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SEEL – The New Test Centre for Research and Development on Electromobility

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Summary

SEEL Swedish Electric Transport Laboratory is being established as a new independent test centre for research and development in the field of electromobility including batteries. The aim is to enhance knowledge development and to improve collaboration between enterprises and researchers. Electrification of the transport sector is to be speeded up at SEEL's facilities in Borås, Gothenburg and Nykvarn in Sweden. SEEL works together with companies from Belgium, Finland, France, Germany, Italy and Poland in an important project of common European interest for batteries, IPCEI Batteries.

Keywords: battery, electric drive, research, safety, testing processes

1 SEEL Swedish Electric Transport Laboratory

A new electromobility test centre called SEEL Swedish Electric Transport Laboratory is being established in Sweden by Chalmers University of Technology and RISE Research Institutes of Sweden. Electrification of the transport sector is to be speeded up at SEEL's facilities for tests and research on electromobility. The SEEL facilities will be operational in the spring of 2023.

The aim is to consolidate efficient knowledge development and improve the conditions for collaboration in the field of electrified transport in Europe. Actors in the automotive, aerospace, and maritime sectors, together with companies developing technology in relevant areas, will gain the possibility to test prototypes and products at independent test facilities with state-of-the-art equipment.

The business actors will also gain a common platform on which to meet, and will jointly benefit from the knowledge development and technology shift currently taking place. Researchers from academia and institutes will at the same time gain access to advanced research infrastructure in the field of electromobility.

In addition, SEEL works together with companies from Belgium, Finland, France, Germany, Italy and Poland in an important project of common European interest for batteries, IPCEI Batteries.

2 Facilities and Capabilities

The largest of SEEL's three facilities is being constructed in Gothenburg, involving a planned area of 13 000 square metres. The facility will be able to meet the needs of developers of heavy and light vehicles, trucks and buses, construction equipment, aircraft, and ships. A wide range of testing in the field of electromobility will be offered. The range of possible test objects include battery systems, charging systems, electric machines, electric power trains, and full-size electric road vehicles.

In Nykvarn the emphasis of work will be on research and testing in the field of battery technology, and dynamic testing of electric drivetrains for heavy vehicles.

Safety tests will be the focus of the Borås facility, related to charging, short circuits, vibrations, mechanical shock, extreme temperatures and fire risks.

At the test centre's three facilities, industry, institutes, and academia will be able to test most of the types of technology and safety consideration required for electrified transport – including innovative new concepts at early stages of development. The test objects comprise several different kinds of components for electrical powertrains and energy storage intended for vehicles and ships, as well as systems for propulsion and energy management. Physically this means gearboxes, shaft systems, hubs, electric motors, power electronics, batteries, and fuel cells.

The marine sector and aviation will also greatly benefit from the test centre – for testing and as a meeting place and platform for wide-ranging knowledge development in the field of electromobility.

Figure: Imaginations of the SEEL facilities in Borås, Gothenburg and Nykvarn.

3 IPCEI Batteries

SEEL is part of a pan-European research and innovation project in all segments of the battery value chain. In this project, IPCEI Batteries, SEEL is unique with the focus on test capability.

The European Commission announced on 12th December 2019, that the commission has approved under EU State aid rules an important project of common European interest ("IPCEI") jointly notified by Belgium, Finland, France, Germany, Italy, Poland, and Sweden to support research and innovation in the common European priority area of batteries [1].

The project participants – Automotive Cells Company (ACC), BASF, BMW, Elemental Strategic Metals, Endurance, Enel X, FAAM, Flash Battery, Fortum, Keliber, Nanocyl, SEEL, Solvay, Terrafame, Umicore, and VARTA – will focus their work on four areas:

1. **Raw and advanced materials:** This involves the development of sustainable innovative processes for the extraction, refining and purification of ores in order to obtain high-purity raw materials. With regard to advanced materials (such as cathodes, anodes and electrolytes), the aim is to improve existing materials and develop new materials for innovative battery cells.
2. **Battery cells:** The focus here is on developing innovative battery cells and modules that meet the safety and performance requirements of the automotive industry and other applications (e.g. stationary energy storage and power tools).

3. **Battery systems:** This involves developing innovative battery systems including battery management systems (software and algorithms) and innovative test methods.
4. **Repurposing, recycling and refining:** The goal here is to develop safe and innovative methods for the collection, dismantling, reuse, conversion and refining of recyclable materials.

Information about IPCEI Batteries is published on the project www-site [2].

4 Crossroad for Research and Collaboration

The SEEL network includes industry companies, research collaborations in Sweden, and collaborations in Europe. The Swedish industrial network consists of e.g. the automotive industry and companies active in the battery industry. Within the Swedish research networks there are e.g. Swedish Electromobility Center and BASE, which bring together companies, academia and institutes. The European network consists of e.g. the research program Battery 2030+ and the industrial project IPCEI on Batteries.

The aim is to consolidate efficient knowledge development and improve the conditions for collaboration in the field of electrified transport in Europe. Researchers, small and medium-sized enterprises, and large-scale industry companies will gain the possibility to perform test activities at independent facilities with state-of-the-art equipment.

SEEL aspires to an open and unique test centre with diversified equipment that can manage test objects ranging from battery coin cells to complete light and heavy-duty vehicles. At SEEL, all kinds of actors can meet at a neutral place to jointly strive for a good exchange on the way forward to a sustainable and fossil-free society.

Within the framework of IPCEI Batteries, SEEL plans to execute research collaborations on

- methods for accelerated testing of cells focusing on cycling procedures,
- methods to “translate” measurement performed on coin cells into understanding how the chemistry will perform in a commercial cell,
- methods to characterize aging of a battery cell and its state of health,
- methods to capture in situ information such as temperature and local ion concentration enabling more accurate models of state of power, state of charge, and state of health,
- testing new solutions for battery packs adopting advanced materials, and
- testing of physical and chemical characteristics of used batteries with regard to transportation, storage and mechanical treatment.

SEEL is open to European and international customers committed to electrified sustainable transports.

Acknowledgments

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References

[1] European Commission. State aid: Commission approves €3.2 billion public support by seven Member States for a pan-European research and innovation project in all segments of the battery value chain, Press release 12 December 2019, https://ec.europa.eu/commission/presscorner/detail/en/ip_19_6705

[2] IPCEI Batteries, https://www.ipcei-batteries.eu/

Authors

Martin G. H. Gustavsson is Research Director at SEEL. He has a Ph.D. degree in Physics and has a profound experience of product management and business development in telecommunication. He has for several years at RISE Research Institutes of Sweden been involved in various activities concerning sustainable mobility. Martin Gustavsson has managed projects on research and innovation for electric road systems, charging infrastructure, automatic charging of electric cars, telecom-based human mobility analytics for buses etc.

Henrik Svenningstorp is CEO at SEEL. Background in Project management and Product Development, with strong emphasis in the areas of electro mobility and alternative fuels. Henrik Svenningstorp has a Ph.Lic. in electrochemical sensors bases on SiC and 17 years' experience from product development in the field of automotive electromobility. Worked e.g., as program responsible with budget and strategic responsibility for the technology development projects in the field of alternative fuels and electro mobility at AB Volvo.

Ellen Olausson has been working as a researcher at RISE within the electromobility area since 2012. The research has mainly been focused on charging infrastructure for electric vehicles including inductive charging and electric roads. The projects have partly been technical oriented, but usually with a focus on the user experience. Since 2017 Ellen Olausson has been working in the management team to realize the establishment of the test and research centre SEEL.

Martin Ljungberg is acting as CFO at SEEL. He joined the management team in 2018 and has focused on the financial aspects such as the funding-gap analysis of the necessary investment in order to realize the establishment of the test and research centre SEEL.

Jan Almqvist is Director Powertrain Testing at SEEL. He has a MSc EE / Acoustics degree and 14 years of experience from automotive industry within complete vehicle R&D on light and heavy-duty vehicles as a test engineer and feature responsible. 7 years' experience within research institutes as laboratory director and leading researchers, calibration and test engineers.

Danijel Miljanovic is Director Energy Storage at SEEL. He has 19 years of experience from automotive industry. Most of the experience gained within R&D laboratories, particularly on component, sub-system and system level within electromobility including development of laboratories, testing facilities, new testing equipment and testing procedures. Besides electromobility, also covering logging and testing on emerging technologies, like connectivity, hydrogen and autonomous solutions.