-Climate Nexus, Houston Advanced Research Center (HARC)
Topic - *Water, Sustainability, and Equity in Texas*



Amanda Tyndall

Vertical Market Manager Industrial & Environmental for Veolia Water Technologies & Solutions Analytical Instruments
Topic - Industrial Water Management Strategies for Compliance, Sustainability and Cost Efficiency

For additional information and updates, please visit: https://uh.edu/uh-energy-innovation/uh-energy/educational-programs/industrial-energy/tieep/2024-water-forum/

STS-AIChE Dinner Meeting
The TIEEP Water Forum will be followed by STS-AIChE's March dinner meeting program at the same venue. Registration for the dinner meeting program, both online and in-person, will be available approximately 2

weeks before the meeting, on the STS-AIChE events page, STS | South Texas Local Section | AIChE.

TIEEP Spring Energy Forum: Wednesday, May 1, 2024, 4:00-6:00
Theme: *Energy and Decarbonization: The Big Picture*.
Venue: Hybrid event. You can join us in-person at the University of Houston's Elizabeth D. Rockwell Pavilion, or online.
PDH certificates available.
In-person | Virtual

Overview
We will examine some of the major themes in the energy transition (e.g., CCUS, Hydrogen), and explore how they are being developed regionally in the Texas Gulf Coast area. This goes beyond individual projects, or even individual companies, and looks rather at regional strategies and the organizations that are developing them.
For additional information and updates, please visit the Upcoming Events section of the TIEEP webpage, TIEEP: Texas Industrial Energy Efficiency Program - University of Houston (uh.edu).

STS-AIChE Dinner Meeting
The TIEEP Spring Energy Forum will be followed by STS-AIChE's May dinner meeting program at the same venue. Registration for the dinner meeting program, both online and in-person, will be available approximately 2 weeks before the meeting, on the STS-AIChE events page, STS | South Texas Local Section | AIChE.

FROM THE CASEBOOK
The Strange Case of the Magic Burner

Of all my consulting assignments, there has been none so strange as the Case of the Magic Burner. My client asked me to evaluate this new technology, with the objective of upgrading some boilers. The vendor claims were interesting, to say the least. The burner requires virtually no excess air, and it produces no carbon monoxide or NOx. Furthermore, because of high flame speed, it delivers excellent heat transfer. However, what really caught my attention was the claim that the burner would reduce fuel use in the boilers by 30-40%.

Remarkable claims demand remarkable evidence! I told the vendor CEO that if he could prove his claims, I would personally recommend the burner's inventor to the Nobel Committee. The efficiency of boilers and furnaces is defined as: efficiency (%) = (useful heat delivered)/(total heat supplied)*100. This is deceptively simple. "Heat supplied" can be based on either higher heating value (HHV), which includes the latent heat of condensation of water vapor in the exhaust gases, or lower heating value (LHV), in which the latent heat is omitted. The nameplate efficiency of the boilers we were evaluating was over 90% (LHV), equivalent to about 81% (HHV). If the burners could reduce the fuel use by even 30%, while still delivering the same amount of useful heat, the energy efficiency would be significantly greater than 100%, thus violating the First Law of Thermodynamics (conservation of energy).

One of our most common fuels is natural gas, which consists mostly of methane. Its combustion can be represented as: $CH_4+O_2 \rightarrow CO_2+H_2O$; $\Delta H = -891$ kJ/mol. However, this process is imperfect, and excess oxygen is required to drive the reaction to completion. Furthermore, in almost all cases we support combustion with air, not pure oxygen; so a great deal of nitrogen, and smaller amounts of other gases, enter the burner with the fuel and oxygen, diluting the mix. All of these gases eventually leave through the stack, carrying heat with them. The more excess air we supply, the more excess oxygen (plus nitrogen and other gases) goes up the stack, and the greater the heat loss will be. Modern gas-fired industrial boilers are typically designed for 2.0-2.5% excess oxygen. With a stack temperature of 320ºF and 2% excess oxygen, and an ambient temperature of 90ºF, the stack loss (excluding latent heat) would be around 6%.

There are also smaller losses (typically <1% in good, modern designs) through the wall (or "shell") of the equipment. In addition, for boilers, and also for furnaces that incorporate steam generating equipment, there is usually an additional heat loss (typically 1-3%) due to blowdown water. This is a hot water stream that is withdrawn to remove dissolved solids and other impurities that would otherwise build up and damage the equipment. Thus, a good boiler efficiency would be around 100-6-1-1 = 92% (LHV).

I asked the vendor for validated test results to support their energy savings. They claimed to have such results, but they never produced them. At my client's request, I located a facility that could test burners and

results, but they never produced them. At my client's request, I located a facility that could test burners and provide the measurements needed to prove the energy savings, but the vendor wanted my client to pay for the tests, and they were unwilling to do this.

Consequently, the efficiency benefits of the Magic Burner remain unproven, and the Laws of Thermodynamics remain stubbornly unchanged. And no, I never contacted the Nobel Committee. Have you ever encountered outrageous vendor claims that seem too good to be true? In the realm of energy, I suggest checking thermodynamic feasibility first. If the claims fail there, move on!

Adapted from: Alan Rossiter, *"Is it Too Good to Be True?" Chemical Processing, Vol. 82, No. 4, p. 12, April 2020*.

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 at 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.

If you have any questions, or difficulties with registration, or to request removal from this distribution list, please contact Alan Rossiter, aprossit@central.uh.edu or 713-743-1566.

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UH Energy is an umbrella for efforts across the University of Houston system to position the university as a strategic partner to the energy industry by producing trained workforce, strategic and technical leadership, research and development for needed innovations and new technologies. That's why UH is Houston's Energy University.