UNIVERSITY of HOUSTON

UH ENERGY

Highlights from the Texas Industrial Energy Efficiency Program Newsletter Volume 4, Number 1, October 2022

Greetings, from the Texas Industrial Energy Efficiency Program!

In this issue:

Fall Program Recap

TIEEP's Fall 2022 program included two events. The first was our Fall Energy Forum at the AIChE Southwest Process Technology Conference. The second was our co-sponsorship of UH Energy's ***Critical Issues in Energy*** symposium and livestream on **The Future of Nuclear in the Energy Transition**. These events provided important insights into recent advances in industrial energy management, and glimpses into what may lie in the future, as highlighted in the summaries below.

Fall Energy Forum

TIEEP's Fall Energy Forum took place at the AIChE Southwest Process Technology Conference, September 29, 2022, in Sugar Land, Texas. We continued the theme of Energy Efficiency and Decarbonization from last year, but also added the dimension of climate equity and environmental justice.

FORUM OVERVIEW

The energy transition is affecting the oil refining and chemical industries in many ways. It makes us look at new options for powering, heating, and cooling, of course; but it is also leading to a fundamental reassessment of supply chains and process design philosophy, and a fresh evaluation of the societal goals surrounding our industry. In this session, we examined all these issues, with presentations focusing on decarbonizing the process industry, specifically aimed at powering, and heating industrial processes, and recycling materials, along with climate equity and environmental justice. The abstracts of the presentations are given below; additional details, including pdfs of the presentations, are available on the TIEEP website at: https://www.uh.edu/uh-energy/educational-programs/tieep/tieep-energy-forum-2022-september.php.

PRESENTATIONS

1. Climate Equity and Environmental Justice in the Energy Transition. **Jane Stricker**, Senior Vice President, Energy Transition & Executive Director, Houston Energy Transition Initiative, **The Greater Houston Partnership**

Abstract. The Houston Energy Transition Initiative (HETI) is dedicated to leveraging Houston's energy leadership to accelerate global solutions for an energy abundant, low-carbon future. But a successful energy transition requires going beyond decarbonization and emission reductions goals. The transition must also drive our economy, create new jobs, and improve the quality of life for all Houstonians. Central to those goals is the concept of a just or equitable energy transition, addressing core issues in Houston such as:

- Climate and flood adaptation and resilience
- Energy burden both in terms of access and affordability
- Environmental hazards such as quality of air and water
- Workforce development and access to great, high-paying, clean energy jobs

Working with a wide group of stakeholders, HETI is developing a broad, practical framework for addressing equity issues as part of Houston's energy transition strategy.

2. Decarbonization of Industrial Facilities. **James Turner**, Manager, Houston Process and HSE Departments & Executive Director, Process Technology, **Fluor**

Abstract. Existing refineries and chemical plants currently have greenhouse gas emissions in their normal operation. Almost all facilities have fired process heaters and steam boilers that emit CO2 to the atmosphere, and some have processes, such as Fluid Catalytic Crackers, Cokers and Sulfur Plants, that vent CO2 to the atmosphere as part of their process operation. The facilities will need to make significant changes to their operations to reduce their Scope 1 carbon emissions and achieve net zero goals.
This paper discusses the major emissions from refineries and chemical plants, the potential techniques to significantly reduce the emissions, and the advantages, disadvantages, and example economics of each option. The impact of electrification and energy efficiency is considered, and the primary decarbonization techniques of carbon capture and using hydrogen as fuel to existing heaters are explored.

3. Certified Circularity through Advanced Recycling. **Robert Kerr,** Commercial Manager**, ExxonMobil Product Solutions**

Abstract. As both global population and living standards increase, meeting the demand for energy and products in an affordable and sustainable way is society's dual challenge. Plastic materials are integral to meeting this challenge due to their low cost, light weight, flexible properties, and lower life cycle GHG emissions compared to alternative materials. These aspects of plastics also make them too valuable to waste. Improved infrastructure for collection, sortation and recycling of plastics is needed at scale to establish a more circular value chain. Traditional mechanical recycling is an efficient approach when the waste feed is well sorted and contains predominantly one type of plastic, but its product use is often limited to low-grade applications. Advanced recycling complements mechanical recycling, using chemical processes to break down hard-to-mechanically-recycle plastics to make virgin-quality plastics and other valuable products. This presentation discusses how advanced recycling can play a pivotal role in driving towards a more circular economy for plastics, as well as ExxonMobil's plans to scale the technology at multiple sites around the world.

4. Utility-Scale Renewables Development, Construction, Operations, and Commercial Overview. **Jordan Andrepont**, commissioning engineer, **ENGIE**

Abstract. This presentation covers the basics of development, construction, and operation of renewable energy projects, including storage. The focus of the presentation is the high-level technical considerations, as well as an overview of commercial offtake structures.

Symposium and Livestream: The Future of Nuclear in the Energy Transition.

The Future of Nuclear in the Energy Transition was the first topic of UH Energy's 2022-2023 ***Critical Issues in Energy*** Symposium Series, and it was co-sponsored by TIEEP. The in-person event was held at the Hilton University of Houston, on October 20, 2022, with a simultaneous livestream.

Rising electricity prices, increasing concerns about grid reliability, and achieving carbon-free electricity in the U.S. by 2035 have refocused attention on the role of nuclear in the energy transition. This comes after a decade of low investments, accumulating nuclear waste, an aging fleet of reactors, public opposition, and regulatory mandates that stalled the growth of nuclear and led to declines in production. Meanwhile, the nuclear industry has maintained its safety record, made remarkable progress in fusion and advanced nuclear reactors, and improved operating safety and efficiency. The symposium addresses if and how headways in advanced nuclear reactors, fusion, and waste management can overcome the challenges of economic feasibility, efficient and safe waste disposal, and build public and regulatory support for the increased deployment of nuclear energy in the U.S., including deployment within industrial facilities.

You can see a recording of the event at https://uh.edu/uh-energy/energy-symposium-series/future-of-nuclear-energy/.

Panelists:
Carol Lane, Vice President, Government Relations for **X-energy**
Mark Woodby, Director of Engineering for the Nuclear Sector at **EPRI**
Sue Clark, Deputy Director, Science and Technology, **Savannah River National Laboratory**

Moderator:
Jessica Lovering, Executive Director, **Good Energy Collective**

Upcoming TIEEP Events

Saturday, January 28, 2023: STEM Zone Saturday K-12 Outreach – Energy in Industry

Thursday, March 16, 2023: Spring Energy Forum

Thursday, May 4, 2023: Water Forum

(Houston area venues; all dates tentative. Details to follow.)

From the Casebook: Nuclear Power for the Process Industries

I was born in the era of Atoms for Peace — President Eisenhower's Cold War strategy to shift the focus from the horror of Hiroshima and Nagasaki to the hope of peaceful, productive, and profitable uses for nuclear power. That strategy made some headway. From small beginnings in the 1960s, nuclear power generation expanded rapidly around the world through the 1970s, 80s and 90s. However, safety concerns — punctuated by the Chernobyl disaster of 1986 — together with rapid cost escalation, put a damper on growth. Despite these setbacks, nuclear power today represents 10% of electric generation globally; in some countries — such as France (70%) and Sweden (40%) — the percentage is much higher (1).

Recent events in Eastern Europe have reawakened the specter of nuclear holocaust. However, we are in a new era, where decarbonation is front and center. Nuclear power has long been recognized as a massive opportunity for low carbon energy, and that includes applications within the process industries. The critical question is, has the technology matured to the point where we can capture this potential both safely and economically? Some major players believe it has.

On August 9, 2022, Dow and X-energy announced that they will collaborate with the intent to deploy X-energy's Xe-100 high-temperature gas reactor technology at one of Dow's U.S. Gulf Coast sites. It is expected to be operational around 2030 (2). This follows the announcement, in December 2020, that Utah Associated Municipal Power Systems (UAMPS) awarded design and licensing scope to Fluor to build a NuScale VOYGRTM-6 on the Idaho National Laboratory site. This is the first U.S. commercial deployment contract for a small modular nuclear reactor (SMR). Initial operations of this 6-reactor, 462 MWe (gross) power plant are expected in 2029, and it should be 100% operational in 2030. Fluor and NuScale have agreed to deliver this plant at or below a levelized cost of electricity (LCOE) of $58/MWh. The project economics are aided by advanced nuclear production tax credits (PTCs).

Full-scale conventional nuclear power plants are typically of gigawatt capacity. For example, each of the two South Texas units in Matagorda is rated at 1,280 MW(e). In contrast, SMR designs range from 10-300 MW(e), with a subclass of microreactors less than 10 MW(e). The sizes mean these units can be deployed for relatively small off-grid applications in remote regions, and they also make SMRs accessible for a host of commercial and industrial applications. These new designs incorporate a range of safety improvements, such as high-pressure containment vessels and passive reactor cooling, which dramatically reduce the risk of releasing fission products and radiation. The modules can be substantially manufactured in a factory and installed at the site rather than constructed on-site — a huge cost saving. Also — important for applications in the process industries — most designs include the option of exporting steam, which can be used for process heating and other applications.

One application of nuclear energy that has attracted a lot of attention recently is the production of so-called "pink hydrogen" — hydrogen generated through electrolysis of water by using electricity from a nuclear power plant. However, SMRs open up a much larger range of decarbonization opportunities in the process industries. A study in 2014 examined opportunities to provide both heat and power to an oil refinery from light-water SMRs (3). The same study identified a wide range of chemical and petrochemical processes, producing products as diverse as ethylbenzene, terephthalic acid, urea, soda ash, and nylon 6.6, that would be amenable to a similar heat and power system. Perhaps there are applications for this technology at your plant.

Adapted from: Alan Rossiter, *"Could Chemical Plants Go Nuclear?" Chemical Processing, Vol. 84, No. 4, p. 10, April 2022*.

References

1. **Our World in Data** - https://ourworldindata.org/nuclear-energy, accessed 01/22/2022.
2. **Dow, X-energy to drive carbon emissions reductions through deployment of advanced small modular nuclear power**, https://x-energy.com/media/news-releases/dow-and-x-energy-to-drive-carbon-emissions-reductions-through-deployment-of-advanced-small-modular-nuclear-power#:~:text=Dow. accessed 10/13/2022
3. D. T. Ingersoll, C. Colbert, R. Bromm and Z. Houghton, **NuScale Energy Supply for Oil Recovery and Refining Applications**, Proceedings of ICAPP 2014, Charlotte, USA, April 6-9, 2014, Paper 14337

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.

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