

## SEC Workshop Electromobility in Sweden

### Background

On the 27th of June 2019 Swedish electromobility centre hosted a workshop on Electromobility in Sweden.

Three topics were given:

- The broader perspective - Electromobility in Sweden
- SEC's role as a leading network
- Specific projects we need to move forward

90 participants were divided into ten groups for group discussions on the three topics. The groups were intentionally mixed with respect to competence and organizations in order to create dynamic discussions. A group leader was responsible for taking notes on a poster.

Results from the discussions were presented to the others as a poster presentation and finally a summary discussion in plenary was held.

Below is a summary of the general conclusion of the workshop. All the notes are found in appendix 1. The conclusions provide an overview of the results of the workshop, and should be seen as a contribution to clarify the needs that exists within the field of electromobility, not as the views and standpoint of SEC. Many participants expressed that it was very useful to sit down and discuss the broader perspective and the role of SEC in that context. Many expressed the need for more time to discuss these questions. This should be repeated. The participants thought it was important to have discussions like these and learn from each other in the network.

### General conclusions

#### **Broader perspective:**

Realizing electromobility means building systems of systems and every system needs innovation at all levels.

The whole value chain needs to be considered and new business models are needed. What is the value that the customer will pay for? We must rethink mobility from the customer perspective

with less technology push. The legitimacy of e-mobility in society will require taking customers and users into account to deliver the right products and value. Bringing forward new innovative ideas, for example could the grid-owners own the batteries in the car, would make the car less expensive, and the batteries could be used for balancing the grid. How do we include other modes of mobility, air and sea?

The industry needs rapid industrialization of research innovation and access to the right competence. The scientific research needs to be accessible to the product developers, and the workforce needs to be educated and re-educated. Securing the access to the right competence is extremely important. How do we educate all we need? Much has been invested in the technology and competence of the combustion engine and now we must shift this knowledge toward electrification. How do we include and build up the Swedish supplier industry in this, and what can we learn from the railway industry?

In short, two value chains that needs to work:

1. From early research to industrialization of innovation
2. From mining of minerals to mobility infrastructure systems

The Swedish society is very flexible to change. We could think global and act local, use Sweden as a test lab to find models for society change to support other countries. We have both the automotive and the power industry in Sweden, we should use that. Identify and use unique competence and strength in Sweden, and then determine what to focus on.

### **SEC's role as a leading network**

The coordination role of SEC is very important. SEC connects the competence from different areas and serves as a knowledge hub, coordinating research and facilitate networking. It is a knowledge base that bring experts and competence together, providing a comprehensive knowledge base. SEC facilitates the exchange of ideas and contributes to building up necessary human capital. This platform should grow, i.e. invite others, and SEC could do even more to enable the network; breakfast meetings before meetings, facility visits, university labs and industrial facilities. Skype-meetings and webinars could be used to limit travelling or if travelling is restricted.

Formulate SEC's vision for common goals. How can we talk to politicians and the Swedish government about the conclusions of science? Promote SEC as an entry door to our knowledge. Give smaller companies access to our knowledge. Help with technology scouting. Educate people on how to use the new technology.

Further, external collaborations should be strengthened. We could work together with other centers, to learn more about them and to co-organize activities. Enhancing international collaborations would be most desirable, as well as support and networking for the EU. Could we form close collaboration with other clusters internationally? UC Davis?

Since we are dealing with a system of systems, SEC need to facilitate system optimization. Put goal on system levels with combination of components, forcing component people to talk to each other. To facilitate this, one possibility is to let some focus areas be on system levels.

### **Specific projects we need to move forward**

SEC should have a mixed project portfolio with both long and short projects. The outcome of the projects should be known in advance before approving proposals. The broad questions should be formulated by the centre, and then the researchers should respond. Make sure that projects include the user-consumer perspective. Thematic researchers are key in keeping projects together.

It is important to enhance and maintain cross-thematic collaboration: making sure that all relevant aspects are included in projects including the system perspective. With five theme areas: How do we link them to each other? How do we ensure cross-thematic collaboration? One suggestion is to further break down the themes into sub theme areas (=focus areas?) and establish clear links to sub-themes from another theme area.

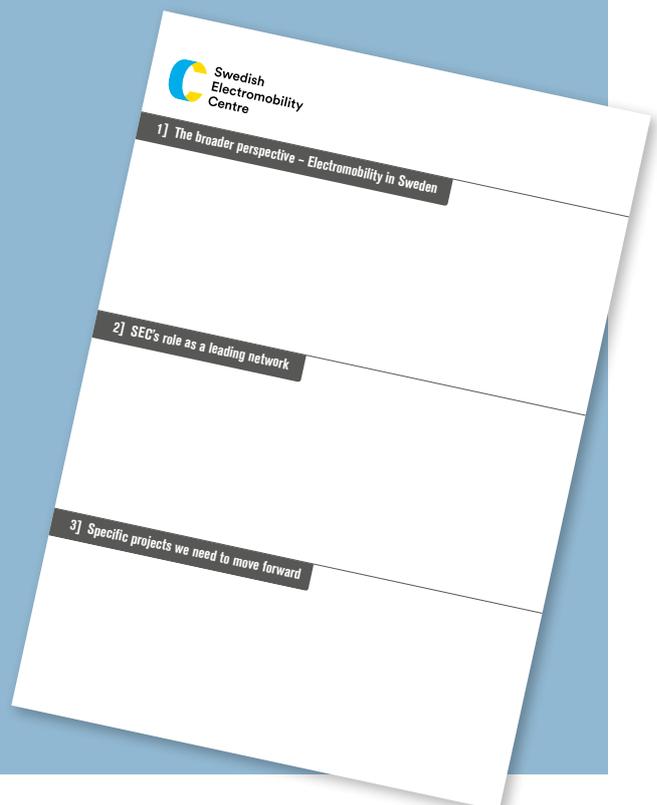
The focus areas should be at a certain level and kept dynamic. Cultivate a fruitful test environment for cooperation on testing novel concepts/products.

Some suggestions concerning project topics:

- Formulate a SEC Lighthouse project
- Encourage data-driven projects; to enhance simulation and develop realistic business cases.
- Transport systems; charging/storage/powertrain
- WS for the new team - theme 5 with grid actors and automotive industry during the fall
- High risk projects
- LCA and circular economy, critical resources. From mining to mobility infrastructure. Grow the whole value chain sustainable.
- Enable foresight studies that allows us to understand the visions and goals of all stakeholders within the SEC, and connect these to possible steps that actors could take to arrive at these long-term goals.



# Results of the Workshop 27 juni 2019



## 1. The broader perspective – Electromobility in Sweden

### Group 1

- Think global – Act local: E-mobility for industrial excellence at a global market
- Push and Pull important
- Forskning -> Specificering -> Realisering & Industrialisering
- Think about the value chain (industrial perspective)
- Connect e-mobility to other business models
- How to include other modes of mobility?
- H<sub>2</sub> as part of e-mobility: el -> H<sub>2</sub> -> eFuels
- Need of parallel tracks (not only batteries)
- Sverige blir testlabb för framtidens samhällsmodell för att testa egen och andras lösningar

### Group 2

- Systemoptimering (inklusive komponenter):
  - Livslängd (med flera användare, nätinkoppling, ...) => Prediktering (av livslängd)
- Laddteknik:
  - Mognad, standardisering, AUTOMATION
  - Nätintegration
- Lagring
  - Som strukturelement
  - Design for second life

### Group 3

- International funding: SEC as an entity to apply for funding internationally
- Cooperate/communicate with other centres and other business (than automotive) i.e railway
- Action 1: Join academic lobbying as a centre
- Action 2: A person on the board from Vinnova. To have an overview of the on-going research from different centres.
- Action 3: Strategy / Support within the SEC centre

### Group 4

- Green energy globally, in order to have green electromobility
- Awareness in Sweden of the need to shift to e-mobility, despite the large installed base in jobs, companies, assets, into ICES
- Strong combination of automotive industry, El power industry and CO<sub>2</sub> neutral electricity
- Ownership models, who owns a car and how should we design cars, long range vs short range
- Important to not only look on the Swedish perspective when developing transport solutions in/for Sweden
- Competence shift and its effect on society (unemployment etc) -> Educate the new & OLD

### Group 5

- Do not be afraid to say “we shall lead the way”
- Keep and capitalize on innovation
- Sweden and SEC to advance in Europe
- E-mobility in Sweden as platform for Europe/globally
- Education of labour
- Education: New qualified professionals and society
- “Minorities” etc education, respect
- Charging infrastructure: research and deployment
- End to end: From battery minerals/metals to infrastructure (European perspective)

### **Group 6**

- Why haven't we seen a broader collaboration between Swedish automotive industry and the Swedish electric power industry?
- How can we increase the number of industry persons that effectively can collaborate with the University and has the right expectations?
- How can we better identify the needs for people living in non-urban areas?
- We need to increase attractiveness of electrical engineering as a career for Swedish gymnasiestudenter. Have our professors preaching in three gymnasiums each year.
- Realistic power and capacity demand studies
- National build out plan
- Standardisering
  - Laddning
  - Elvägar, mm
- Involvera/engagera SME/underleverantörer
- Standardization of smart communication
- Standardization of heavy duty charging
- Övertyga OEMs om smart användning av elektriska drivlinor
- Övergripande mål -> FoU -> vinstdrivande industri HUR?
- Målbilder för 1) Sverige, 2) Sverige i EU samt 3) Sverige globalt
- Kostnadsperspektiv för xEvs
- Stora kompassen: Regeringsbeslut -> STEM -> SEC -> ... + Återkoppling
- Integrated:
  - Societal / beteende
  - Grid
  - Laddinfrastruktur (stolpar, ERS, ...)
  - Fordonsdimensionering
- Transport, infrastructure, operations, optimization - control vs pricing
- Data-driven predictive AI:
  - Sharing of information
  - Data economy
- Co-integrated simulation, modelling:
  - Transport
  - Traffic
  - Grid
  - Vehicle
- Business models (=> Actors behavior) & Politics (=> User behavior)
- Co-optimization of infrastructure:
  - Multiple technologies
  - Components (grid + charging)
- Total energy efficiency
- New mobility system solutions "move people and goods, not vehicles"
- Information security and intelligence
- Electromobility over borders

### **Group 7**

- Collaboration between car industry, grid owners and costumers
- Power and capacity shortage
- Solutions for people
- Win-win-win solutions
- Change in ownership models

### **Group 8**

- Identify and use unique competence and strength in Sweden
- Education and re-education of students
- Narrower focus area
- Find overlap between industry and academia

### **Group 9**

- More towards, BEV
- Handover research results to industry applications:
  - More concrete examples
  - Faster implementation
- Develop awareness for risk of path dependency
- Bring working products faster to the market
- Supplier industry in Sweden? Build up! Production capacity
- 5 theme areas: How do we link them to each other? How do we ensure cross-thematic collaboration-suggestion further break down the themes into sub theme areas (focus areas? Lindas anm) and establish clear links to sub-themes from another theme area
- What is our ambition to do ourselves?
- Smart use of electromobility systems/components
- Electromobility integration in Society
- Social responsibility?

### **Group 10**

- Competence! How do we educate all we need?
- Attractive:
  - Work environment
  - Environment – Clean air
- Attracting competence – Take climate change seriously
- Critical materials

## **2. SEC's role as a leading network**

### **Group 1**

- Support other countries with solution by and from SWE e-mobility
- Export Swedish models and solutions to global challenges
- Formulate a SEC vision to direct our forces to common goals
- Excellent, focused research with a broad & global perspective
- Forskning följer framtids affärsutveckling
- Business driven research
- Sammanfatta och sprida kompetens
- Competence transfer from academy to society
- Få med underleverantörsindustrin; Tier 1, Tier 2
- Secure that industry can get working force in Sweden
- Samverkan med andra aktörer:
  - Kraftforum
  - Teknologitbyte
- Kompetensbrister; kompetensskift & omställning

### **Group 2**

- Kartlägga kompetenser
- Kunskaps“hub”
- Samordning av FoU – Identifiera “överlapp” och ”gap”

### **Group 3**

- Steering the research; Increase collaboration and cooperation among scholars
- Action: Force researchers from different Universities to work together

### **Group 4**

- Education (courses for existing engineers)
- Workshops – Cross-functional mind set
- International collaboration – What makes you a leader?
- Cooperate with / influence politicians more. More role of a “remissinstans”.
- SEC as public opinion / lobbying shaper
- Perhaps lacking an organization that could push e-mobility in Sweden? A role for SEC?
- Grow more network elsewhere...
- SEC needs to man up for more interaction with:
  - Society
  - Government
  - Media
- SEC needs perhaps be more independent of Chalmers
- Workshop with grid companies (Theme 5)
- Proactively vs reactively – Seek joint projects with boat-, air-, etc e-mobility

### **Group 5**

- Critical mass of R&D, industry & academia, in a small arena. Easy collaboration.
- SEC and Sweden to broaden sector perspective
- Constantly work for creating new connections
- Transport plugs in SEC need to connect to the energy sector
- Research agenda - Coordination
  - 2 years => Companies
  - 10 years => SEC(?)
- Development of standards
- Influence the political & decision-making process
- Pitch events; minor & major companies etc
  - Link!
  - Test opportunities
- Riktade insatser till startup-företag

### **Group 6**

- Breda konferenser, både ämnen och deltagare
- Internationella samarbeten, tex med liknande centra
- SEC nätverk:
  - FoU Horisont
  - Akademi ↔ Industri
  - 10 år <= Metoder? => 3 år
- Business driven research => Implementation and value creation
- Competence: Creation & Maintenance
- How can we increase collaboration with similar research centres/organisations in Europe?
- Standardisering i elektromobilt samhälle

- Fortbildning för elektromobilitet
- Perhaps: SEC's visibility in Europe can be improved by representation at selected conferences/workshops
- Data availability
- Better links with leading actors in other funding bodies
- Identify & encourage (industry) synergies
- Manage wot to deal with IP's in collaborations
- Input to (and from?) society – building organizations/actors

#### **Group 7**

- Connecting research from different disciplines
- Multi-disciplinary, cross-section platform
- Communicate specifications, requirements, challenges, expectations, responsibilities
- Education of future technology designers

#### **Group 8**

- Enable more networking
  - (More info in the list of attendees)
  - Breakfast meetings
  - Meetings in between cities
- More meetings within the thematic areas
  - Facilities visits
  - Different meeting locations
- Role description of the Thematic Leader
  - (Spread more info to everyone)
  - More involvement

#### **Group 9**

- Knowledge bank for e-mobility
- A place to turn to get help/cooperation
- Competence development & provider
- International network & activities
- Breaking the “silos” => Real collaboration & co-evolution
- Act as a facilitator of “test-bed” projects
- Secure the collaboration/interaction EU and/or globally
- Need to identify our ... gaps and where the opportunities are (focus)

#### **Group 10**

- Work together to promote “the cluster”
- Cross-thematic regular interaction
- Always remind about the “bigger picture” – Sanity check!

### **3. Specific projects we need to move forward**

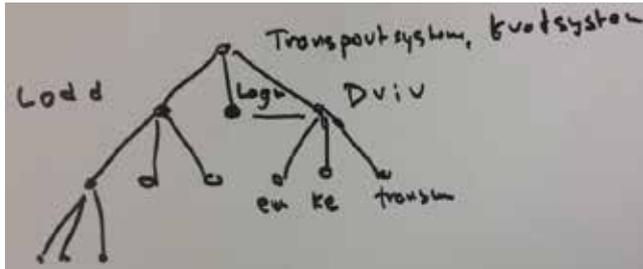
#### **Group 1**

- SEC connects to bodies for international policies incentives (eg US Davies) => WS
- Collect info: All projects relevant to the e-mobility area
- Use webinars to share results and insights
- Technology scouting and analysis of business potentials
- A common SEC lighthouse project (get all parts of SEC to work in a collaborative way forward)

- Hur ser vi till att all energi till mobilitet blir fossilfri?
- Research topic: Produkter med god kvalitet över tiden

### Group 2

- Systemoptimering
- Diagnostik/prognostik
- Transportsystem, kvotssystem(?) => Laddning/lagring/drivlina



### Group 4

- High power charging (commercial vehicles)
- Intermediate storage is expensive compared to liquid fuels. Where is the balance of grid feed vs local storage?
- Define a goal for electromobility in Sweden and then back cast
- How will large increase of electrical boats & aircraft affect electric infrastructure (Theme 5)

### Group 5

- Solid State
- Battery system safety for maritime, aeronautic applications and mining
- Cell design & cell manufacturing
- Kombination: Fordonsindustri – celltillverkare – lärosäten med cellkompetens
- Integrations with power grid & standardization
- Recycle batteries – second life – minerals – Re make
- High risk projects for disrupted charges
- Charging infrastructure projects, research and developing
- Next generation electric driveline
- System studies
- E-mobility + digitalization + automatize narrow down in vehicles projects

### Group 6

- Not ICE-projects
- Charging for AD vehicles (wireless? charging)
- Charging management in vehicles – vs – in grid?
- Move towards DC-grids, DC-charging (benefits?)

### Group 7

- Scaling of solutions region-city-area
- Common sand boxes
- Proof of concept vehicles – Utility companies
- Behavior of users – AI
- MATSim – Power grid
- Common projects; Car Industry - Utility