THE MISSING LINK IN GREEN ENERGY SAFETY RESEARCH

A new postgraduate safety course invites students — whatever their academic background — to learn how to MITIGATE GREEN ENERGY'S COMPLEX RISKS.

As the global green energy transition gathers pace, scientists are working to understand how to make this fast-developing industrial environment as safe as possible.

Technologies incorporating hydrogen and other flammable gases, reactive material such as batteries, fast-moving equipment, remote environments and increasing electrification all raise new research challenges. And while industry is an important contributor to this discourse, wider civil society has a stake in the environmental, economic and social factors involved. Properly understanding these risks, then, is more than just a technical endeavour — it means bringing together voices from across the academic spectrum.

Given the expected expansion of the green energy sector, and the number of people needed to support this growth, this is a task that needs to be undertaken soon, says Harald Raupenstrauch, a process engineer and professor at Montanuniversität Leoben, an Austrian technical university. To help young scientists understand these phenomena in more detail and develop effective solutions, he says, it is "essential to offer science-based study programmes".

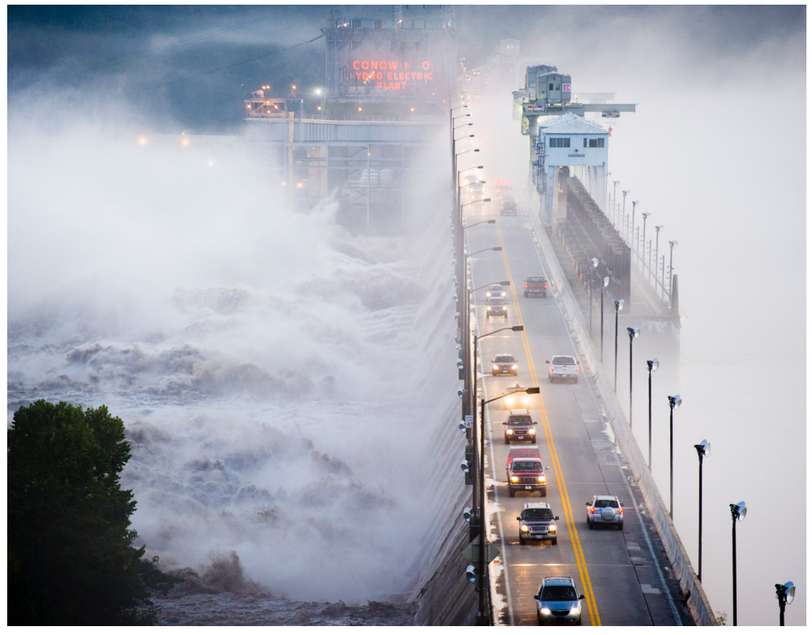
In September 2023, Montanuniversität Leoben is set to launch such a programme, which Raupenstrauch describes as a "missing link" in the field. The postgraduate course, Safety and Disaster Management, is intended to help a new generation of professionals prepare for and respond to the emerging risks posed by climate change and the energy transition. By combining technical, economic and sociological perspectives, the course will explore a range of approaches to find the right management techniques.

NEW TECHNOLOGIES, NEW QUESTIONS

Production of clean energy still requires an industrial environment, and it's clear that business-as-usual thinking isn't translating when it comes to safety. According to industry figures, in 2020 the lost time injury frequency (LTIF) rate in UK offshore renewables was considerably higher than in global offshore oil and gas, which is known as a hazardous industry. While onshore renewables had considerably fewer incidents than installations at sea, the rate was still higher than in offshore oil. Safety training — and the science that informs it — needs to adapt to a changing energy landscape.

"Industry and the wider public need to grasp these technologies and how they work in practice," says Johann Rinnhofer, chief executive of clean energy company thyssenkrupp nucera in Perth, Australia, which offers world-leading technologies for highly efficient electrolysis plants. "To exploit the benefits of green hydrogen on the necessary large scale, we also must consistently do our homework in terms of occupational health and safety management."

The renewables industry involves a lot of working at height, lifting operations and maintaining electrical systems. Because fossil fuels are very energy-dense, hydrocarbon-based energy production tends to be concentrated in a few small sites. Matching the energy output of fossil fuels with renewables, Rinnhofer notes, takes more complexity and a larger scale, from sprawling solar arrays to huge farms of offshore wind turbines.



Edwin Remsberg/ Getty Images

▲ **Conowingo Hydroelectric Plant in Maryland, US during Tropical Storm Lee. Energy infrastructure must reckon with the systemic risk of extreme weather events influenced by climate change.**

New technologies also bring new questions. Raupenstrauch's research group works on the safe operation and recycling of batteries. This requires research to understand ignition behaviour and how to extinguish fires. He also studies how climate change affects industry and how to, for instance, cool exothermal reactors when faced with a lack of water because of drought.

"WE NEED TO STIMULATE A POSITIVE RISK CULTURE."

Direct reduced iron (DRI), a hydrogen-based intermediate metal that is likely to see increased use as steel producers look to reduce their emissions, poses its own safety challenges. DRI reacts readily with air and water to liberate the hydrogen, creating a severe risk of explosion during transport. As the use of this material increases, one question being considered by researchers is whether it's safer — and more environmentally sound — to bring the hydrogen directly to steel mills, or to first transport the iron ore to the geographic sources of hydrogen. And in either case, what measures can be employed to reduce and to deal with the risks? Zero risk is impractical, Raupenstrauch points out, so society must learn to reckon with uncertainties.

ACCEPTED RISK

Society is confronted with highly complex risks where the relationship between cause and effect is not completely clear. New technologies, as well as so-called systemic risks such as climate change and pandemics, can have unexpected secondary and tertiary impacts. But, as Renate Renner, a sociologist at Montanuniversität Leoben, points out, perception of such risks is low, and we still lack policy instruments to deal with them. This is where sociology makes a valuable contribution to the new course.

"We need to address how to stimulate a positive risk culture, which includes expecting the unexpected, learning from mistakes and developing a tolerance for error," Renner says. "This makes us resilient."

A major part of that approach — and something the new course will focus on — is technology assessment and the societal evaluation of risk. What risks seem acceptable may vary by culture and sector, but must be defined in a process of social negotiation. Methodological foundations are needed to develop fair risk participation processes. Strategies to communicate these risks are also vital, so that people are prepared but not frightened. All this requires more than simply understanding the new technology.

Beyond the obvious impacts on human safety, an accident could threaten social acceptance of clean energy technologies and halt investment in its tracks. Human behaviour is driven not by facts but by perceptions of risk, Renner says. "A single, high-profile accident could disproportionately change a fundamentally positive attitude toward a new technology," she says, emphasizing the importance of dynamic risk communication and further research on how to integrate the subjective perception of risk into risk management.

© Wassler

▲ **Left to right: Michael Hohenberger, Yangyue Pan, Renate Renner and Harald Raupenstrauch of Montanuniversität Leoben's Chair of Thermal Processing Technology, pictured in front of a MIKE 3 instrument, which measures the minimum ignition energy of combustible dust/air mixtures.**

ALL SKILLS WELCOME

Although Renner, Rinnhofer and Raupenstrauch have different backgrounds, they are united by what Renner describes as a "technology-optimistic" approach that still acknowledges the need to deal with new uncertainties. To do that, it's important the new course draws graduates from across the board.

"We decided to open the programme to students from all disciplines, without any supplementary tests," says Renner. "If we have people from different disciplines, we can enhance the critical discourse. And we need to think about how to transfer this knowledge to skilled workers and civil society."

Everyone can contribute. Those with a background in engineering offer technical expertise. "Physical geographers have a more spatial perspective, and have natural hazards in mind," Renner adds. Students of sociology, meanwhile, bring a wealth of empirical knowledge around social behaviour and attitudes to risk.

These human factors are an important aspect of risk, and they represent a blind spot for technical experts that the new course aims to address, notes Raupenstrauch. "When we talk about disasters, a common conclusion is that it was down to human failure," he says. "It was a sociological aspect — but as engineers, we never learned about that." ■

MONTAN UNIVERSITÄT LEOBEN

SDS SAFETY AND DISASTER STUDIES

Advertiser retains sole responsibility for content