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Understanding the drivers of fleet emission reduction activities of the German car manufacturers

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ABSTRACT

The current mobility system, dominated by fossil fuel powered automobiles, is under increasing pressure due to its environmental impact. To address this issue there is a need for a transition of the system towards one that is more sustainable, including the introduction of car technologies that allow a decrease in fuel consumption and the substitution of fossil fuels as primary energy source. Due to the stability of the current automotive industry and the dominance of the internal combustion engine technology, it is expected that the incumbent firms and their activities will play a crucial role in the transition. Policy makers have therefore introduced a variety of policies to encourage the industry to provide suitable solutions. We have conducted a micro-level analysis of how the three main German car manufacturers have changed their activities in the field of low emission vehicle technologies in response to national/international events and policy making. Our analysis suggests that policy makers only have limited influence on the type of disruptive solution that is chosen by these individual companies and that activities related to solutions that were not familiar to the individual car manufacturer were mainly induced by internal or

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external champions. Still, while the existence of regulatory policies allowed such activities to succeed, on its own it only encouraged the industry to work on incremental solutions based upon the knowledge already possessed.

1. Introduction

Over the last few decades the automotive regime has been experiencing a number of challenges, both changing customer expectations and needs, particularly their perception of oil supply uncertainty and price volatility, and also governmental and regional policies driven by climate change and local air quality issues. As automobiles are responsible for a large fraction of total energy-related GHG emissions (IEA, 2010; WEC, 2011) the on-going discussions on fuel efficiency and emission reduction goals has led, and will lead, to changes in behaviour, strategies and products in the automotive industry.

One way of addressing these pressures is the introduction of technologies such as hybrid, battery and fuel cell electric vehicles (Howey and Martinez-Botas, 2010; IEA, 2010; Offer et al., 2010). It is argued that the whole spectrum of electric vehicle technologies is likely to be needed in a future decarbonised road transport system, each playing a different role (Contestabile et al., 2011; IEA, 2010; McKinsey & Company, 2010). As a result scenarios, such as those analysed by the IEA and World Energy Council, are used to highlight futures with a diffusion of those different vehicle propulsion technologies that may lead to the change of whole socio-technical systems (IEA, 2010; Vallejo et al., 2013; WEC, 2011). Hence the diffusion of a new vehicle propulsion technology is potentially a complex systemic problem, subject to issues such as technology lock-ins (Unruh, 2000, 2002).

While policy makers have tried to create policies leading to futures that are favourable for their countries, economies and citizens, the response of the system is not always as expected. And even now in the current transition towards electric cars the diffusion of low emission vehicles is not happening as fast as it was aimed for by policy makers. This can be explained by the stability of the system and especially the role of the automotive industry that is strongly embedded in the current private car transport regime (Wells and Nieuwenhuis, 2012). Because of that stability we assume that the change towards electric cars will happen at least with the participation of the current incumbent automotive manufacturers, if not even be executed entirely by them. Even in the case of the electric vehicle manufacturer Tesla we would argue that it is actually an 'offspring' of the existing automotive regime, as it strongly relies on an employee base that has been hired from the automotive industry regime except for the engine engineers. Additionally they take advantage of the existing automotive supply chains. Using the typology of stereotypic historical transition pathways (Geels and Schot, 2007), this would imply a transformation or a reconfiguration pathway where the current regime players – namely the automotive industry – still play an important role in a future regime where electric vehicles dominate (Wells and Nieuwenhuis, 2012). Hence as a result this paper focuses on a transition towards electric vehicles that is executed by the existing automotive industry. This is confirmed by the fact that this industry has presented different types of low emission vehicles in the past. Not only have there been a vast number of low emission vehicles in the past, such as the electric EV-1 by GM in 1996 and the fuel cell vehicle Necar by Daimler in 1994 to name two early ones. But recently we are observing the introduction of various low emission vehicles into the mass market, such as the Tesla S by Tesla Motors, the i3 by BMW, the Leaf by Nissan or, before that, the Prius hybrid vehicle by Toyota.

A number of studies (Bakker and Farla, 2015; Bakker et al., 2012a,b, Geels, 2012; Köhler et al., 2013; Mazur et al., 2015; Wiesenthal et al., 2010) have emphasised the strong role of policy in leading to this development. Other studies (Farla et al., 2012; Mazur et al., 2015; Penna and Geels, 2012; Wells and Nieuwenhuis, 2012; Wesseling et al., 2013) have also emphasised the importance of the existing automotive industry in delivering this transition, implying that the understanding of the micro-level activities of this industry is crucial if policy makers are intending to design policies that are able to deliver the desired environmental objectives.