

# There is a new road in town

## Commercialization of electric road systems in urban environments

Oscar Jakobson & Anton Lindstrom

Faculty of Engineering (LTH), Lund University  
Department of Production Management

June 2021

---

*The transport-sector is in the driver seat of electrification, switching over from traditional combustion engines to battery electric ones. This switch comes with opportunities and challenges, including how all these vehicles are going to be charged. A potential solution is Electric Road Systems (ERS), allowing vehicles to charge while driving. The technology is in the commercialization phase, markets are yet to be established. To move forward with the commercialization process, one important question to answer is: How can an ERS supplier commercialize their product in an urban environment?*

---

### Introduction and Background

Electric vehicles (EVs) are becoming increasingly more relied on as a promise for a fossil-free future. However, high purchasing costs, limited battery range, and cumbersome charging has limited the adaptation, especially commercially (Bateman et al., 2018). One emerging field, aspiring to give the electrification process of road transport an extra gear, is electric road systems (ERS). ERS allows electric vehicles to charge their batteries while driving, through the ERS charging infrastructure connected to the road.

Large scale deployment of ERS is a great undertaking that requires long-term collaboration between various stakeholders. For instance, ERS with dynamic charging introduces a new demand to the power grid and will create new load profiles, increasing grid demand (von Bonin et al., 2020). Simultaneously, ERS systems can introduce a potential for battery-powered EVs to become energy storage units, providing demand-side management assistance to the power grid (von Bonin et al., 2020; Elonroad, n.d.).

ERS can be categorized as a systemic innovation, attempting to change the nature of society by enabling a major transition concerning electrification.

### The study

The purpose of this study was to examine how electric road systems could be commercialized in urban environments, focusing on Sweden. This purpose was twofold. First, it was to analyze the current stakeholder environment surrounding ERS, aiming to understand the different roles and drives. Second, it was to study a case of potential commercialization of ERS in urban environments, to bring new insights and knowledge into the processes and decisions associated with the commercialization. This study intended to contribute to the specific field of ERS, as well as to the theory related to commercialization of systemic innovation.

The research design used in this study was based on conducting semi-structured interviews, finding subjects through following a pre-set stakeholder model. However, the process was iterative, and the model was altered as more information and perspectives were gathered. Following the interview process, a case was conducted in collaboration with a prominent ERS-user, the public buss authorities in Stockholm. The case was conducted to evaluate whether the ERS can be financially feasible for a sole user, as well as to investigate environmental aspects.

### Stakeholder analysis

The stakeholder analysis was an integral part of this study since there exists no market for urban

ERS and the roles are not defined yet. Stakeholder groups were identified, and their drivers to participate in ERS deployment, are shown in Table 1.

Table 1. Stakeholder groups and drivers

Stakeholder group	Driver
ERS providers	Financial profits and improving the environment through electrification.
Vehicle suppliers	Financial profits and shareholder satisfaction
Electricity suppliers	Financial profits
Grid Owners	Maintaining and developing the electrical grid while making profits.
Road constructors	Financial profits
Authorities & Government	Public opinion, re-election, and environment
Public transport	Providing an optimal transport system to their consumers
Transporters of goods	Financial profits
Academia	Increased understanding in how ERS technology could work in a market setting and understanding how ERS could aid in the transition to a fully electric vehicle fleet
Road Owners	Public opinion, re-election, and environment
Owners of ERS	Financial profit from the ownership
Citizens	Affordable, safe, and environmentally friendly modes of transportation, as well as not harming the cityscape.

Understanding what drives the stakeholders is an important in order to forge the cross-sector partnerships/collaborations needed to succeed with commercializing the systemic innovation.

#### Case: Stockholm public bus line 4

A way to ignite commercialization of systemic innovation is to find suitable business cases. Throughout the interview process, potential first markets from where to grow was discussed, *beach-head markets*. The most prominent seemed to be public bus companies. To deep dive into this market and find a suitable case, a collaboration with Stockholms Public Transport Authority, Trafikförvaltningen, was formed.

Together with Trafikförvaltningen, bus line 4 was identified to be a good line to investigate if investments in ERS is feasible. The line runs between Radiohuset and Gullmarsplan and is very popular. Currently, the line runs using a

50/50-split between biogas and biodiesel busses, respectively.

Financially modelling the investment and comparing it to keeping the current solutions, including investments, cost of fuel/electricity, installation costs etc., resulted in a timeline showing how costs and investments accumulate for the options, as well as the net present cost of the options. The net present costs are presented in Table 2.

Table 2. Net present cost ERS versus combustion buses

Net present value	MSEK (5% discount factor)
Biogas/diesel	402,8
Buying ERS	384,9
Leasing ERS (15y)	414,9
Leasing ERS (30y)	391,5

The study indicated that investing in ERS on line 4 is financially feasible, even without considering the attainable network-effects associated with having different customers share the same ERS. Also, using electric buses remove emission of particles and reduces noise.

#### Conclusions

The stakeholder analysis helped form an understanding of the future markets for ERS. Using insights from the stakeholder analysis, the case was found and studied.

Results from the case study indicate that a way forward for ERS suppliers, in the initial phase of ERS deployment, is to target the public transport sector and/or electricity suppliers as potential customers. The public transport sector has shown a potential to be able to finance the deployment of ERS and electric buses since it can be cheaper and more environmentally friendly than other options for public transport. The public transport sector also has a government mandate to reduce environmental effects of their operations which is positive for ERS because of its environmentally friendly solution.

Looking at commercialization of systemic innovation from a more general lense, this study indicated that finding a high potential business case and proving financial viability can be a first step on the commercialization journey.

### References

Bateman, D. *et al.* (2018) *Electric Road Systems: A solution for the future?* La Défense: World Road Association (PIARC). Available at:

[https://www.trafikverket.se/contentassets/2d8f4da1602a497b82ab6368e93baa6a/piarc\\_elvag.pdf](https://www.trafikverket.se/contentassets/2d8f4da1602a497b82ab6368e93baa6a/piarc_elvag.pdf) [Accessed: 7 April 2021].

von Bonin, M. *et al.* (2020) *Electricity supply to electric road systems: Impacts on the energy system and environment.* Reserach Collaboration. COLLERS. Available at:

<http://www.diva-portal.org/smash/get/diva2:1467139/FULLTEXT01.pdf> [Accessed: 7 April 2021].

Elonroad (n.d.) 'Electric Road System'. Available at: <https://elonroad.com/> [Accessed: 7 April 2021].