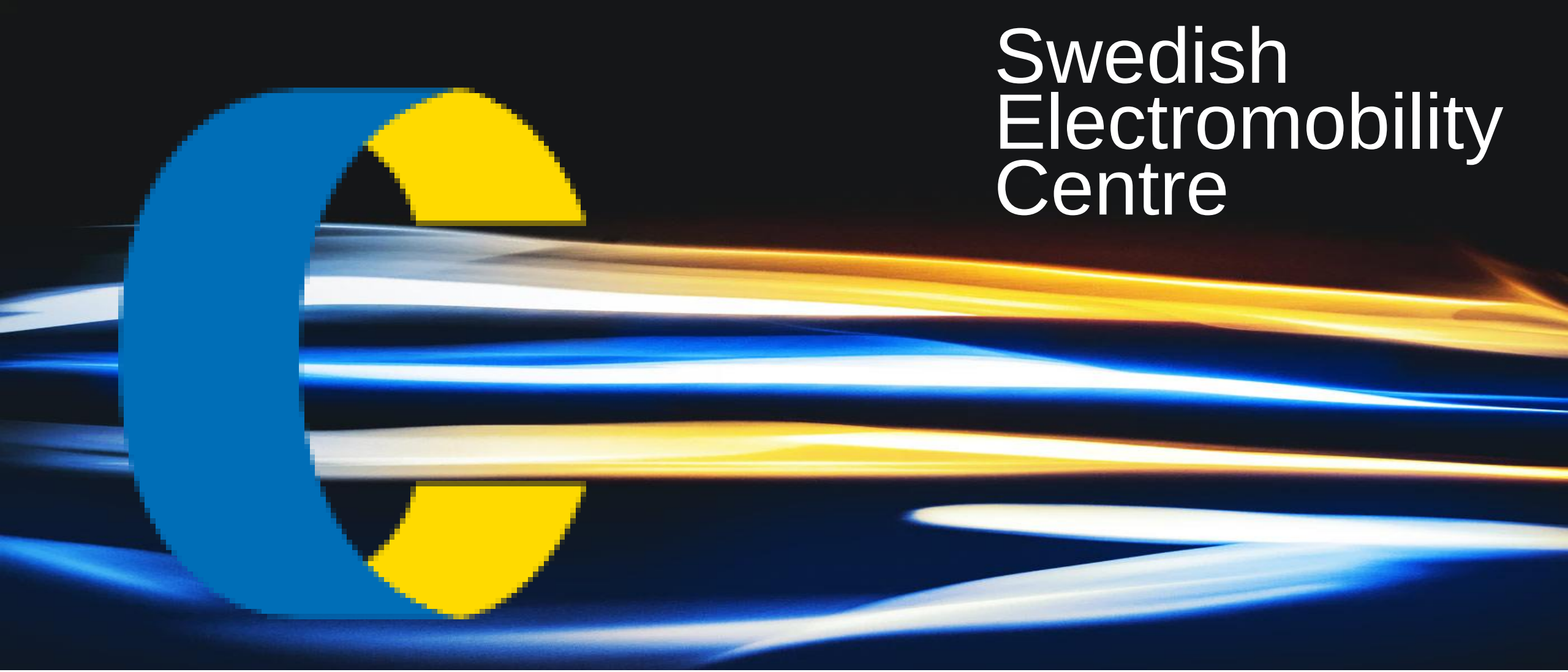
Swedish Electromobility Centre



VOLVO · BorgWarner · VATTENFALL · CHALMERS · LINKÖPINGS UNIVERSITET · LUND UNIVERSITY · vti · KTH · SAAB · ivl Swedish Environmental Research Institute · ABB

HÖGSKOLAN VÄST · SCANIA · Lindholmen Science Park · VOLVO · UPPSALA UNIVERSITET · CEVT · Energimyndigheten · Epiroc · POWERCELL · ALSTOM · mobility by nature · TITANX · e·on

Vital solutions for electro-mobility, a key to the sustainable future

-A growing centre with unique trust and collaboration
-The coming decade is crucial for the success of transformation and SEC is part of the solution

Our five theme areas – response to a growing need for solutions

1. System studies and methods
2. Electrical machines, drive systems and charging
3. Energy storage: batteries and fuel cells
4. Electromobility in society
5. Interaction between vehicles and the grid

SEC Thematic Leaders: Fransisco Márquez-Fernández [2], Mikael Lantz [5], Linda Olofsson (Director), Göran Lindbergh [3], Anders Nordelöf [4], Cecilia Boström [5], Daniel Brandell [3], Magnus Blinge [4], Oskar Wallmark [2] and Jonas Fredriksson [1]. Absent: Lars Eriksson [1].

Our goal is to make the complete value chain sustainable.

Societal level

Fit electromobility into circular economy

Sustainable integration of electromobility in the energy system

Vehicular level

Minimize total cost of ownership and environmental impact

Technology supporting (new) business models (standardization and data)

Vehicle

Vehicle energy management manage the vehicle's on-board energy for propulsion, cooling and heating of the powertrain.

Total ownership experience driver modelling, coaching for energy efficient driving, cost aspects for ownership of the vehicle

Electric traction machines and power electronic converters cost of ownership and environmental impact

Charging systems on-board chargers, automatic charging, challenges with high-power charging

Energy storage Adopting batteries and fuel cells for larger systems safety aspects are becoming critical: energy- and power density, lifetime, cost and safety

Vehicle to grid

Sustainable integration of electromobility in the energy system

- Charging infrastructure - a system perspective.
- Need and use of energy storage in the power system.
- Charging at different power levels

Society

Understanding technology adoption and its implications on personal mobility and freight transports services

Measures for resource availability and circular economy

Assessment of impacts on the environment, human health, and resource use

Integrate electromobility into the circular economy

New powerful technologies emerging

Software
Big data management, blockchain and smart algorithms (AI) - possibility for cross-sectorial business models as well as predictive lifetime of crucial components and control of origin of materials

Hardware and Manufacturing
Wide-bandgap semiconductors, solid state batteries and additive manufacturing -open new possibilities for increased lifetime, more compact and lighter solutions and enhanced recyclability

E-machine design for enhanced recyclability and minimized environmental impact

Goal of the project

To design induction and synchronous reluctance machines from a recyclability perspective and to compare their performance both regarding Torque/Power/efficiency as well as environmental impact.

Expected result

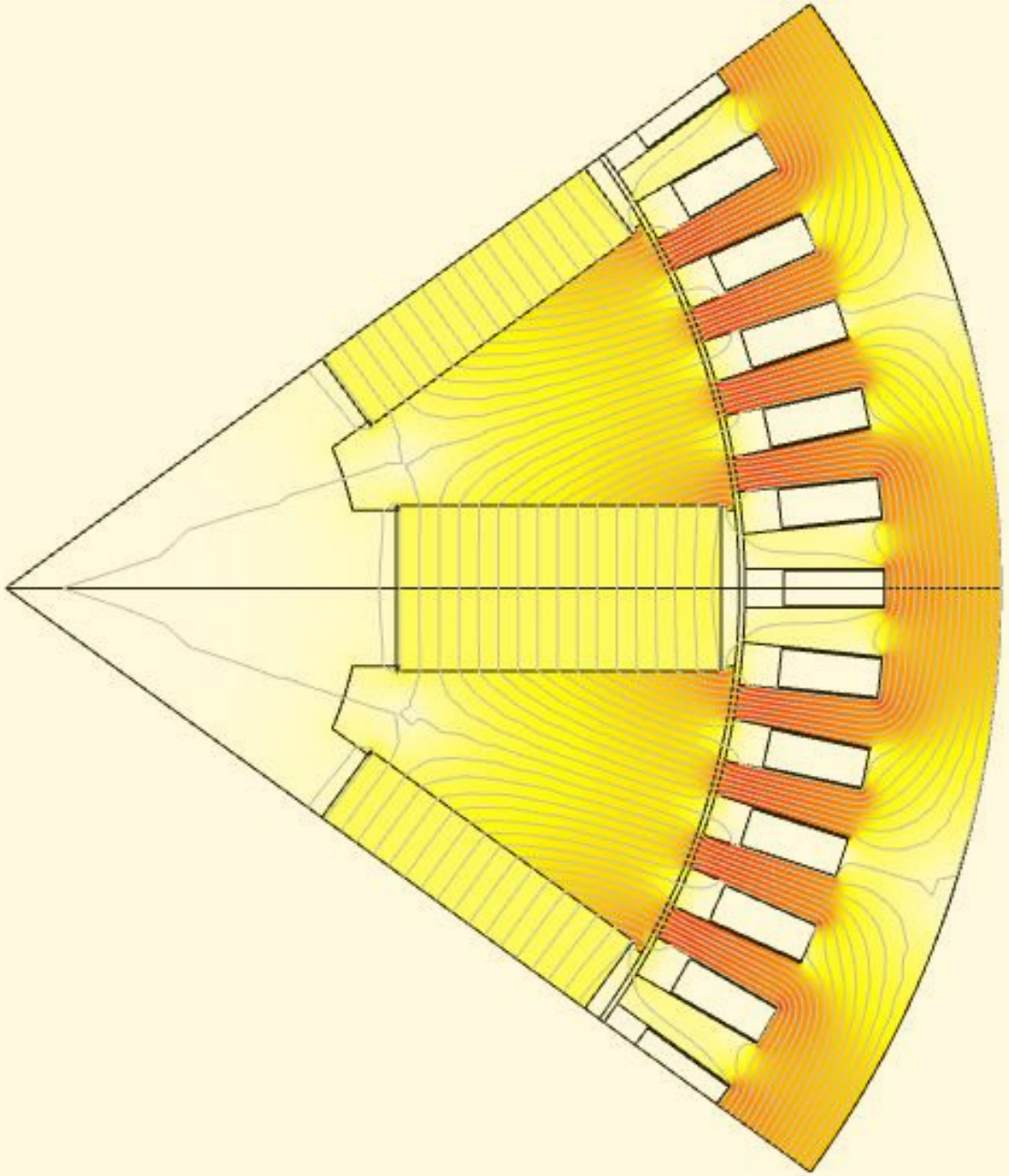
Quantification of environmental impact, energy consumption, cost and weight consequence of using machines designed for remanufacturing/reuse/recycling composed with materials of minimized environmental burden compared to current state-of the art machines.

Project leader: Torbjörn Thiringer

Electrical machines, drive systems and charging

CHALMERS UNIVERSITY OF TECHNOLOGY

Electromobility in society



Design of rare earth element free motors for electromobility

Aim: To design a motor without rare earth magnets; finding alternatives to the common rare earth magnet-based motors commonly used in electromobility.

Project leader: Sandra Eriksson

Life Cycle Assessment of Large-Scale Lithium-Ion Battery Production and Recycling

Goal of the project

Address existing gaps in research and knowledge of the environmental impacts of LIB production and recycling, and thereby provide updated and relevant information about the role of LIBs for the environmental impacts of electric vehicles.

Expected result

Complete LIB production study and important competence building.
Quantification of the environmental burden LIB production and benefits of LIB recycling.
Description of the parameters governing the environmental burden and the influence of different EOL LCA modeling approaches

Project leader: Anders Nordelöf

CHALMERS
UNIVERSITY OF TECHNOLOGY

Electromobility in society

Environmental Assessment of Electromobility Charging Systems

Goal of the project

Investigate the environmental impacts of charging systems for electrified vehicles, with a specific focus on resource use.

Expected result

Comparative quantification of the environmental burden of at least two stationary charging systems and two dynamic charging systems

Project leader: Torbjörn Thiringer

Electric vehicle charging strategies and grid management – interaction with the electric grid

The aim of this project is to analyse how a strong ramp-up of electric vehicles (EVs) to 2030 can be integrated in the electricity system and the electric grid. A special focus will be to:

- Describe how the EVs and stationary batteries interact with the local and regional grid
- Identify bottlenecks in the capacity of the grid when charging EVs
- Calculate a cost to reinforce the local grid and the value of V2G

The outcome of the project should be valuable for SEC partners in the understanding and design of the future electric grids in a system with increasing share of EVs.

Project leader: Maria Taljegård

CHALMERS UNIVERSITY OF TECHNOLOGY

Electromobility in society

Interaction between vehicles and grid

Thermal control and fault prognosis for Li-ion battery systems

The goal of the project: Improved battery performance and safety via temperature control through an advanced temperature management system for EV batteries

Chemical quenchers for inhibition of battery fires

The goal of the project: Chemical intervention, quenching, will inhibit production of flammable and toxic gases, and the overall process will be completely quenched or significantly suppressed.

Energy storage

Thank you!

Contact: linda.olofsson@emobilitycentre.se
www.emobilitycentre.se