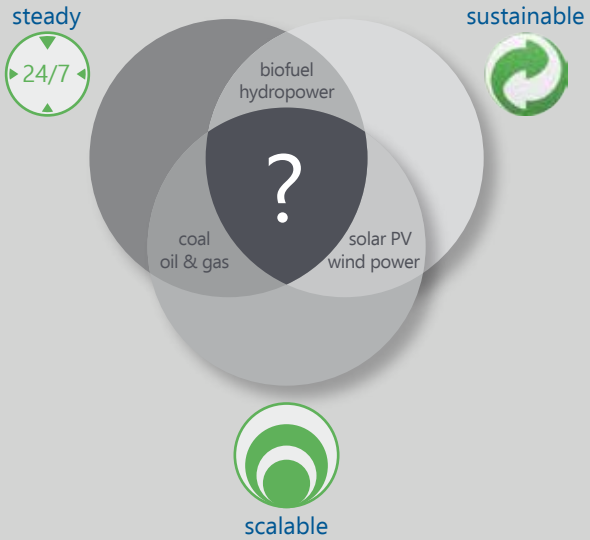
Energy challenge



We sorely lack energy technology meeting the 'triple-S challenge': Sustainable, Scalable and Steady.

The CCER research program focuses on enabling the transition to a triple-S energy future:

Sustainable: meeting the current needs without compromising the ability of future generations to meet their own needs

Scalable: expandable and affordable towards global energy supply

Steady: supply available on demand – when you need it, where you need it.

Joint initiative

The Center for Computational Energy Research (CCER) is a joint initiative of Eindhoven University of Technology (TU/e) and the Dutch Institute For Fundamental Energy Research (DIFFER).
The CCER has the ambition to become a hub for computational energy research in the Nether-lands and Europe.

Where to find us

photo: Bram Lamers | DIFFER

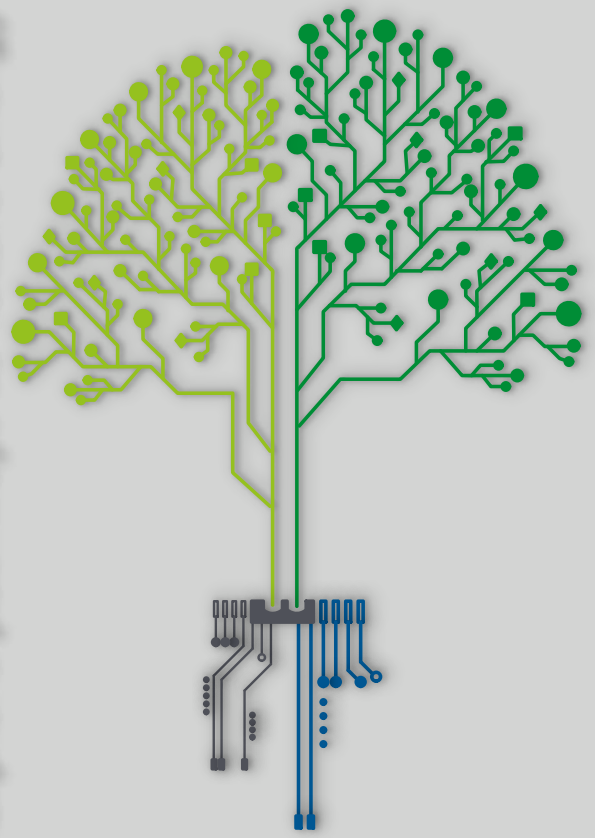
TU/e Technische Universiteit Eindhoven University of Technology

DIFFER Dutch Institute for Fundamental Energy Research

The DIFFER building at the TU/e campus provides a home to the CCER.
You can find us at: www.ccer.nl

Contact address:
De Zaale 20
5612 AJ Eindhoven
The Netherlands
info@ccer.nl

Explore pathways to future energy



CCER

Center for Computational Energy Research

Our mission

Aim
The CCER aims to accelerate innovation in energy technology through high performance computing.

Focus
The focus is on exploring pathways to future energy systems via computational simulations that complement experimental energy research.

Environment
The CCER achieves this by providing an environment for mutual learning and exchange of ideas where computational scientists from a variety of backgrounds find opportunities for interdisciplinary collaboration on energy transition related challenges.

"Models and computer simulations may be used to identify experimentally viable options in an early stage. What methods look promising? Which materials might be suitable?"
– Vianney Koelman, scientific director

Our capabilities

In order to create an environment that is most likely to evoke breakthroughs, the research program of the CCER is organized according to the length and time scales at which topics are studied, with research lines and typical methods used indicated in the figure below.

Bridging length & time scales	System scale	Data-driven modeling
Coarse Graining, Moment Methods, Homogenization, Renormalization Group	Magnetohydrodynamics, Computational Fluid Dynamics, Continuum Mechanics	Computational Discovery, Machine Learning, Reduced-order Modeling
	Mesoscale Coarse-Grained Molecular Dynamics, Dissipative Particle Dynamics, Phase-Field Modeling, Lattice-Boltzmann	
	Nanoscale Density-Functional Theory, Molecular Dynamics, Quantum Mechanics/ Molecular Mechanics	

- Computations on materials and processes at the nanoscale, the mesoscale and the system scale
- Upscaling simulation results obtained at micro length scales and integrating these in full system optimizations by bridging length & time scales
- Data driven modeling for real time control and machine learning guidance to exploratory computational (materials) science

Our offer

Much of the CCER research is focused on rendering dense energy carriers, such as solar fuels and heat batteries, scalable. Computational exploratory research along with experimentation provides faster routes towards successful applications.

Examples of CCER computational themes:
- Atomistic and multi-scale modeling of photo-electrochemical processes in creating solar fuels
- Atomistic and multi-scale modeling of photo-physical processes in novel photovoltaics
- Computational studies of plasma-assisted CO_2 splitting
- Computational optimization of thermochemical materials for heat batteries
- Computational fusion plasma control

Opening event. Photo: Vincent van den Hoogen, Eindhoven

The CCER provides an environment for mutual learning. Computational scientists from a variety of backgrounds collaborate across disciplinary boundaries on energy transition related challenges.