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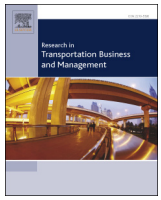

Introducing plug-in electric vehicles in public authorities

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ABSTRACT

Plug-in electric vehicles have the potential to contribute to a more energy-efficient and a less fossil dependent road transport system. Swedish local authorities are obligated through legislation to substitute fossil-fuelled vehicles and plug-in electric vehicles offer an alternative for achieving their climate goals. Previous studies assign certain individuals – the policy entrepreneurs – a central role when implementing new technologies in public authorities. By combining the theoretical model of policy entrepreneurs with the theory of outcome indicators, this paper demonstrates how the policy entrepreneur affects and accelerates the introduction of plug-in electric vehicles in local public authorities. The result shows that policy entrepreneurs undertake actions to inform and persuade the decision-makers and raise the issue on the political agenda. The policy entrepreneurs assess the travel demand, find appropriate applications and supervise the deployment process. The policy entrepreneurs inform and inspire vehicle users as a way to ensure acceptance and to increase usage. There are examples of policy entrepreneurs that have accomplished changes in policies governing vehicle use to favour the plug-in electric vehicles. Practical experiences legitimate the policy entrepreneurs when involving local society. The policy entrepreneurs consolidate the new technology within policy documents, amongst the users and in the surrounding society.

1. Introduction

The transition towards a more carbon and energy-efficient transport system is an ongoing global process. Road transport is still heavily dependent on fossil fuels – up to 98% according to the International Energy Agency (IEA, 2011) – and the transition process is slower than that of the stationary sector. Even though average European fleet fuel economy has improved significantly (EEA, 2011), the European Commission is working actively to accelerate the adoption of new energy-efficient vehicle technologies. Plug-in electric vehicles (PEVs) include both battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs). The electrical powertrain is four times more energy-efficient than a conventional mechanical powertrain (Larminie & Lowry, 2003), and given the possibility to charge the vehicles with renewable electricity (i.e. wind, solar, hydro and biomass), a transition to plug-in electric vehicles could contribute significantly to a more sustainable transport system. Usage of plug-in electric vehicles may contribute to positive environmental effects as well as the possibility to improve urban health (Tiwary et al., 2013; Namdeo et al. 2014). While the advantages are many and the technology exists, the uptake of plug-in electric vehicles is still modest.

Technology procurement is a policy instrument the European Commission has identified in particular to accelerate the development and deployment of new energy-efficient technologies (EC, 2011). Establishing progressive technical specifications in the tender process is, compared to a laissez-faire introduction, expected to create a market pull by enlarging an emerging market (IEA, 2010). It can ensure politically compliant purchases, which favour the introduction of new vehicle technologies (Nesbitt & Sperling, 1998). Technology procurement is recognised as an effective policy measure for reducing the purchase cost of plug-in electric vehicles (Pasaoglu, Honselaar, & Thiel, 2012) as well as being identified as an enabler for demand-driven expansion of charging infrastructure (Falvoa, Lamedicaa, Bartonib, & Maranzanoc, 2011). A technology procurement process may be open for others to share the established framework agreement. This way, new technologies are enabled for many organisations with progressive ambitions, which alone may not possess the knowledge to start a transition.

Public authorities using technology procurements as an instrument to accelerate transition towards an energy-efficient transport system is rather new. There are examples of local public initiatives (Sunnerstedt, 2013), national government programmes (Hensdal & Fridstrand, 2000) and European collaborations (ZEUS, 2000; SEA, 2001). However, further knowledge of the obstacles and possibilities of technology procurements of electric vehicles and plug-in-hybrids is needed.

This paper departs in a Swedish technology procurement scheme, called the Swedish National Procurement of Electric Vehicles and

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Plug-in Hybrids, starting in 2010 and ending in 2015.[1] Based on an extensive socio-technical analysis of the procurement it has shown that specific engaged individuals has a key role for plug-in electric vehicle deployment in public authorities (Hjalmarsson, 2014; Wikström & Alvfors, 2015; Wikström & Sunnerstedt, 2012, 2013; Wikström, Hansson, & Alvfors, 2014; Wikström, 2015). Theoretically, these individuals can be referred to as *policy entrepreneurs* (Roberts and King, 1991). The aim of the paper is to show how the policy entrepreneurs influence and accelerate the introduction of plug-in electric vehicles in local public authorities, and with this bring a new theoretical perspective, and a practical contribution, to the current debate on efforts to accelerate the uptake of electric vehicles.

The policy entrepreneur has been recognised as an important catalyst for sustainable transitions (Block & Paredis, 2013; Loorbach, 2010; Timmermans, van der Heiden, & Born, 2014; Uyarra & Gee, 2013). However, the role of policy entrepreneurs is new in the literature on electrical vehicles. General studies of policy entrepreneurs discuss the entrepreneur in relation to other actors (Gustafsson, Ivner, & Palm, 2014; Morris & Jones, 1999; Shane & Venkataraman, 2000). This paper shares the research approach of Roberts and King (1991) and focuses directly on the policy entrepreneurs. With this approach, the paper also complements general studies with new knowledge of how the policy entrepreneurs' actions influence the transition process through technology procurement and in specific on the transition to electrical vehicles.

The paper also contributes with new knowledge regarding plug-in electric vehicles in fleets, and in particular public fleets. Amongst studies with an end-user focus, it is more common to target plug-in electric vehicles operated by private owners (see for example Franke & Krems, 2013). The present studies show a rapid market development of plug-in electric vehicles; see Fig. 1 (EVI, 2015). The public sector and such fleets play an important role in this development. The global market in 2014 included 665,000 plug-in electric vehicles and constituted approximately 0.08% of all passenger vehicles. Global sales in 2014 amounted to 300,000 plug-in electric vehicles.

The paper focuses on the introduction of plug-in electric vehicles in Sweden. Sweden held the fourth largest market share in 2014. The sales of plug-in electric vehicles amounted to 1.4% and a total of 7928 of such vehicles were in operation in Sweden (EVI, 2014; ELIS, 2016). Sales have continued to increase and in December 2015 were the total number of plug-in electric vehicles was 15,962. Approximately 80% of the plug-in electric vehicles in Sweden are used as fleet vehicles or as company cars, i.e. significantly fewer plug-in electric vehicles are in private ownership (ELIS, 2016). See Fig. 2.

The three countries that hold larger sales market shares than Sweden are Norway, Netherland and USA. Norway stands out with a sales market share of 12.5% in 2014 (EVI, 2015). Norway has a substantial incentive framework and the total number of plug-in electric vehicles surpassed 50,000 in April 2015. At that level, the Norwegian Government had initially decided that it would repeal several incentive schemes, but that decision has been revised and the schemes extended (Höyre, 2015). The Netherlands has the second largest market share, with 3.9% in 2014. Incentives from the Dutch government became less generous during 2014, reducing the market share from 5.3% in 2013. The third biggest market share is held by the United States – 1.5% in 2014 – but given the size of this market, it is estimated that approximately 40% (about 260,000) of all plug-in electric vehicles are in the US. About 120,000 of these are in California. Over the past decades, the California state government has pushed for progressive policy-making and the development of Zero Emission Vehicles — ZEVs, which also includes fuel cell vehicles (Sperling & Eggert, 2014). The goal for 2025 is to reach 1.5 million ZEVs and the action plan has come to include not only technical, legal and financial measures, but also consideration

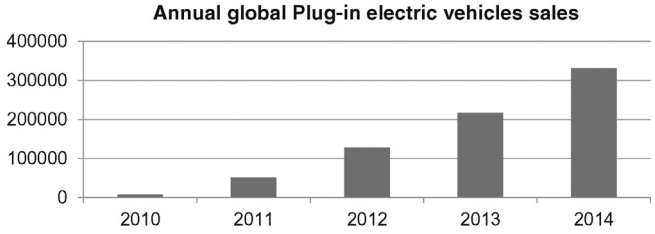

Fig. 1. Global sales of plug-in electric vehicles (EVI, 2015).

of social perspectives and suggested frameworks to specifically promote ZEVs for low-income consumers (Brown et al., 2013). Studies have shown that introduction of plug-in electric vehicles in public fleets has advantages over introduction in the private market. Fleets constitute a favourable physical entry for new vehicle technologies (Transport Analysis, 2015). New vehicle technologies are initially more expensive than conventional ones, and the infrastructure for refuelling is not yet developed; these are two prominent factors that have been identified to inhibit the adoption of plug-in electric vehicles (Gnann & Plötz, 2015; Dumortier et al., 2015). Fleet vehicles are used more than the average privately owned vehicle (Nesbitt & Sperling, 1998), which means that fleet vehicles can maximise the benefit with low operational costs and motivate a higher purchase price. Fleets also benefits from being precisely fleets, i.e. consisting of multiple vehicles. A composition of different vehicles integrates flexibility and allows battery electric vehicles to be used for tasks suitable for the technical specifications. Even though plug-in electric vehicles are commercially available products, powertrain components and materials are still being improved. Since the battery constitutes a significant part of the total lifecycle cost (Delucchi & Lipman, 2001) and there are still uncertainties regarding the ageing of the batteries (Klett et al., 2014), fleets have better possibilities to account for that risk compared to a private consumer. Furthermore, the mobility need for (most) fleets is considered more predictable compared to that for a private household (Schmidt, Eisel, & Kolbe, 2014). This paper brings new knowledge to the existing studies of public fleets by showing obstacles and possibilities of entering the arena and how a policy entrepreneur can accelerate an entry.

2. Theory

The paper combines the theory of policy entrepreneurs with an outcome indicator perspective. Theories with respect to policy entrepreneurs are used to identify and explain the influence of individuals, while the outcome indicators provide a systematic process to examine the effects of introducing new technology.

Kingdon (1984) describes the policy entrepreneur as an individual, inside or outside the public institution, with the ability to influence the political agenda in public-policy processes. According to Kingdon (1984), the policy entrepreneur possesses four certain qualities: access to the political area, good contacts within the political sphere, good negotiating abilities and persistence. The policy entrepreneur is willing to invest resources (time, energy, reputation and to some extent money) to promote a certain policy, because she/he has identified a future gain in the form of material, purposive and non-material benefits. Roberts and King (1991) have clustered the entrepreneurial activities that the policy entrepreneurs undertake within the public policy process as follows:

- advocate new ideas and develop proposals
- define and reframe problems
- specify policy alternatives
- broker the ideas amongst the many policy actors
- mobilise public opinion and
- help set the decision-making agenda.

[1] This paper will not go into details about the particular procurement process. The different stages of the technology procurement process are described in the work of Edquist, Hommen, and Tsipouri (1999).

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