

4TU.Energy Research Map narrative

Society's transition from fossil fuels to renewable energy is central to 4TU.Energy's mission. This transition involves a change in the way we convert, distribute, transport and consume energy.

Transitioning energy

4TU.Energy researchers explore new ways of reducing CO₂ and improve renewable energy sources to convert green energy. Research in these areas is either fundamental or applied.

Three examples illustrate our efforts in this area. For one, researchers study the use of CO₂ as raw material, capturing and storage of CO₂. In addition to that, researchers also develop membranes as a separation technology contributing to reuse of energy source materials (feedstock). Second, safe storage and retrieval of hydrogen, in for example underground porous reservoirs, is being studied in-depth. Moreover, a hydrogen detector is being developed, by changing the optical properties of sensors to detect this tiny molecule in the air. Third, fundamental research in fluid dynamics and mathematics plays an important role in the development of technology applications.

Safe energy distribution

When it comes to energy distribution, researchers are developing digital tools to help coordinate and predict energy use in a distributed and diverse energy system. It is here that electrical engineering, mathematics and computer science play a significant role in improving the power grid and where new applications are developed.

What would happen to the power grid when hit by a cyber-attack? Power outages resulting from cyber-attacks can't be experimented with in real-life. Therefore, a digital twin of the power grid is being developed. This digital twin allows for experimenting in a safe environment.

Besides a digital twin of the current power grid, the power grid as we know it, is being further developed into a smart grid. This enables us to diversify the input of power sources, such as wind power and solar power. At the same time, the smart grids allows us to accommodate for peaks in power usage, when we charge electrical cars, use electrical appliances during day-time, etc.

Changing our energy consumption patterns?

Last but not least, energy consumption is also a focal point of attention of 4TU.Energy researchers. Shifts in consumer behaviour, policy changes and technological innovation play a major role in the future of energy consumption and help shape energy conversion and distribution. Researchers studying these topics look at energy accessibility, trade-offs of sustainable energy systems, how our values develop over time, decision-making processes, and ethics of technological innovations, to name a few issues.

The energy transition is expected to have significant consequences for a number of sectors in society, such as industry, mobility and transportation and the built environment. As these are just a few of the application areas where 4TU.Energy has expertise, this clearly demonstrates the breadth of the research (and education) in the field of Energy.