



DESIGNING A  
BRIGHTER  
FUTURÉ



## *Professional engineers are stepping up to lead on creating sustainable and resilient communities.*

Professional engineers are uniquely positioned to be a positive and driving influence in creating, maintaining, and renewing sustainable communities. NSPE recognizes that attention to sustainable and resilient design practices is critical to the health of the planet and is an integral part of the practice of engineering. *PE* magazine will regularly spotlight the work of NSPE members and professional licensed engineers in the areas of climate change, sustainability, and resilience (in addition to pertinent projects, initiatives, and research).

### **Leading on Addressing Climate Change Challenges**

The NSPE Board of Directors endorsed “*The Role of the Engineering Community in Addressing Climate Change*.” *Climate change is real – the impacts are serious, and they are accelerating. There is an urgent imperative for the engineering community to take informed and intentional actions now to both reduce greenhouse gas emissions and adapt to the impacts of a changing climate. It is our duty and purpose to contribute our skills and knowledge of human-centered technologies and of the natural world to lead humanity out of the climate crisis with a focus on sustainable, resilient, equitable, and innovative approaches.*

This statement was prepared with the input from a working group of 16 organizations including NSPE. It is intended to unite, energize, and motivate people within and across organizations, and to fulfill their

desires for meaning and purpose in their professional lives.

NSPE, in partnership with the Engineering Change Lab–USA coalition, is calling on the engineering community to demonstrate leadership by undertaking the following:

- **Collaborating** with scientists, public policy makers, businesses, and other stakeholders to further this critical endeavor.
- **Focusing** on affordability, sustainability, and reliability as we transition our energy systems.
- **Championing** justice, equity, diversity, and inclusivity in climate change strategies, recognizing that the human impacts of climate change are felt the most by those with the least resources.
- **Producing and using information and communications technologies** that are climate change neutral to communicate sound, scientifically valid information about climate change to society.
- **Unleashing innovation and entrepreneurship** to contribute to transformational developments in areas that include energy system modeling; energy storage; renewable energy; electrification; energy efficiency; hydrogen; nuclear energy; carbon capture, removal, and storage; reduction of embodied carbon in materials and

material choice; transportation/land use; agriculture; natural climate solutions; and adaptation.

- **Advocating for public policies** that address climate change, such as incentivizing energy efficiency and reduction of greenhouse gas emissions and embodied carbon, while also prioritizing public and private sector expenditures for adaptation.
- **Engaging early-career professionals** who place a high value on addressing climate change and empowering them to drive change in their organizations.
- **Educating the public (and those in our community)** around the science of climate change and the strategies that will most effectively transition our energy system and facilitate adaptation to a changing climate.

### **Educating for a Sustainable Future**

In September 2022, the US Department of Energy’s Building Technologies Office announced its first-ever Zero Energy Design Designation (ZEDD) given to 12 US institutions that have education programs that are excelling at preparing future architecture and engineering leaders to put sustainable design at the forefront. NSPE members Brad J. Miller, P.E., J. Chris Reilly, P.E., and Scott Sabol, P.E., serve as educators in the Vermont Technical College (VTC) Architectural

Engineering Technology bachelor's degree program, which received this new designation. VTC will be renamed as Vermont State University beginning in July.

DOE's Zero Energy Design Designation recognizes academic programs that teach best practices of zero energy design and require students to apply those concepts in design projects. The designation is managed by the DOE Office of Energy Efficiency & Renewable Energy and can be renewed every three years. To receive the designation, the schools must show that their program requires the following for graduation:

- Building Science Education Curriculum
  - » Option 1: Solar Decathlon Building Science Education learning modules
  - » Option 2: School-created building science education program addressing required learning objectives.
- Zero Energy Design Practicum
  - » Option 1: Solar Decathlon Design and/or Build Challenge through final submission (even if not selected as a finalist team).
  - » Option 2: A zero energy building design project meeting DOE Zero Energy Ready Home certification (or something more stringent).

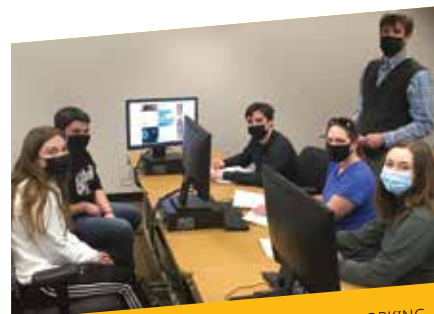
The VTC program, located at the Randolph Center campus, provides knowledge and skills in structural engineering, HVAC, plumbing, electrical, and integrated sustainable design through hands-on learning opportunities in the classroom, the lab, and out in the field. The program has maintained a focus on energy efficiency and sustainability in building design since its launch, says J. Chris Reilly, P.E., a professor in the Architectural & Building Engineering Technology Department. "We teach our students that the goal is to design a building that lasts, but also to design a building that uses as little energy as possible using the technologies that are available to us at the time."

The VTC program takes into consideration building design trends and new requirements set forth by the federal government and states to address climate

change. Vermont has established goals in its Vermont Climate Action Plan to reach zero emissions across all industries by 2050. "Our program and the other programs that have received this designation are helping to educate and supply engineers and designers that are going to be out there doing this work on a daily basis in their careers," says Reilly. "It's not going to be this specialized area of engineering design and will eventually become the standard that we are all working towards. We are preparing our students for this reality."

The program attracts students who appreciate the art and aesthetic aspects of the curriculum, says Reilly, while some students have a strong interest in buildings and building systems. The program also attracts individuals that have worked in the building trades. They now want to focus on designing systems rather than working on the construction side.

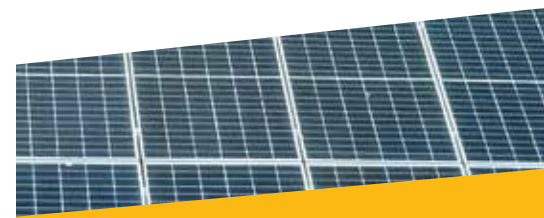
The VTC program provides opportunities for real-world design projects, which includes competing in the Solar Decathlon Design Challenge and working on a project for the annual ASHRAE competition. For



VERMONT TECHNICAL COLLEGE STUDENTS WORKING ON THEIR 2022 SENIOR CAPSTONE PROJECT, A NET ZERO ENERGY PERFORMING ARTS BUILDING, WITH INSTRUCTOR NATHAN MASCOLINO, P.E.



THE VERMONT TECHNICAL COLLEGE STUDENT TEAM PARTICIPATED IN THE 2023 SOLAR DECATHLON DESIGN CHALLENGE WITH A 10-UNIT, ZERO ENERGY, ATTACHED HOUSING DESIGN.



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instance, students worked with a local middle school principal on a renovation project to provide additional spaces, while also making energy use improvements and upgrading HVAC systems. Students also get feedback and insight from NSPE-VT members on their senior capstone project presentations.

VTC faculty take on opportunities to promote professional licensure and demystify what's required to become a licensed engineer. For example, Reilly incorporates PE exam review problems in his fluid mechanics and thermodynamics course work. "We try to [show] that what they are learning in school is preparing them for their careers and the potential to become licensed. Licensure is not this unattainable thing and it's something that they can achieve if they put in the time and effort."

There is also a review class students can take as part of their senior curriculum to prepare for the FE exam. "All of our students that took the FE exam last year passed and we have [graduates] that have gone on to obtain their PE licenses."

Reilly is hopeful that the DOE designation will put a bigger spotlight on the future Vermont State University's focus on zero energy design and offer insight into architectural engineering, which encompasses mechanical, electrical, and structural engineering in addition to architectural design. "It's also a great acknowledgement of our students and gives them something that they can put on their resume for employers



to see. Our students are already in high demand, but this gives them another feather in their cap.”

### **A Global Spotlight on Sustainability and Resilience**

The United Nations Climate Change Conference (COP27) was held in Sharm El-Sheikh, Egypt, November 6-18. As the conference took place, NSPE made it a priority to provide highlights of interest to professional engineers.

### **The History of the UN Focus on Climate Change**

The US was among the 197 nations that signed on to the United Nations Framework Convention on Climate Change in 1992. Beginning in 1995, the UN gathers the signatories for an annual Conference of the Parties (COP) to discuss how to jointly address climate change.

In 1997, the COP set the stage for the Kyoto Protocol, which required developed nations to reduce emissions of greenhouse gases, while developing nations (i.e. China, India, and Brazil) would make an effort. The US Senate unanimously refused to ratify. In 2015, after decades of back-and-forth, the US signed the Paris Agreement under which all countries agreed to address climate change. The US withdrew from the agreement in 2017 (effective in 2020) and rejoined in 2021.

This recent conference is the 27th time the COP has been convened. President Biden and more than 100 heads of state attended at least part of COP27 along with tens of thousands of other delegates.

The tension between developed and developing countries was expected to continue at the COP27. Developed countries want to focus on helping developing countries to transition to renewable energy. Developing countries want to focus on funding from the developed countries to compensate them for damages, such as salt-water intrusion into fields, heat waves, flooding, drought, and erosion, already being suffered from worsening weather disturbances.

### **COP27 Highlights**

**UN Secretary General António Guterres opened the conference and set the tone very quickly.** He established that

milestone reference point that during the conference the 8th billionth citizen will be born. From there, he called the climate the defining issue of our age. He pointed out that the invasion of Ukraine has “exposed the profound risk of our fossil fuel addiction.” However, he provided the soundbite that will likely identify COP27: “We are on the highway to climate hell with our foot still on the accelerator.”

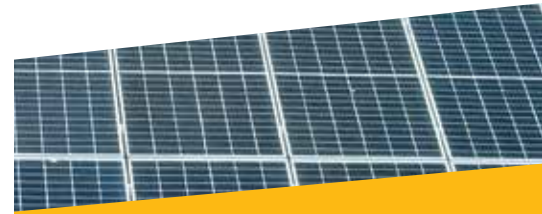
**A conversation with Elizabeth Gaines, CEO of Fortescue Metals (iron ore) of Australia and Morten Bo Christiansen, vice president, decarbonization, at AP Moller-Maersk (shipping) took a look at how heavy industry is looking at the energy transition.** Christiansen provided a quote of the day: “[The]first thing it takes is that you as a company realize that you are part of the problem. Then, you need to decide whether you want to remain part of the problem or you want to be part of the solution.”

Fortescue has learned that implementation of new technologies requires retraining the workforce and that the regulatory process can be a barrier to moving quickly. Fortescue’s plan is not to achieve net zero by 2030, but to achieve real zero – no fossil fuels by 2030. Green hydrogen, both as a production fuel and as an export, is a potential solution.

While Gaines expressed concern that carbon capture is untested, unproven, and tends to encourage further development of fossil fuels, Christiansen felt that carbon capture may be the method of last resort for some industries.

**There was an analysis of the First Movers Coalition (coordinated by the World Economic Forum).** The First Movers Coalition is a global initiative harnessing the purchasing power of companies to decarbonize seven hard-to-abate industrial sectors that currently account for 30% of global emission: aluminum, aviation, chemicals, concrete, shipping, steel, and trucking. The coalition also supports innovative carbon removal technologies.

**Egypt and the United Arab Emirates entered into a memorandum of understanding to build a 10GW land-based (as opposed to off-shore) wind farm.** UAE’s \$20B renewable firm, Masdar, with capacity in excess of 15 GW, will act in joint venture with Egypt’s renewable developer, Infinity, and the investment platform, Hassan Allam



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Utilities. This farm will produce 47,790 GWh of clean energy, reduce Egypt’s natural gas costs by \$5 billion, and offset 26.2 million tons of CO<sub>2</sub>e each year – about 9% of Egypt’s current CO<sub>2</sub>e emissions. This project follows after an agreement in April 2022 to build green hydrogen projects capable of producing 4 GW of green hydrogen.

**Developed nations had previously committed to \$100B/year to support developing nations in transitioning to clear (or cleaner) energy by 2020.** But in 2020, those countries transmitted only \$83 billion. How does that information fit into the COP27 goals? There were essentially three paths being pursued at the same time: facilitating the achievement of the goal to limit warming to 1.5°C (a/k/a adaptation), mitigation, and, for the first time, acknowledging the demand of developing nation for compensation for loss and damage caused by the climate chaos.

Access the full COP27 recaps on the NSPE’s Advocacy webpage in the Sustainability and Resilience section. [PE](#)

*Danielle Boykin, associate editor for NSPE, and Rebecca Bowman, Esq., P.E., D.F.E., NSPE’s senior director for ethics and professional practice, contributed to this feature article.*