TOWARDS SUSTAINABLE PERSONAL MOBILITY WITH ELECTRIC CARS AND BUSES

Sven Borén

Akademisk avhandling
som för avläggande av Teknologie doktorsexamen vid Blekinge Tekniska Högskola kommer att offentligen försvaras i J1650, Blekinge Institute of Technology, Karlskrona, 2018-10-18 , kl. 09.30

Handledare:
Professor Göran Broman, Institutionen för strategisk hållbar utveckling
Henrik Ny, Institutionen för strategisk hållbar utveckling
Louise Ödlund, Linköpings universitet

Opponent:
Dr. Maria Grahn, Chalmers

Blekinge Tekniska Högskola
Institutionen för strategisk hållbar utveckling
Karlskrona
Abstract

The aim of this thesis was to explore if, and then how, electric cars and buses can contribute to sustainable personal mobility. Electric vehicles have increasingly been seen as a potential sustainable solution for the transport sector due to their high energy efficiency, close to zero emissions in the use phase, and the possibility to be powered by electricity from renewable resources. However, there are concerns about future scarcity of resources (e.g. lithium and cobalt for batteries), vehicle range, costs, high energy use in the production of batteries, as well as insufficient scientific support for how electric vehicles could be a part of a transition towards sustainability regarding personal mobility.

The challenges for a fast transition towards sustainability are large and many. The transport sector is not contributing to such development, mainly due to emissions, use of fossil energy, and use of materials mined and recycled under unacceptable conditions. Furthermore, existing societal goals (e.g. fossil-fuel independent vehicle fleet by 2030 in Sweden, UN Agenda 2030, and the Paris agreement) are insufficient for sustainability and are not complemented by concrete plans or an approach for how to engage stakeholders and achieve coordinated actions for sustainability. The Framework for Strategic Sustainable Development includes a principled definition of sustainability that is necessary and sufficient for sustainability and procedural support for collaborative innovation for a strategic transition to fulfillment of that definition, which is why it has been used as an overarching methodology in this thesis.

The research verified through several studies conditions for how electric vehicles can play a vital role in a strategic transition of personal mobility towards sustainability. Through stakeholder collaboration (e.g. interviews and workshops), a vision for sustainable transport with a focus on electric vehicles and an initial development plan towards that vision were designed. Several life cycle focused studies investigated (through calculations and data collection from literature, life cycle databases, interviews and workshops) about environmental and social impacts and costs for electric cars and buses. The stakeholder collaboration, combined with conceptual modelling, also resulted in models for generic support for multi-stakeholder collaboration and planning for strategic sustainable development of transport systems and communities, and for how to include electric buses in the procurement model of public transport.

The strategic sustainable development perspective of this thesis broadens the analysis beyond the more common focus on climate change issues and should be able to reduce the risk of sub-optimizations in community and transport system development when applied in that context. The generic support for multi-stakeholder collaboration could potentially also promote a more participatory democratic approach to community development, grounded in a scientific foundation.

Keywords: Strategic Sustainable Development, Transport Planning, Electric Vehicles, Testing, LCA, Mobility