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**Infrastructure development for electric mobility: a Nordic perspective on national and cross-national challenges**

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**Abstract**

The European Transport Policy focuses on regional wide-infrastructures to promote sustainable transport, including electric mobility. The key to integrate or coordinate the ongoing development of electric mobility into a Europe-wide technological infrastructure consists of a number of challenges. As a result, European regions of a cluster of national regions that offer different industries are seen as a strategic point to prepare for a transition towards standardised regional infrastructures. This paper studies the national cases of Norway and Denmark within the context of the seemingly homogeneous Nordic region. The paper focuses on the different approaches taken by the national level to develop electric vehicles (EVs) within a (re-)technological infrastructure. Norway and Denmark provide apt, contrasting focal points. Despite its position as a large fossil fuel exporter and its mountainous topography, Norway exhibits high – and rapidly increasing – EV sales. Denmark, on the contrary, is characterised by the development of a very different electric mobility infrastructure and each has experience of different levels of EV penetration. We look at a set of factors to explain these differences, the role of electric vehicles from renewable sources, the types of renewable sources, the composition of them, public support for infrastructure, public sector incentives for EVs use, etc. This analysis can help inform a discussion of the transition from national to European transportation infrastructure. Implications for the building out of infrastructure for new energy vectors (hydrogen for use in fuel cells and others) are also drawn.

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**Infrastructure system architectures**

- **Distribution systems**
- **Communicative systems**
- **Accumulative systems**
- **Mobility systems**
- **Sewer systems**
- **Electricity supply**
- **Water supply**
- **Telecom systems**
- **Waste disposal systems**
- **Radio and TV**

**Possible pathways to change of infrastructure systems**

- **Optimization**
- **Energy and mobility infrastructure system**
- **Fundamental shift**
- **Energy: Distribution and Efficiency**
- **Energy: Decentralization and Efficiency Analogy**
- **Energy: Efficiency, Improvement and Capacity between**
- **Mobility: Alternative Use and Design**

**Interplay of Infrastructure Systems in Response to Change**

- **Supplementary Infrastructure Systems**
- **Technological Innovation**
- **Actors in the different parts of the Better Place value chain – very complex!**
- **Decision mechanisms**
- **Infrastructure systems which have complementary functions and can**
- **Decline of an infrastructure which is leading to a breakdown**
- **Competition of Supplementary Infrastructure Systems**
- **Broader societal innovation**
- **Infrastructure systems which need to change in response to climate change**
- **Competition of Supplementary Infrastructure Systems**
- **System of systems**
- **Further analysis of the interplay between factors can help inform a discussion of the transition from national to European transportation infrastructure. Implications for the building out of infrastructure for new energy vectors (hydrogen for use in fuel cells and others) are also drawn.**

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**Conclusion and Conclusions**

**European transport-policy aspirations face a number of challenges on the road toward harmonising region-wide recharging-infrastructure for electric mobility. Our work compares the distinct ways in which two Nordic countries have attempted to shape electric mobility infrastructure up until now.**

**The Norwegian and Danish cases represent two ‘natural experiments’ in the dissemination of distributed technological systems. Our approach pairs these two rather small countries in an attempt to control for important country effects (a population, socio-economic development) that otherwise strongly influence the dissemination process. This allows us to focus on the divergence of pathways that can be attributed to conscious (i.e. policy and technology) choices.**

**The cases indicate that:**

1. **Different technological paradigms have been pursued, with Denmark backing a more experimental technology (car sharing) with distinct implications for recharging infrastructure.**
2. **Public support has differed in each country in terms of incentives (tax-breaks, parking, road-access) and of the provision/facilitation of infrastructure in urban areas and in corridors.**
3. **Each country has experienced different levels – and patterns – of BEV dissemination, with roughly 10 times the number of BEVs in the road on Norway than in its fatterneighbour.**

It is important to review the different ways in which BEV technology already are rolled out, and to understand why different choices have been made and the results these have fostered. The distinct trajectories followed – and the different levels of experience – have implications for further developments in terms of European efforts to move towards a more Europe-wide recharging infrastructure.

**One implication of the comparison here involves system ‘orphans’. European harmonization risks ‘orphaning’ new players in cross-national traffic corridors.**