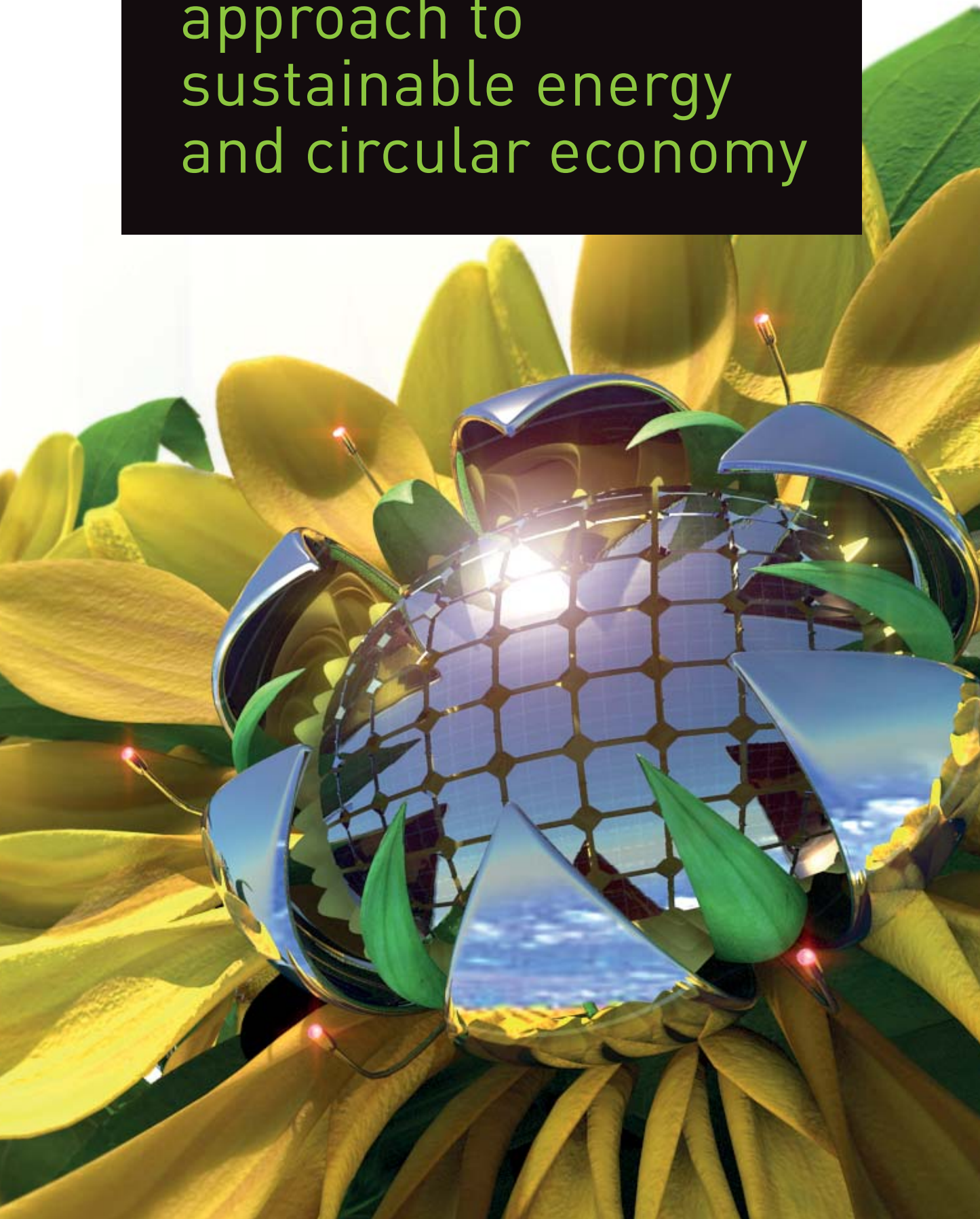


# System-based approach to sustainable energy and circular economy



## WE ARE THE DIFFERENCE-MAKERS

### WE ARE COMMITTED TO

- Energy solutions that favour renewables
- Sustainable and smart business models
- A waste-free world, where we recycle everything
- Clean water for all
- The promotion of new green-collar entrepreneurship to boost growth in Europe

## AREAS OF EXPERTISE IN ENERGY RESEARCH AT LUT

- Bioenergy renewables
- Environmental technology
- High-speed technology
- Electrical machines and drives
- Nuclear energy technology
- Electricity and heat generation systems
- Electricity and energy market
- Solar economy
- Mechatronic system design
- Welded structures
- Sustainable production in mechanical engineering

# LUT ENERGY SYSTEMS

## Energy Technology | Electrical Engineering | Sustainability Science | Mechanical Engineering

The planetary boundaries and managing climate change are among the major challenges facing humanity. Energy technology and its various applications play a key role in combating this global problem. No one technology can solve all the problems, but we need a system-based approach to sustainable energy and circular economy. In other words, a combination of technologies and actions building on life cycle thinking and sustainable development is required.

Management of the energy sector calls for a comprehensive understanding of various technologies. Lappeenranta University of Technology, LUT, has all the required expertise to answer the future challenges associated with energy systems.

The European cutting-edge research at LUT addresses challenges concerning energy generation, power systems and energy markets, and the use of energy. Our core activities focus on research and development of advanced energy systems.

Lappeenranta University of Technology is the largest energy research and education organisation in Finland. More than 300 experts are working in energy-related research and teaching, 80 of which have a doctorate. About 185 Masters of Science in Technology and 30 doctors graduate every year.



# FROM FUNDAMENTAL THEORIES...

- Fluid flow modelling
- Simulation models for magnetic fluids
- Energy balance calculation
- Nuclear safety research
- System analysis for sustainability
- Environmental analysis
- Electromagnetic, thermal and mechanical modelling
- Electricity market analysis and strategic planning methodology
- Combustion processes
- Carbon capture and storage
- Sustainable energy conversion
- Energy efficiency analysis systems
- Micro-bio CHP
- Waste management systems
- Smart grids and energy market
- LVDC electricity distribution system
- Virtual design
- Machine design
- Mechatronics

... TO EMPIRICAL WORK



# RESEARCH RESULTS OF SCIENTIFIC IMPACT...

- ➔ Organic Rankine Cycle (ORC) power plants and compressors
- ➔ Circulating Fluidised Bed (CFB) technology
- ➔ Integral and separated effect thermal hydraulics test facilities
- ➔ Electrical drives technology
- ➔ Fluid flow machines
- ➔ Turbomachinery
- ➔ High-speed electric machines
- ➔ PACTEL safety research facility
- ➔ Solar economy and its impacts on energy systems
- ➔ Permanent magnet direct drive machines for wind power
- ➔ Electrical drives control methods
- ➔ Power electronics applications
- ➔ Low-voltage DC electricity distribution (LVDC)
- ➔ Joulemetric measurement laboratory
- ➔ Active magnetic bearing control
- ➔ EVs and hybrid drives; smart charging and discharging
- ➔ Demand response and energy storages
- ➔ Active customer connections to the electricity grid and ICT systems
- ➔ Distributed generation
- ➔ Biorefinery systems
- ➔ Waste recovery and disposal
- ➔ Steel structures
- ➔ Production technology
- ➔ Welding technology
- ➔ Laser technology
- ➔ Packaging technology
- ➔ Fiber composites

... AND PRACTICAL  
RELEVANCE



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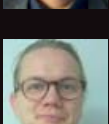
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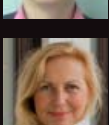
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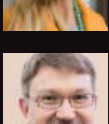
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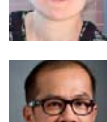
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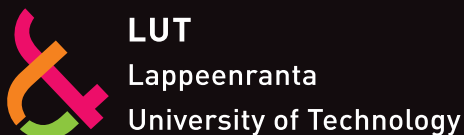
## Trailblazer – Show the way. Never follow.

Ever since it was founded in 1969, Lappeenranta University of Technology, LUT, has brought together technology and business in a pioneering spirit.

LUT's strategy is: Trailblazer. Show the way. Never follow. At the core of the strategy are four global questions to which LUT is seeking answers. Are we burning everything out? Are we leaving humanity to suffer from the water it has spoiled? Will we bury our future with our waste? Will we let Europe degenerate to the status of the world's backyard? No. We will lead the way with a trailblazer spirit.

Our international scientific community consists of 6,500 students and experts. LUT's operation is solution-focused and characterised by "open your mind" thinking: crossing boundaries open-mindedly, together. We are one of the top 300 universities in the world (THE World University Rankings 2014-2015).

Finland's greenest campus: [www.greencampus.fi/en](http://www.greencampus.fi/en)



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Lappeenranta University of Technology

LUT School of Energy Systems

[www.lut.fi/energy](http://www.lut.fi/energy)