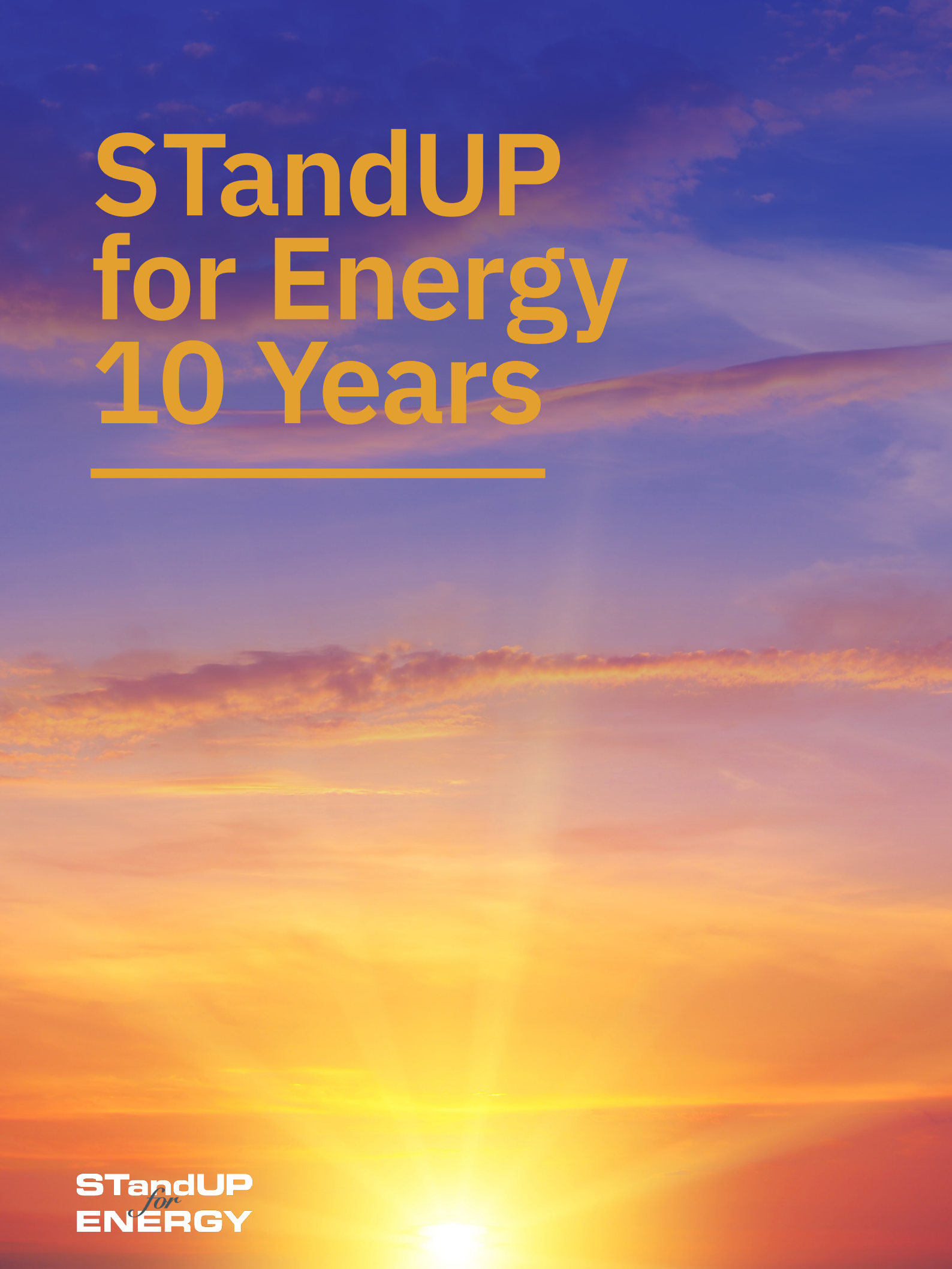
# STandUP for Energy 10 Years



STandUP for ENERGY

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# STandUP for Energy – Introduction

STandUP for Energy, or just STandUP for short, is a research collaboration between Uppsala University, KTH-Royal Institute of Technology, SLU-Swedish University of Agricultural Sciences and Luleå University of Technology. It brings together leading research groups from a wide range of complementary research fields to address some of today's most critical energy problems. STandUP is committed to help building a modern, sustainable energy system.

Societies need a rapid transition towards longstanding sustainable energy sources. Electrification is one of the crucial steps towards a modern, fossil-free energy system. In STandUP we envision a future with access to renewable, reliable and cost-effective electricity for housing, business, transportation, and industry. This shift will require great investments in research and development, as well as a vast undertaking to educate and train a new generation of scientists, engineers and technicians. The energy transition involves the concerted efforts of many different sectors in society. University, industry and civil society working together can achieve ambitious national and global energy goals.

**Universities in Research Collaboration**

UPPSALA UNIVERSITET

SLU

KTH VETENSKAP OCH KONST

LULEÅ UNIVERSITY OF TECHNOLOGY

**STandUP for Energy research focuses on four main themes:**

- Renewable Electricity
- Electric and Hybrid Vehicles
- The Electricity Grid
- Energy Systems

# STandUP in figures

**500**
Active persons working in StandUp

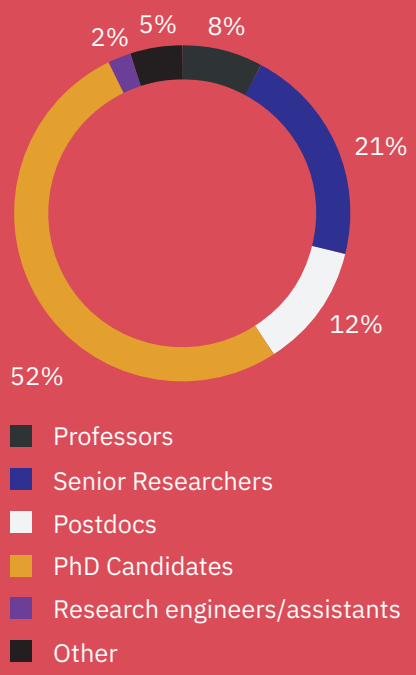
**500**
Publications

**>250**
External collaborations

**>60**
Courses given

**40**
Granted Doctoral and Licentiate degrees

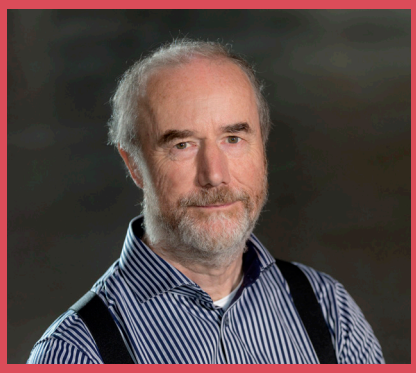
## Positions




# Per Year

# The STandUP Management

## Directors



**Roland Roberts**
**2018–**

**Kristina Edström**
**2010–2017**

## Organisation

**Programme Council**

One representative from each university and one from industry

**Chair:** UU

**Management Group**

**7** Represent-atives from the universities

**Chair:** Programme Director

**Coordinators**

**5** from the different universities

**StandUp Academy**

Research Community, industry and other stakeholders

**Area**
**The Electricity Grid**
Research groups + partners

**Area**
**Hybrid and Electric Vehicles**
Research groups + partners

**Area**
**Renewable Electricity**
Research groups + partners

**Area**
**Energy Systems**
Research groups + partners

# STandUP for Energy 10 years

## 2010 - Start of the STandUP for Energy Collaboration

## 2010 - First STandUP Academy in Sigtuna

## 2011 - World records

### Thin-film solar cells with efficiency above 18%

### Converter technology with efficiency of 99.7%

Increasing the share of renewables requires modern technology that efficiently connects a variety of power sources to work across the electricity grid. Power electronic converters allow large-scale integration of renewable energy sources and electrical vehicles.

## 2012

The Swedish Energy Strategic Research Initiatives, STandUP for Energy, Bio4energy and Chalmers Energy Initiative, are jointly represented at the COP12 in Doha, Qatar

## 2012 - The world's largest wave-power park under construction in Lysekil

## 2012 - USER is conceived

A spontaneous conversation between a postdoctoral fellow and a doctoral student at the STandUP Academy in 2012, sowed a seed that eventually resulted in the interdisciplinary research group USER - Uppsala Smart Energy Research. Today USER is composed of several junior and senior researchers addressing electricity users' role in the energy transition. It includes theoretical methodology from various scientific disciplines, while incorporating applied perspectives through extensive collaborations with the energy industry.

## 2013 - President Barack Obama visits KTH

During his visit to Sweden on 4-5 September 2013, US president Barack Obama stopped at the KTH to hear about Swedish advances in renewable energy and environmental technology. The Applied Electrochemistry group from STandUP informed him about ongoing research on fuel cells and their potential applications.

From left: Göran Lindbergh, Rakel Wreland Lindström, US President Barack Obama, Carina Lagergren and Swedish Prime minister Fredrik Reinfeldt.

## 2016

The largest magnetic bearing ever built in Sweden was deployed at the Porjus test power station in the Lule river. This magnetic bearing, with a lifting capacity of 150 tons, will substantially decrease energy losses by keeping the friction to a minimum.

## 2019 - The Swedish Energy Minister and the Director of the Swedish Energy Agency participated at the StandUp Academy

Swedish Energy Minister Anders Ygeman

Director of the Swedish Energy Agency Robert Andrén

## 2020 - Coordination of the European Battery initiative Battery 2030+

# Areas of Research

## The STandUP for Energy collaboration is based on a holistic vision of the energy system, where technical developments and their environmental, economic, or social impacts are integrated.

This systems approach pervades across research and development efforts, by focusing on sustainable technologies that are acceptable and beneficial for society, and that can be readily implemented in industry.

STandUP focuses on four main research areas that span across the whole energy system, from production to consumption. Some examples of research are:

- **Renewable Electricity**
  Such as Solar cells, wind power, hydropower, marine and wave power, geothermal power.

- **Electric and Hybrid Vehicles**
  Such as Novel electric drives for automotive applications, electric aircraft, high-density batteries, fuel cells.

- **The Electricity Grid**
  Such as Power electronics, grid security, demand flexibility, reliability of power systems.

- **Energy Systems**
  Such as Laws and regulations for renewable energy sources, social acceptance and end-user attitudes, energy services, environmental impacts of energy technologies, decision-making tools for energy resources, life-cycle analyses, climate impacts, user interfaces for electric vehicles, electricity markets.




# Education

The supply of skilled specialists is already becoming a bottleneck for the development of certain technology sectors. Rapid shifts in energy technology will require agile response from universities to update course content, to create new courses and educational programs, and to provide industry and society with specialized training and life-long-learning programs.

Education stands among the greatest challenges that the energy sector will be facing in coming decades. Society must provide massive resources for the education and training of a whole new generation of energy experts in traditional and new roles. Sweden will need thousands of skilled men and women with broad backgrounds: Scientists, engineers, technicians and educators that will design, build and implement our energy future.

STandUP has a strong commitment in education. We offer our students a wider view of the field by introducing into the classroom not only the latest research findings, but also the interdisciplinarity and common experiences of a whole research community.


*"The energy transition is not only about new technologies and systems brought about through research and development. We also need to expand our competencies in order to use these technologies in the right way... The goal of the European project EDDIE (EDucation for Digitalisation of Energy) is to display good examples of existing educations and to develop new programs and courses based on the needs that are identified."*

**– Lars Nordström,**
Professor in Information Systems For Power Systems Control

# STandUP Academy

An important mission for STandUP has been to create meeting places for researchers in an effort to promote collaboration across disciplines and universities, and to facilitate the spread of knowledge about the energy system and the energy sector. The STandUP Academy was established as the main discussion forum for this purpose. In its first years, this inclusive meeting was key to the building of a successful collaboration.

The STandUP Academy is a yearly event that brings together the whole STandUP community. Each meeting addresses specific questions of general interest, and often hosts external guests that bring new perspectives into the group. At the STandUP Academy, researchers share knowledge and exchange insights from their different fields, establish new collaborations, and meet key persons from industry, public office and interest groups.

## STandUP Academy's external guests along the years, include:

**2011 -** Helena Malmkvist, Head of External Research Collaborations, ABB
**2012** - Hans Folkesson, Senior Automotive Consultant, Tobias Persson, Director of the Energy Analysis Department, Swedish Energy Agency, Daniel Karlsson, Pricipal Engineer, Gothia Power
**2013 -** Johan Lindström, Senior Expert Engineer, Scania
**2014 -** Esa Stenberg, National Contact Point for EU R&D, Vinnova
**2016 -** Svante Axelsson, National Coordinator for the Governmental Initiative, Fossil Free Sweden, Sven-Olov Ericson, Department Director, Ministry of Enterprise
**2018 -** Bo Normark, Industrial Strategy Executive, EIT InnoEnergy, Björn Sigurdson, Climate Strategist, Uppsala Municipality
**2019 -** Anders Ygeman, Minister of Energy and Digitilization, Robert Andrén, Director General, Swedish Energy Agency, Catarina Naucler, R&D Manager, Fortum.

# STandUP in large ventures

**As one of the strongest energy research communities in Sweden, the STandUP for Energy alliance provides a solid ground for participation in other large international and Swedish research and innovation ventures.**

STandUP research participates in many EU projects, Swedish Competence Centres, and other international collaborations. Some of them are:

**BASE** - Batteries Sweden (Vinnova)

**Battery 2030+** (EU)

**ECO2 Vehicle Design** (Vinnova)

**EERA JP Hydropower** (EU)

**HydroFlex** (EU)

**Resilient Energy Systems** (Swedish Energy Agency)

**Resistance and Power** – on smart grids for the many people (The Kamprad Family Foundation)

**SEC** – Swedish Electromobility Centre (Swedish Energy Agency, Volvo, Scania, RISE, CEVT, VTI)

**SOLVE** - Swedish Solar Electricity Research (Swedish Energy Agency)

**SVC** – Swedish Hydropower Centre (Swedish Energy Agency)

**Trees For Me** – Trees for energy and other products (Swedish Energy Agency)

**Viable Cities** (Vinnova, Swedish Energy Agency, Formas)

*"With the support of STandUP we have had the confidence to make strategic choices and the courage to enter new collaborations, allowing us to take a leading role in large competence centres."*

**– Daniel Brandell**
Professor of Materials Chemistry

# Sustainable Development

The 17 UN global sustainability goals of the Agenda 2030 aim at a total transformation of our planet towards sustainability. It comprises three dimensions: the social, the environmental, and the economic.

Access to affordable and clean energy for all is at the core of this transformation, and the electrification of society is a major contributor to a sustainable energy system. A growing production of renewable electricity, more electric transportation, and the conversion of many Greenhouse gas-emitting industrial processes can only be attained through solutions based on high quality research.

A successful energy transition requires joint efforts between basic research, industrial development, policy, and societal engagement. Cross-sector collaborations are imperative to ensure that expertise and resources are concentrated. Only in this way can society achieve energy targets at the needed pace and scale.

STandUP for Energy works in line with the goals of Agenda 2030, including:



**GOAL 4 – Quality Education**

- By educating young researchers and engineers that will face the challenges of the future.
- By engaging school children and teachers in meanigful scientific projects.


**GOAL 5 – Gender Equality**

- By introducing more young women into the energy field through focused efforts in early education.
- By creating inclusive research environments that foster equal opportunities.
- By developing technology for the benefit of all.


**GOAL 7 – Affordable and Clean Energy**

- By developing new energy technology for the production, transmission, distribution, storage and use of renewable electricity.


**GOAL 11 – Sustainable Cities and Communities**

- By collaborating with industry and societal sectors to develop and deploy technology and services for more sustainable cities and communities.

## Research, innovation and society

The transition to a sustainable energy system is a collaborative effort between basic research, industrial development and policy. Cross-sector collaborations are imperative to ensure that expertise and resources are concentrated. Only in this way can society achieve energy targets at the needed pace and scale. STandUp for Energy works closely with industry, business and other societal sectors, in the development of key technologies and their implementation in society.

*Uptown Tech*

### Uptown Tech

Uptown Tech, arranged by Uppsala University since 2019, is an inspirational event directed towards high-school girls. Female teenagers who are interested in science and technology are welcome to the Ångström Laboratory to take part in workshops, meet students and alumni, and listen to inspirational lectures. The Division of Electricity has been active in this event by encouraging women to study Electrical Engineering.

"Renewable energy systems and electrical vehicles are gaining enormous interest in society, and electrical engineers have very good opportunities in the job market. Meanwhile, there is an imbalance in the number of women and men who pursue these careers. We need to broaden education in energy systems to ensure that we meet sustainability goals and provide maintenance to our current electrical systems. Recruitment, education, and work in this area should be equally well adapted to both men and women," says Jennifer Leijon, Associate Senior Lecturer, who works with research and education at the Division of Electricity.

*Citizen science*

### Citizen Science

In the project "Sustainable or segregated? Energy communities for a broad sustainable energy transition", non-researchers contribute to science by collaborating with STandUP for Energy researchers. This is an exciting way of simultaneously increasing the public understanding of research, and the awareness and knowledge of the area at hand. This approach also allows to collect huge data sets in a very short time. In this project, more than two thousand Swedish pupils 10-15 years of age interviewed their parents or other adults, as part of a school assignment. The overall aim of the study is to increase our knowledge about citizens' attitudes towards new energy technologies. The study also addresses the question of how different demographic factors correlate with access to modern energy technology.

Ocean Harvesting Tecknologies, Tekniska verken, BRF Stenberg, Svensk vattenkraftförening, Voith, Epiroc, Electricité de France, AMKVO, Länsstyrelsen i Västernorrlands län, DNV GL Netherlands, Iceland Geosurvey, Rainpower, CorPower Ocean, Sjöstadsföreningen, Knivsta kommun, Umeå Energi, Nacka kommun, Renova, GE Grid Solutions, Eksta Bostads, Ericsson, AgTech Kickstart, Skanska Sverige, White Arkitekter, Länsstyrelsen i Uppsala län, Borås Energi, ElectriCITY Innovation, Region Stockholm, STUNS Energi, Haldor Topsøe, SIM-LocalLife, Hvide Sande, Uppsala kommun, Statkraft, SveMin, Ørsted, Svenska Kraftnät, Ellevio, RISE, Scania, Solibro Research, Andritz Hydro, PowerCell, ELISE, CellImpact, aereo, cyberGRID, SMHI, Vattenfall, ABB, CEVT, Mapro Systems, Envac, Lumen Radio, WSP Höganäs, Stockholm stad, VOLVO, Stora Enso, Abengoa Solar New Tecknologies, LifeSize, E.ON, Skelefteå Kraft, Uppsala parkering, Seabased, Pamoja Cleantech, Sweco, Fortum, Lloyd's, Northvolt, HUVA, Energiforsk, Huddinge kommun, Holmen Energi, Borlänge Energi, Slätte Gård, Sigma Marine, EDR Medeso, Skogforsk, Kjeller Vindteknikk, Floating Power Plant, OX, SA, Frivolt, ELS Analys, Kemijokki, AQ System, Solelia Greentech, Australian Energy Regulator, Icelandic Meteorological Office, Tingcore, Airbus, SeaTwirl, Svk

# Collaboration

**In collaboration with industry and various societal sectors, STandUp contributes to the development of technology and services running on renewable, affordable electricity. Many ideas from the STandUp research have also resulted in new companies.**

*"As a central ground for collaboration in Sweden, STandUP has allowed us to formulate future challenges that have led us to important external collaboration"*

**– Lennart Söder**
Professor in Electric Power Systems

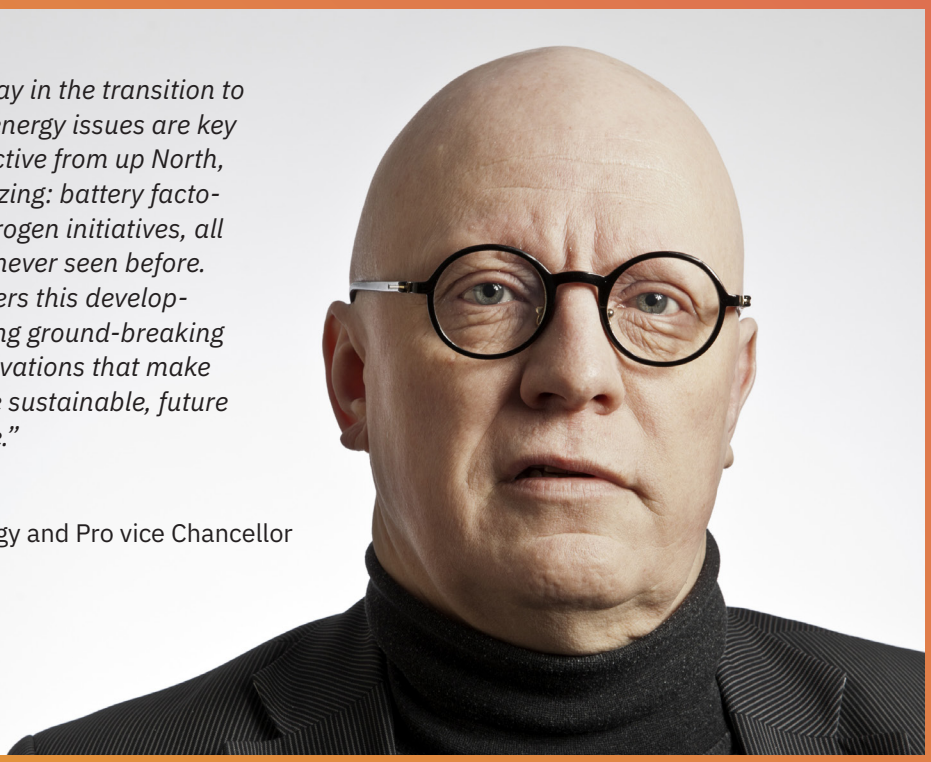
# STandUP for the Future

*" Securing a robust and resilient energy system is one of societies' most important challenges. STandUP for Energy provides a unique platform for research groups from different parts of the country to work together towards the development of solutions for the future energy system."*

**– Lina Bertling Tjernberg**
Professor in Power Grid Technology and Director of the KTH Energy platform

*"Sweden is leading the way in the transition to a fossil-free society and energy issues are key to this end. In my perspective from up North, what's happening is amazing: battery factories, fossil-free steel, hydrogen initiatives, all on a scale the world has never seen before. STandUP for Energy renders this development possible by delivering ground-breaking research results and innovations that make society and Sweden more sustainable, future oriented, and competitive."*

**– Pär Weihed**
Professor of Ore Technology and Pro vice Chancellor at LTU

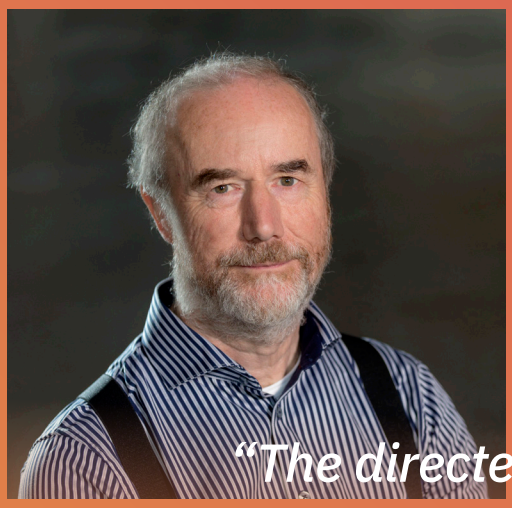


*"Meeting the challenges of the energy transition requires increased cooperation between academy, industry and the public sector. STandUP for Energy represents such an initiative and has been indicative of other initiatives, such as the EIT InnoEnergy and the European Battery Alliance. With the help of established networks such as STandUP for Energy, Sweden has, among other things, gained a central position in the European battery landscape."*

**– Bo Normark,**
Industrial Strategy Executive at EIT InnoEnergy

*"The electrical energy system is the single largest technical system created by man. Enormous financial and human resources have been used to build this collective system. One of today's major challenges is the electrification of the transport sector, covering all kinds of vehicles, from cars, buses and trucks to airplanes and boats. This transition requires long-term research at a local and global level, as well as excellent undergraduate education. STandUP for Energy is a representative example of the long-term Governmental support that is needed to this end."*

**– Mats Leijon,**
Professor of Electricity,
inventor, and entrepreneur



*"The directed Government funding allocated to STandUp for Energy has allowed the design and implementation of a novel and unique collaboration between energy researchers from several universities, building on and complementing strong existing activities. This collaboration has matured and deepened, contributing to many major advances. STandUP for Energy is the largest coordinated academic energy research environment in Sweden. Many major challenges remain if society's ambitions of deeply radical changes in our energy systems are to be achieved. The STandUP platform is designed to meet effectively many of these challenges, far into the future. If STandUP for Energy did not exist, we would probably need to invent it!"*

– Roland Roberts

Professor of Earth Sciences and Director of STandUP for Energy

# A Research Alliance for the Future

# STandUP *for* ENERGY

www.standupforenergy.se