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Perspectives on Norway's supercharged electric vehicle policy

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ABSTRACT

Norway has achieved an unprecedented breakthrough for battery electric vehicles. The market share reached 17.1% in 2015, and the total fleet passed 2.7%, some 70000 vehicles. The multilevel perspective framework demonstrate how Norwegian incentives and policies gradually developed over a 25 year period through interactions between the international landscape, national governance networks, regimes and niches. Actors have been able to utilize windows of opportunities leading to the potential establishment of a BEV regime assimilated into the ICE regime from 2016. BEV incentives, some of which have been in place since 1990, did not yield results until the traditional vehicle manufacturers manufactured BEVs based on Li-Ion batteries from 2010. Norwegian purchase incentives are large enough to make electric vehicles a competitively priced alternative for vehicle buyers. Increased selection of models, improved technology, reduced vehicle prices, and extensive marketing have spurred further sales.

1. Introduction

The introduction of environmental innovations in the fossil fuel-based transportation sector, such as alternative energy carriers, will be required on a massive scale in order to be able to limit global warming from transportation activities. The lock-in effects of existing technology, development and the introductory costs of new technologies and the existing motoring practises are barriers limiting adoption. Understanding the processes involved in introducing such innovations will aid transportation policy makers in formulating more effective measures.

The combination of the electrification of transportation and decarbonisation of electricity will deliver deep cuts in CO_2 emissions (Williams et al., 2012). Battery Electric Vehicles (BEVs) reduce greenhouse gas emissions when the electricity they use is produced from renewables, as is the case for Norway, and to a lesser extent when the European electricity mix is used (EU WTW, 2014). BEVs emit no local pollutants and are up to three times as energy efficient as Internal Combustion Engine Vehicles (ICEVs) (Figenbaum et al., 2015b). Hawkins et al. (2012) emphasize the need for an improved life cycle analysis of BEVs, but also find that BEVs reduce greenhouse gases. The EU's emission trading scheme (EU ETS, 2015) includes electricity production, and since there is a cap on total greenhouse gas emissions, a 100% reduction will in principle be the result when BEVs replace ICEVs (OECD 2011; EU ETS, 2015; Figenbaum and Kolbenstvedt, 2015b). The effectiveness of EU ETS is a controversial issue. A comprehensive 2015 review found that EU ETS so far has functioned as intended (EC, 2015), but a stronger long-term price signal will be needed to provide incentives for investments in the sustainable transition to a low-carbon economy.

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Nomenclature

Acronyms

BEV	Battery electric vehicle, only powered by electricity
ICE	Internal combustion engine
ICEV	Internal combustion engine vehicle
HEV	Hybrid electric vehicle
PEV	Plug-in electric vehicle, includes both BEVs and PHEVs
PHEV	Plug-in hybrid electric vehicle, powered by electricity recharged from the grid and ICEs fuelled by diesel or gasoline, and alternatively, an ICE running as a generator producing electricity used in the motor

The market introduction of BEVs in Norway is an environmental transportation sector innovation that has diffused into a national market at an unprecedented rate. In this article, the Multi-Level Perspective (MLP) transition theory will be used to investigate why and how BEVs have entered the Norwegian market, and how the political framework, stakeholder activities and international developments interacted to create an environment in which BEVs could flourish. Contributions to the transitions theory literature come from the application of MLP on a real world case that has evolved further than cases previously studied in the transportation sector.

The article starts off with a presentation of the Norwegian context and status of BEVs. Section 3 presents the theoretical framework, research method and material used. Section 4 presents the interactions between actors, consumers and events at different levels, and how these have affected BEV diffusion. A conceptual MLP framework for Norway is presented in Section 5 followed by a discussion of results in Section 6. Implications for policy makers and transition theory development, as well as overall conclusions, are presented in Section 7.

2. Norwegian context

Generous incentives have positioned Norway as the leading BEV market in the world. A market share of 18% of new vehicle sales was attained in 2015 (OFVAS, 2016), whereas most other countries had shares below 1%. The share of the total passenger vehicle fleet reached 2.8% in 2015, increasing at a pace of 0.1% per month. Moreover, BEVs accounted for over 5.4% of the traffic flowing through the toll road ring around the capital Oslo in 2015 (Fjellinjen, 2016).

Consumers have bought 80%, and own over 85%, of the BEVs sold and registered in Norway (OFVAS, 2016; NPRA, 2016). In total, 140 000 passenger vehicles are sold in Norway every year. The total fleet consists of 2.6 million passenger vehicles that are driven an average of 13 000 km/year. Conditions for electric vehicle usage are favourable, as three-fourths of households park their vehicles on their own land and can therefore install charging facilities, while another 12% park less than 100 m away (Hjorthol et al., 2014). Most households also have a sufficient power capacity installed to charge electric vehicles, as electricity provides space heating for 74% of households (SSB, 2015b). The average household consumed 16 MWh of electricity in 2015 (SSB, 2016), while the energy consumption of a BEV would only add approximately 15%. The grid may however need reinforcement, as some utilities already say no to home charging faster than 3.6 kW (DN, 2014).

Since 2012, BEV policies have been anchored in climate policy (CPS, 2012). However, the first incentive became available as early as 1990. Norway has no ICEV production. Fuel prices are also among the highest in Europe, whereas electricity is cheap (Figenbaum et al., 2015a,b), with 96% produced in hydroelectric power plants (Figenbaum et al., 2015b). Powering all passenger vehicles in Norway would only consume approximately 5% of the hydroelectric electricity produced in a "normal year".[1]

The Norwegian transportation sector is heavily taxed, which includes registration taxes on new vehicles, annual taxes, taxes on fuels and numerous toll roads. This regime makes it possible to create incentives by selectively foregoing taxes (Fearnley et al., 2015), thus influencing the types of vehicles sold. A range of BEV incentives have been introduced over the years along these lines, also including incentives providing users with special privileges as seen in Table 1.

BEV buyers typically belong to multivehicle households that have many of the same characteristics of early adopters as in Rogers' (1962, 1995) theory on the diffusion of innovations, and on the buyers of new vehicles in general (Figenbaum et al., 2015a, 2014; Hjorthol, 2013), such as high income and higher education. They also live in large households in or around cities (Figenbaum and Kolbenstvedt, 2015a,b).

Fearnley et al. (2015) found that incentives reducing the purchase price have been the most effective in speeding up the diffusion of BEVs by evening out the sales prices of BEVs and ICEVs. Local incentives, such as bus lane access, exemption from toll road charges, parking free of charge and reduced ferry rates, were valued in 2014 (avoided costs and value of time savings) by BEV owners in Norway to be approximately 1 900 Euro/vehicle/year (Figenbaum et al., 2014), hence playing an

[1] Estimate: BEVs consuming 0.2 kWh/km, average vehicle driven 13 000 km per year, 2.6 million passenger vehicles, 125 TWh hydroelectric electricity production; normal year = average weather.

Table 1
Incentives, policies and initiatives in Norway; source: Figenbaum et al. (2015b).

Incentives	Introduced	Benefits for users
Fiscal incentives – a reduction of purchase price/yearly cost gives competitive prices		
Exemption from registration tax	1990	The ICE vehicle tax is based on emissions, engine power and weight. Example taxes: VW Up 3000 €. VW Golf: 6000–9000 €.
VAT exemption	2001	ICE vehicles are levied with a 25% VAT on the sales price minus the registration tax. The VAT on a typical VW Golf ICEV could be as much as 5000 €.
Reduced annual vehicle licence fee	1996/2004	Three rates apply for private cars. BEVs and hydrogen vehicles have the lowest rate of 50 € (2016); conventional vehicle rates: 350–410 €.
Reduced company car tax	2000	The tax on using a company car is lower for BEVs, depending on income.
Direct subsidies to users – reducing usage costs and range challenges		
Free toll roads	1997	In the Oslo area, the avoided costs are about 600–1000 €/year for commuters. Some places avoided cost can exceed 2500 €/year.
Reduced rates on ferries	2009	Similar to toll roads. Drivers avoid cost of using car ferries.
Financial support for charging stations	2009	Reduces the economic risk for investors in charging stations; reduces range anxiety and expands the BEV market, and gets more BEV miles out of every BEV.
Financial support for fast charge stations	2011	More fast-charging stations become available, thereby increasing the BEV miles driven and the total BEV market, including fleets.
Reduction of time costs, which gives relative advantages		
Access to bus lanes	2003/2005	BEV users save time driving to work in the bus lanes during rush hours.
Free parking	1999	The benefit for users is to get a parking space where these are scarce or expensive, in addition to the time saved looking for a space.

important role in the rapid BEV diffusion. Moch and Yang (2014) and Fearnley et al. (2015), found that European markets with substantial incentives have larger market shares than those with less or no incentives.

3. Theoretical framework, material and method

The BEV development in Norway should be reviewed within a socio-technical framework that conceptualizes transportation as a configuration of elements (Rip and Kemp, 1998), including technology, policy, markets, consumer preferences and behaviour, infrastructure, cultural meanings and scientific knowledge (Geels, 2012). The system is maintained, reproduced and changed by actors, such as automakers, consumers, media, engineers, authorities and others. A major shift in these systems is termed a socio-technical transformation, which grows out of initial niches (Hoogma et al., 2002; Rip and Kemp, 1998; Geels, 2002). Long development times and the life of vehicles, as well as the established practises of vehicle-based mobility must also be taken into account. A transformation may therefore take decades to unfold as the new regime develops parallel to the existing. On the other hand, Rogers (1995) states that when a critical mass of users have been reached, others will rapidly follow. Policies, including support for R&D (Rosenberg, 1982) and market incentives (Söderblom et al., 2015), are needed to support the introduction of new technologies that are costly in the early stages of development. Some BEV characteristics, such as range and the time required to refill energy, are inferior to ICEVs and constitute barriers to diffusion (Figenbaum et al., 2015a). The introduction of BEVs may therefore require incentives and political commitment (Ramjerdi and Fearnley, 2014), a situation generally found for environmental technology (Jacobsen and Bergek, 2011; van den Bergh et al., 2011), but may also require information provisions (Faber and Frenken, 2009).

Among others, models or frameworks for the diffusion of technologies in a market have been developed by Rogers (1962, 1995), Al-Alawi and Bradley (2013) and Dijk et al. (2012). Rip and Kemp (1998), Schot et al. (1996) and Hoogma et al. (2002) state that new technologies can grow through strategic niche management. Others attempt to present the complex interaction between different actors at different levels of society, and how that interaction affects the ability to make a breakthrough, such as Geels (2005, 2012) introducing the multilevel perspective (MLP) framework to transportation. The MLP aims at explaining the diffusion of technologies as an interplay between actors and practises at three levels (Geels, 2012):

1. Niches, often demonstration programmes, involving users, buyers and niche producers
2. Regimes with actors such as car producers, charging network providers, NGOs, consumer organizations, other industries and established practises of vehicle-based mobility.
3. The landscape with influential exogenous factors: oil price, international politics, peak oil, etc.

These “levels” refer to heterogeneous configurations of increasing stability, thus constituting a nested hierarchy in which regimes are embedded within landscapes, while niches exist inside or outside regimes (Geels, 2012). The basic concept is illustrated in Fig. 1.

Although each transition is unique, the general dynamic according to the MLP is that transitions come about through interactions between processes on these three levels: (a) niche-innovations build up internal momentum, (b) changes in landscape level create pressure on the regime, and (c) destabilization of the regime creates *windows of opportunity* for

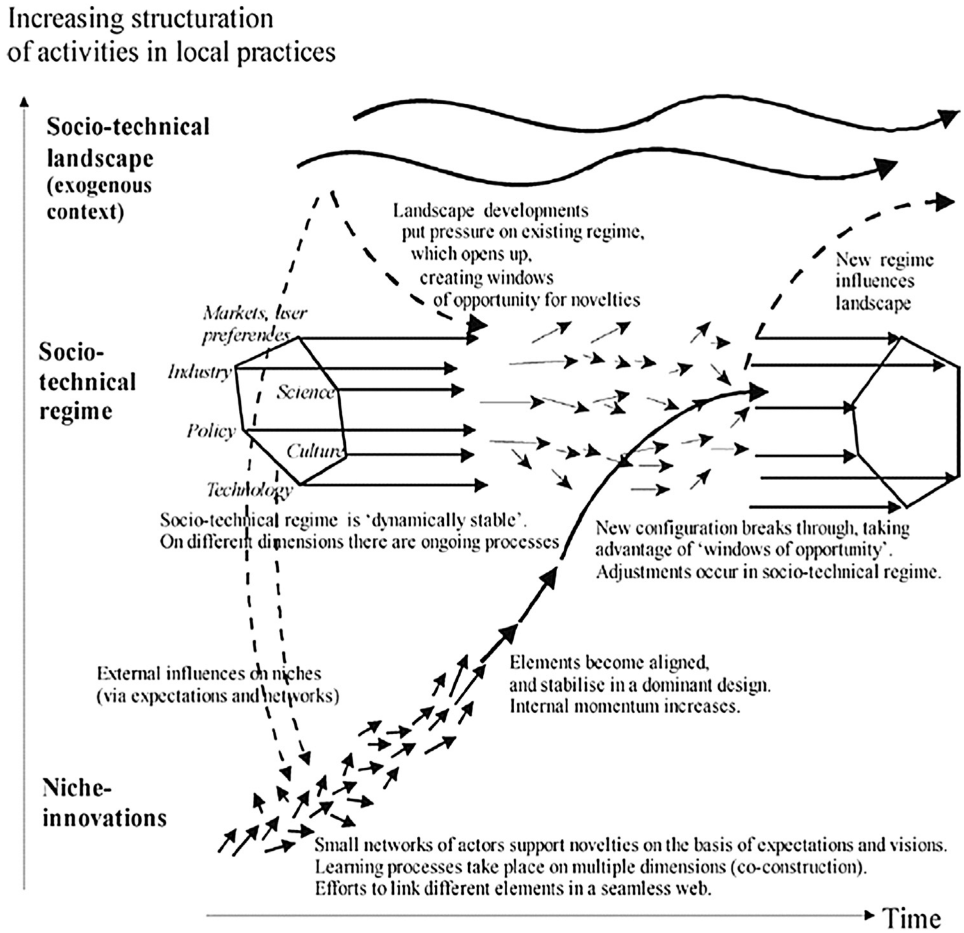


Fig. 1. Multi-level perspective on transitions, illustrating processes at three different levels: the socio-technical landscape, the socio-technical regime and niche innovations. Source: Geels (2012).

niche-innovation (Rip and Kemp, 1998; Geels, 2002; Geels and Schot, 2007). The MLP helps understand why there may simultaneously be a flurry of change activities (at the niche level), and relative stability of existing regimes, in uncertain and messy transition processes (Geels, 2012)). The MLP is a heuristic framework requiring substantive empirical knowledge, which guides the analyst's attention to interesting patterns and mechanisms (Geels, 2012, p. 474).

MLP is commonly used at the global level. Nonetheless, Nykvist and Nilsson (2014) used MLP in a local study on the diffusion of BEVs in Stockholm to investigate three hypotheses for why the BEV market in Stockholm has not developed: (1) a lack of niches or poorly functioning niches, (2) a strong ICE regime, and (3) the lack of economic incentives, policy direction and visions (governance). In their analysis, the national governance "network" was lifted out of the regime and placed in a "national landscape". They found support for the *niche* and *regime* hypotheses, but inconclusive evidence for the *landscape* hypothesis. In climate policy, the national governance network will act on influences from the landscape, seeking to push the regime and support niches. Consequently, there is an argument for lifting the national governance network out of the regime level.

Norway is a highly successful BEV market and a neighbouring country to Sweden. The three opposite hypotheses will therefore be tested in Norway, with the addition of a hypothesis that explores the importance of windows of opportunity.

1. *The niche hypothesis*: The rapid development of BEVs in Norway is the result of well-functioning niches for BEVs to expand in and from.
2. The *regime hypothesis*: The rapid development of BEVs in Norway is the result of a weak ICE regime in Norway
3. *The governance hypothesis*: The rapid development of BEVs in Norway is the result of economic incentives, policy direction and visions at different scales.
4. *The opportunity hypothesis*: The development of BEVs in Norway is the result of "windows of opportunity" opening up regimes, and niche actors taking advantage of these opportunities.

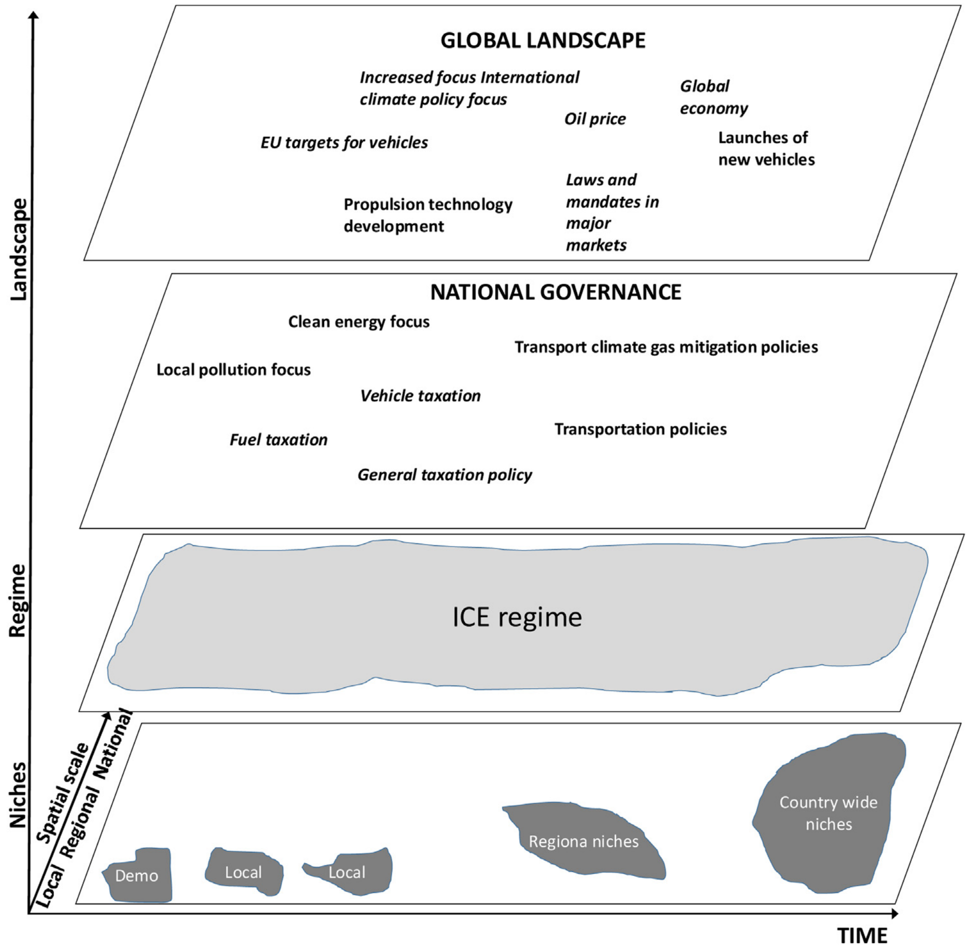


Fig. 2. MLP concept adapted for this article.

A layer in-between regime and global landscape, termed "National governance", is introduced to enable an analysis of how national policies have helped to contribute to making Norway's BEV trajectory so different from that of other countries. This layer contains national transportation and climate policies, BEV incentives and initiatives to help support the Norwegian BEV industry's development in the early 2000s (Figenbaum et al., 2015a,b). External exogenous factors not controlled by actors in Norway, such as the activities of the auto industry and the European Union, are placed in the international landscape. This approach allows for a structured and transparent analysis of the importance of national governance in explaining why the Norwegian BEV development deviates so much from that of other countries.

The *x-axis for the MLP framework is time* and the *y-axis shows the degree of societal structuration at different levels,* as in Geels (2002). *A third axis will be used in this article for a local, regional and national dimension for niches*, thus taking into consideration the importance of peer-to-peer communication in consumer technology diffusion processes (Rogers, 1995). Rogers's theory of diffusion of innovations states that technology interested innovators are the first adopters of innovations. They are influenced from outside information sources such as mass media, and can thus be geographically dispersed. The next adopters, termed early adopters, take the innovation into use, inspired by these innovators and by seeing the technology at work (Rogers, 1995). In turn, they are well connected with their peers, and respected for their judicious innovation decisions. Thus, they influence and inspire the early majority that live around them to also adopt the innovation (Seebauer, 2015) through an experience transfer effect (Xiong et al., 2016) that make adoption much more likely (McMichael and Shipworth, 2013). Supported by this peer-to-peer communication, a critical mass will be reached and further adoption will be self-sustaining (Rogers, 1995). Thus, adoption is expected to start in geographically dispersed niches that expand radially into regions eventually merging at a national scale, when the technology has evolved into a regime. The general concept is illustrated in Fig. 2 as a basis for the analysis, with the final result displayed in Fig. 11.

The following sources will be used in the analysis:

1. Policy documents such as
   - Government white papers, settlements and decisions in the parliament

Table 2
Characteristics of the main periods in BEV development in Norway.

Period	Characteristics
1989–1998 Experimental activities	Experiments, field testing and attempts at creating niches and industrial development. Incentives justified as a means to allow experimentation to see whether BEVs could be viable. French Ni-Cd battery industrialization enabled newcomers, such as the Norwegian BEV developer Think, to use this battery. The period ended when Think went bankrupt.
1999–2002 Failure in attempt to expand niches to a regime	The Ni-Cd battery industrialization led to the launch of BEVs from automakers such as Peugeot, Citroën and Renault. Needing BEVs to meet California regulations, the Ford Motor Company took over Think in 1999. New incentives were introduced to support Think.
2003 to the end of 2009 Successful niches keep the BEV option alive	All major vehicle makers terminated BEV production in 2003, after changing regulations in California, a slow market uptake and Ni-Cd batteries no longer being an option with new European battery regulations. Ford sold Think, and the political focus shifted to hydrogen and biofuels. Li-Ion batteries were not yet available, and most countries abandoned BEVs. Second-hand BEVs became available for import to Norway and successful niches were established. Think was restarted as a result of an increased policy focus on climate, and a new model entered production in 2009. The period ended when the financial crisis hit Norway, and Think lost funding and was incapable of producing.
2010–2013 Niches expanding regionally	Support for development of electrified vehicles was introduced in the wake of the financial crisis. The Li-Ion battery was industrialized, the global climate focus was increased and new ZEV regulations were introduced in California. Nissan, Mitsubishi and Renault successfully launched BEVs in 2010/11, but Think went bankrupt again. BMW, VW and others launched BEVs in 2013, and the Tesla Model S came about in 2012. Niches expanded around cities into regional markets, and a broad settlement on BEV policies was decided in the Norwegian Parliament.
2014 to the start of 2016 A BEV regime on the horizon	Regional niches overlapped into a national market, and a new regime was on the horizon. Being the biggest importer of vehicles to Norway, VW launched the E-Golf. New customer groups were attracted, reaching into the early majority segment. Some incentives had to be scaled back, and a new political agreement was settled in the Parliament in June 2015.

   - Municipal and provincial activities and policies
   - White papers from consumer and trade organizations and NGOs
2. Historical material and literature
   - Historical news articles (Retriever, 2015), reports, articles and papers
   - Reports, articles on BEV market developments in Norway and internationally
3. Statistics
   - Vehicle market and vehicle fleet
   - Energy and household statistics
4. Surveys of owners of BEVs, non-owners and interviews with stakeholders
   - Survey of 1 722 BEV owners recruited nationally from the Norwegian Electric Vehicle Associations membership register, and 2 241 ICEV owners recruited from the Norwegian Automobile Federation membership register in the Oslo-Kongsberg region. The survey was conducted online in February 2014. The questionnaire was based on a review of literature and older surveys. Further information on the design of these surveys is found in Figenbaum et al. (2014).
   - Thirteen interviews (five with more than one interviewee) with transportation sector stakeholders in Norway between April and October 2014. Further information is found in Assum et al., 2014.

These data sources are combined to analyse developments in the BEV market niches, the various actors' involvement in- changes to, regimes, national and international policies, and interactions between these levels creating windows of opportunity, for five distinctive periods in the BEV development. The analysis will then be used to test the four hypotheses.

4. Niche, regime, governance and landscape developments

Since 1989, the Norwegian BEV market development has been divided into five periods based on significant activities or events arising in the niches, regime, governance network and international landscape, as seen in Table 2:

4.1. Experimental niche activities – 1989 to1998

In 1989, some pioneers started BEV niche activities in Norway. The first BEV was imported by enthusiasts, who were inspired by the tour de sol races (BEV race) and the Solarmobil (lightweight BEV) exhibitions in Switzerland (Asphjell et al., 2013). These pioneers applied for a registration tax exemption for that vehicle, leading to the first BEV incentive, with the exemption from the vehicle/registration tax being temporarily introduced from 1990. At first, it was enforced as a letter stating that an exemption was granted "to allow for the testing of BEVs". The exemption became permanent in 1996. The reasoning behind the exemption was, "to stimulate the usage and development of BEVs" (Ministry of Finance, 1989, 1995). This incentive was crucial, as the progressive registration tax could amount to more than 100% of the sales value of the vehicle. Because BEVs had a higher sales value due to low volumes and being a new technology, the tax would have been prohibitive. This exemption laid the foundation for all subsequent BEV activities, as illustrated in Fig. 10.

Upstarts, among them the Norwegian PIVCO[2] and the Danish Kewet, attempted to develop small two-seater BEVs. Prototypes of the PIVCO vehicle were field tested in Norway and California (CALSTART, 1995), and a very limited number of Kewet's were imported to- and sold in Norway. The municipality of Oslo and Oslo's monopolist electric utility, Oslo Energi, supported these activities. Deals between the Stavanger region's electric utility company (owned by the municipality) and Peugeot in France, and between a Norwegian leasing company and the French utility EdF, resulted in the availability of Peugeot and Citroën BEVs in a few places (Figenbaum and Kolbenstvedt, 2015a). The first market niches were municipal and utility fleets testing the technology (Figenbaum, 1994). These activities were separately established from the auto industry regime, since importers and dealers showed no interest (Figenbaum and Kolbenstvedt, 2015a).

A small, BEV niche struggled to gain a foothold, through ongoing innovation processes, and gradually build political and industrial support. The 1990 California ZEV mandate that included an obligation to sell 2% of BEVs from 1998, 5% in 2001 and 10% in 2003 (CARB, 2015), was an important inspiration to Norwegian actors targeting the reduction of local pollutants and the introduction of clean electricity into the transportation sector. Actor networks, such as the EV association, were initiated by the municipality of Oslo and Oslo's electric utility company with support from industrial actors (Asphjell et al., 2013) to help foster industrial and market development. It was founded in 1995 as a stakeholder organization, and inspired by CALSTART, a California EV business incubator, took the name NORSTART.

The 1994 Winter Olympics in Norway saw the establishment of an industry and commerce network, "Birkebeinerlaugets Bedriftsutvikling", which worked for improved framework conditions for the Norwegian BEV industry. The Norwegian BEV prototype from PIVCO (name changed in 1998 to THINK) was successfully demonstrated at the Olympics, operating down to −20 °C, giving the company a boost in the search for investors that could support industrialization.

Free parking and free passing on toll roads were established as national BEV incentives from 1997 and 1999 by national laws. These changes were induced by actors of the BEV niche, such as municipalities, electric utilities and fleet users. Back in 1993, an NGO started the process by seeking media attention, driving their BEV on the toll roads of Oslo and parking in municipal parking spaces without paying for either, thereby breaking toll road and parking legislation. The NGO's goal was to put pressure on the municipality of Oslo, and the Public Roads Administration, to allow BEVs to use toll roads and park for free. The EV association and BEV actors pressured politicians from their side. Oslo's politicians were receptive, as they targeted less local pollution and wanted to make Oslo an attractive place for Think to locate their BEV production, but nonetheless had to go to the government to obtain the required changes to the parking and toll road regulations. Municipalities now had the tools to develop local BEV policies.

Advances in Ni-Cd batteries during the 1990s made it possible for French car manufacturers, to put BEVs on the market in 1998 with government support (Arval, 2010). THINK used the same battery, piggybacking on the French development, thereby reducing their industrialization costs.

As seen in Fig. 3, the price of a BEV was twice that of small gasoline vehicles in 1998, the quality was not quite up to automotive standards and a proper dealer network was not available, although a few fleets and enthusiasts still bought vehicles to simply experience the technology. The ICE regime did not fight against BEV incentives, and there are no traces of criticism in old newspapers (Retriever, 2015). However, hardly any BEVs were sold at the time (see Fig. 3), and Think and Kewet went bankrupt in the end of 1998, and BEV prospects thus seemed dim.

4.2. Failing attempt to expand niches to a regime – 1999 to 2002

The Ford Motor Company bought Think in 1999. Ford's main target was to deliver low-cost BEVs to California to help meet ZEV mandates (Ford, 2000) at a lower cost than their own internal BEV project (Figenbaum, 2015). Ford invested in product development and in setting up production, opening the Think factory in late 1999. Ford had expectations of deliveries to fleets owned by the Norwegian government to establish a viable home market for THINK (Asphjell et al., 2013; Figenbaum, 2015). Nonetheless, the government did not instruct public fleets to procure BEVs, stating that it was up to the market to respond to the BEV incentives that had been introduced. Uptake in fleets was low, but a few municipalities and businesses (utilities, couriers), as well as technology- or environment-oriented consumers, tested BEVs. The summer/winter range of approximately 80 km/50 km, high prices, reliability issues, battery service every 6000 km, no EuroNcap safety rating, and limited availability, were all barriers to adoption.

The Norwegian importer of the Danish Kewet bought the bankruptcy estate from Denmark in 2000, moved the equipment to Oslo and initiated small-scale production.

With Ford on board in THINK, and a small BEV producer using the remains of Kewet, a BEV niche emerged. Specific BEV number plates (i.e. EL00001) were introduced from 1999 to make incentives easier to administer. Consequently, pressure was on the government to introduce more incentives to support this cluster of BEV production, and reduced company car taxation came in 2000. Municipalities such as Oslo and Stavanger, as well as utility fleet owners, who in the previous period had been eager to support the introduction of BEVs, were now not eager to buy BEVs themselves.

The vehicles proved too expensive for the market, hence resulting in slow sales, in part because the production cost of the THINK vehicle rose 20% after Ford took over due to a need to improve quality and reliability (Figenbaum, 2015) and low

[2] From 1998, the name was changed to Think, written as TH!NK.

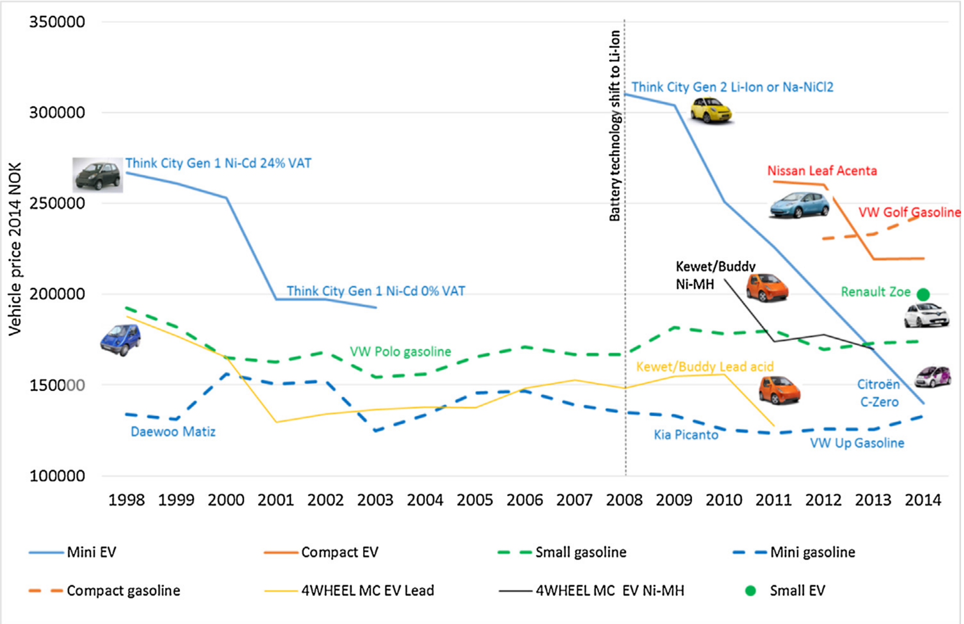


Fig. 3. Sales prices of BEVs in Norway compared with gasoline vehicles. BEV prices are without all taxes according to the incentives. ICE vehicle prices include all registration taxes and VAT. Source: Tax Norway 2015, various webpages, news articles and historical sales material.

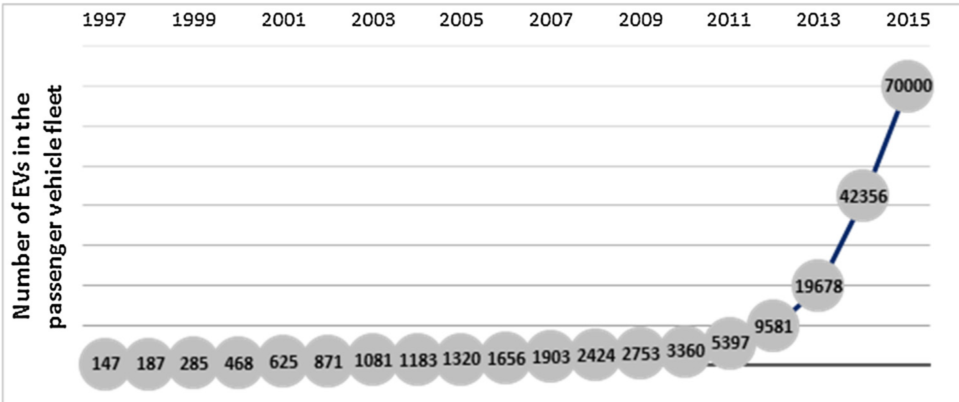


Fig. 4. Passenger BEV fleet in Norway, 2015 preliminary ±1%; source: Asphjell et al. (2013) and OFVAS (2016).

volumes. Exemption from VAT (then 24%) was therefore proposed to increase BEV competitiveness. It was introduced in 2001 (Figenbaum and Kolbenstvedt, 2013; Innst. O. nr. 24 (2000–2001)) following a political agreement in the parliament on a revision of the VAT law, with one sentence in the agreement stating that BEVs shall be exempted from VAT (Adresseavisen, 2000; Budsjettavtale, 2001). The municipality of Drammen (a small city 40 km south of Oslo) even introduced a 25 000 NOK purchase support for its inhabitants (Aftenposten, 2001), resulting in an improvement for the competitive situation of BEVs. The VAT exemption is seen as the reason for a price drop from 2000 to 2001 in Fig. 3.

Still, sales remained modest, partly due to limited vehicle supply. Ford was keeping production of the Think vehicle limited, waiting for a new cheaper model better suited for the US market (Figenbaum, 2015). A slow increase of the BEV fleet followed, as seen in Fig. 4.

With government support, French car manufacturers put about 10 000 BEVs on the market in the period from 1998 to 2002 (Arval, 2010), including some that were sold in Norway.

At the end of 2002, Ford decided to sell Think after California amended the ZEV regulation in 2001, thereby allowing PHEVs to fulfil most of the ZEV requirement. A lawsuit resulted in a further relaxation in 2003. Ford did not need to sell Think vehicles in the US anymore, the Norwegian market was still slow and the new model required further development (Figenbaum, 2015).

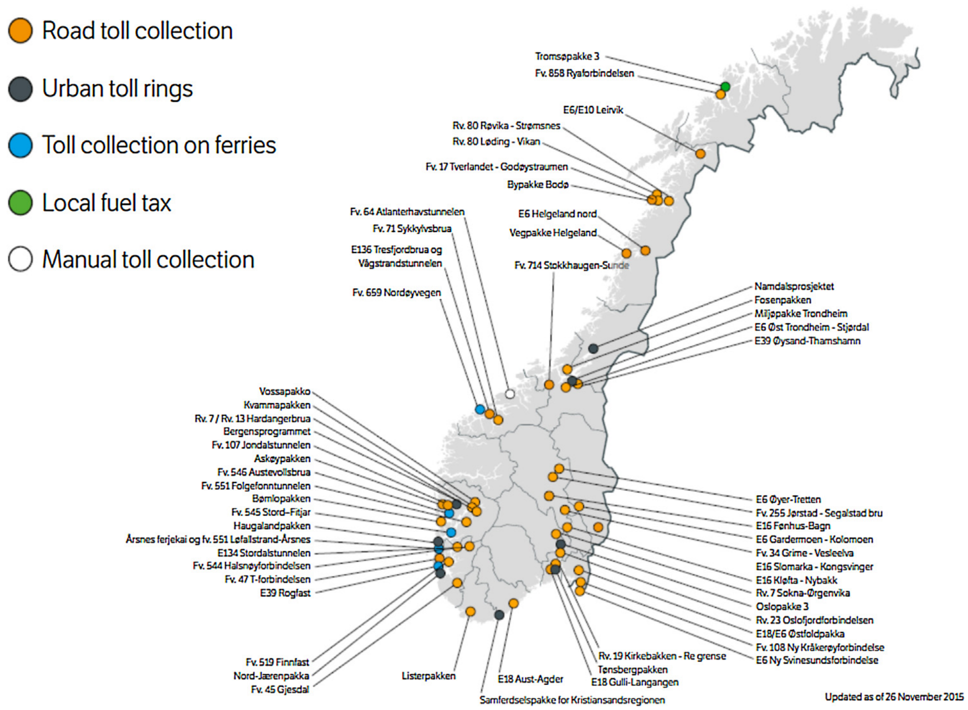


Fig. 5. Tolling projects in Norway as of 26 Nov. 2015; source: NPRA (2015).

4.3. *Successful niches keep the BEV option alive – 2003 to 2009*

From 2003, there were several BEV setbacks. French car manufacturers stopped producing BEVs. Poor sales, changing priorities and a planned ban on Cadmium in batteries in the EU all contributed to that decision. By 2003, all automakers and most countries had abandoned electric vehicles. Ford sold Think in 2003 (Asphjell et al., 2013), but the new owner proved incapable of producing vehicles, leading to a new bankrupt within a couple years. Kewet lost the type approval, but by 2005 managed to reclassify the vehicle as a 4-wheel "motorcycle" with less extensive technical requirements. The previous period had proven that there was a potential for use of BEVs in Norway, so politicians left the incentives in place in this turbulent period.

In 2003, an administrative decision opened the bus lanes for BEV owners in Oslo and surrounding municipalities, after intense lobbying from BEV niche actors. An opportunity arose when the Public Roads Administration wanted to ban private minibuses from bus lanes (Figenbaum and Kolbenstvedt, 2013). The access was expanded to all of Norway in 2005 after it had been demonstrated that busses were not delayed in the Oslo area. Moreover, private minibuses were thrown out of bus lanes in 2009, thus leading to a further boost in BEV demand.

A steady increase in toll roads around cities and main roads provided another geographically expanding BEV niche market, see Fig. 5, and by 2014 toll road revenues had reached 10.5 billion NOK, up from two billion in 2000 (Ministry of Transport and Communications, 2015).

The Norwegian BEV producers were not in a position to take advantage of these developments, as Think was not producing BEVs anymore, and the Kewet production was only 100–200 hand built vehicles per year. These two BEV niche markets were therefore created and kept alive by importers of second-hand BEVs produced in France and by Think previously (Asphjell et al., 2013), an opportunity created when other countries terminated their BEV activities.

By now, the EV association had evolved into a growing consumer organization actively promoting BEVs and fighting to keep incentives in place. It became even more difficult for the government to touch BEV incentives, and they remained intact.

Think was re-established in 2006 by Norwegian investors, eyeing the political focus on climate policy as an opportunity. A new model based on the vehicle Ford developed in 2002 was launched in 2009, but unfortunately the company ran out of cash following the financial crisis in 2008–2009. A Norwegian government investment fund provided support, but required that an automotive actor should be involved in the project (Asphjell et al., 2013). Valmet in Finland bought into THINK, although the production then had to be moved to Finland. The price of the Think vehicle, now with Li-Ion batteries, was

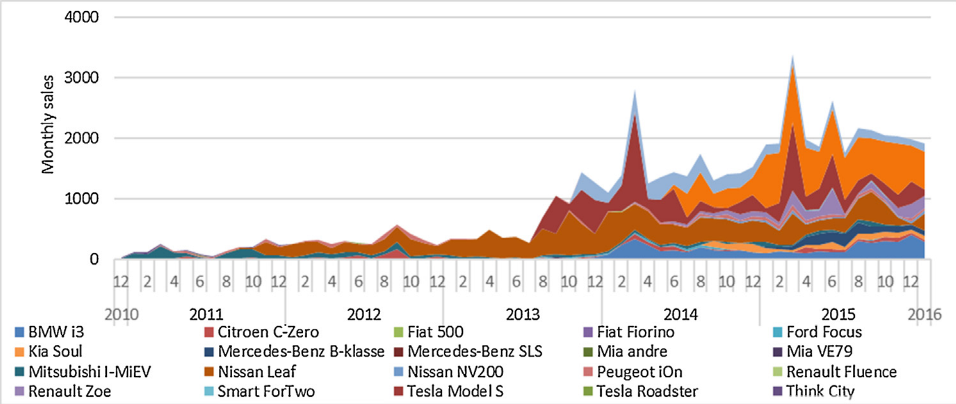


Fig. 6. Monthly BEV sales in Norway 2011–2016; source of data: OFVAS (2016).

approximately three times that of small gasoline vehicles, c.f. Fig. 3. Some vehicles were nevertheless sold to bus lane and toll road users, and Kewet[3] introduced a new model in 2009.

Arguing that BEV should also be attractive in rural and coastal areas to help support climate policy targets, and as an aid to THINK and Kewet, the government reduced rates for BEVs on national main road ferries from 2009 (Ministry of Transport and Communications, 2008). Things started looking rosy for BEV niche actors, apart from the plans by major automakers to introduce BEVs within a few years. The ICEV regime represented by the Vehicle Importer Association was apparently seeing a threat from BEVs, voicing concerns over the loss of tax income due to BEV incentives in the report from a Government-appointed resource group tasked with looking at ways to improve the BEV market (Resource group, 2009). The politicians ignored these concerns, and the incentives were kept in place. The political BEV targets had therefore moved from local pollution and industrial development towards climate policy targets.

4.4. Niches expanding regionally – 2010 to 2013

After the financial crisis in 2008/2009, the Norwegian government, influenced by NGOs, introduced an economic stimulation package, including six million Euros for the establishment of charging stations for BEVs to keep up activity among electricians (Innst. S. nr. 139, 2008–2009), while simultaneously improving BEV infrastructure. Nissan got UK support for the Leaf BEV production facilities, (EIB, 2011; Nissan, 2010). At the same time, the EU had proposed the 95 g/km average CO_2 emission target for new vehicles in 2020 (COM (2007) 856 final), which indicated a need for a share of electrified vehicles in the sales mix to reach the target and thus avoid fines.

The traditional vehicle industry re-entered the BEV scene in 2010, following advances in Li-Ion battery technology and cost reductions as shown in Nykvist and Nilsson (2015), as well as a global focus on climates policies and measures. In 2010, Mitsubishi started sales of the I-Miev through all dealers in Norway. The first vehicles were delivered in early 2011 to desperate previous minibus drivers around Oslo who wanted to gain access to the bus lanes they had been accustomed to using. Chaotic conditions occurred at the dealer in Asker, a municipality 20 km southwest of Oslo (Asphjell et al., 2013), and over 1000 vehicles were sold in less than a year in Norway. Later the same year, Peugeot, Citroën and Nissan joined the BEV market, and sales increased rapidly, as seen in Figs. 6 and 7. These producers profited heavily on the opportunity created by the incentives that were already in place, which was a result of the BEV niche actor's struggle over two decades.

The Norwegian BEV producers Think and Buddy Electric (formerly Kewet) soon ran out of cash in the struggle to compete with BEVs from these large multinational companies and importers with huge resources. For this reason, the Norwegian BEV production ended (Figenbaum et al., 2015b).

A BEV-specific policy was proposed for the first time in the white paper on Climate Policy in 2012 (Norwegian Climate Policy, 2012), followed by a broad climate policy settlement in the Parliament the same year (CPS, 2012). A target for new passenger vehicles to emit on the average 85 g CO2/km by 2020 is presented in the two documents. Figenbaum et al. (2013) have shown that this target can be reached if BEVs and/PHEVs together will achieve 20–30% market shares. The settlement further states that the tax system will be used in the greening of the vehicle fleet, and Norway will continue to be at the forefront in the greening of the transport sector, while the government will contribute to the establishment of infrastructure and allow BEVs to continue using the bus lane for as long as possible. No specific BEV volume target was stated other than that incentives would remain in place until 2017 or 50 000 BEVs were on the road (CPS, 2012).

[3] Kewet was bought by the Norwegian importer Kollega Bil in 1999, changing its name to Pure Electric and later to Buddy Electric. In this article, the name Kewet has been used to avoid confusion.

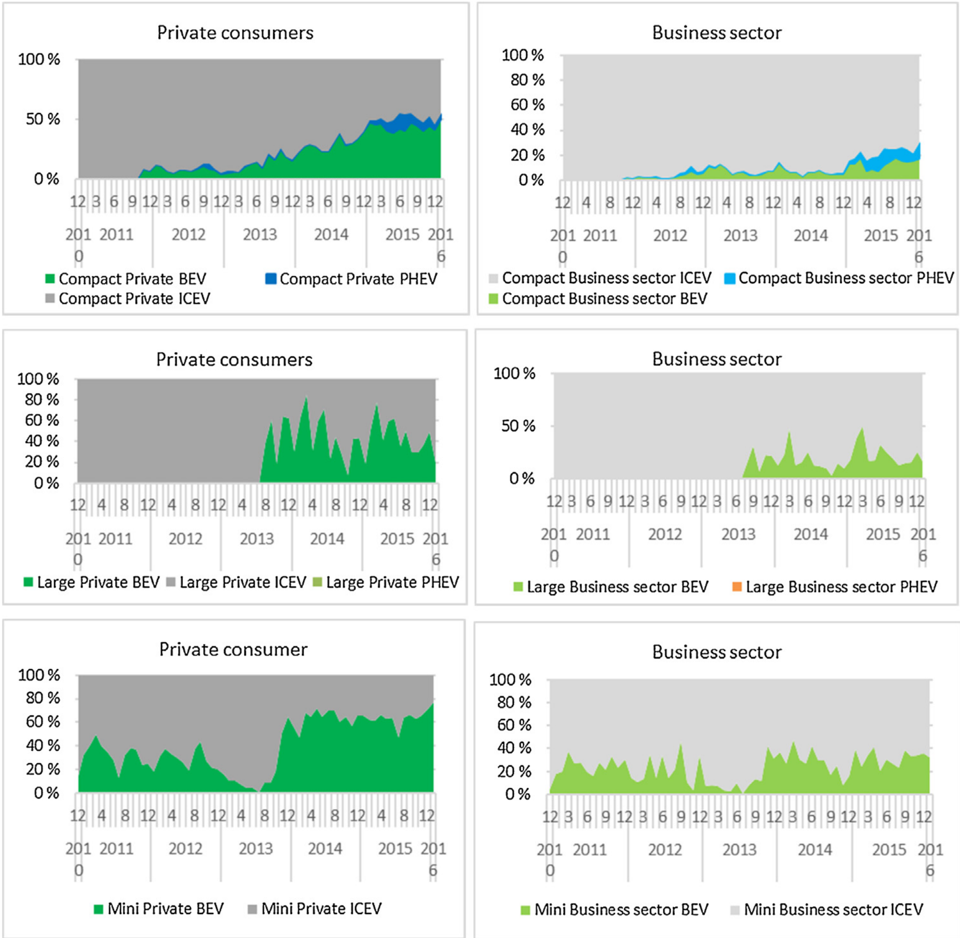


Fig. 7. BEV, PHEV sales in the Private and Business sectors for the mini, compact and large-vehicle segments 2010–2016; source of data: OFVAS (2016).

By 2013, an increased selection of vehicles was available (see Fig. 6), leading to a very competitive market with falling prices. BEVs became a cheaper option than ICEVs in compact and larger vehicles, and on par with ICEVs in smaller vehicle sizes, as seen in Fig. 3. Sales therefore increased rapidly. The bus lane access and toll road user niches were effective in recruiting customers uncertain about the total economy of BEVs, as these incentives had an immediate and high value. The final breakthrough for BEVs came when the leading market actor, VW, launched two models in 2013/14. Importers without BEVs lost market share, those with BEVs gained market shares and niches expanded across the country. The BEV association persuaded dealers to give away one-year membership for free to all buyers of BEVs, which rapidly gained importance with growth in membership.

4.5. BEV regime on the horizon – 2014 to the start of 2016

The total BEV share of new passenger vehicles reached 18% in 2015. The main reason for the expansion over the previous period was the increased selection of models from more suppliers and dealers, and that the VW E-Golf came on the market. The share of sales of the electric version of the VW Golf, of the total sales of the Golf, was 48% in the first months it became available in 2014, and rose to 55% in 2015. If considered a separate model, the E-Golf would have been the bestselling vehicle in 2015. Nissan Leaf was in third position in 2013 and 2014. Tesla Model S was the bestselling large vehicle in Norway in 2014 and 2015 and number five of all vehicles sold in those years. The market shares of BEVs and PHEVs are shown per segment in Fig. 7, illustrating that BEVs dominate the segments they are available in, with approximately 40% of private sales in the compact and 50% in the large vehicle segments. In the small vehicle segment market shares are a bit lower.

More than 80% of BEVs are bought by consumers (Figenbaum and Kolbenstvedt, 2015b), whereas 74% of these were owned by multi-vehicle households according to a 2014 survey of BEV owners. Most users in the survey said they would buy a BEV again, while less than 1% said they would not, indicating that the technology has been accepted in the market. The survey data also shows that BEVs are driven about as much per year as other newer vehicles, an indication that BEVs have been easily assimilated into the transportation system. Owners are younger than traditional new vehicle owners. If they

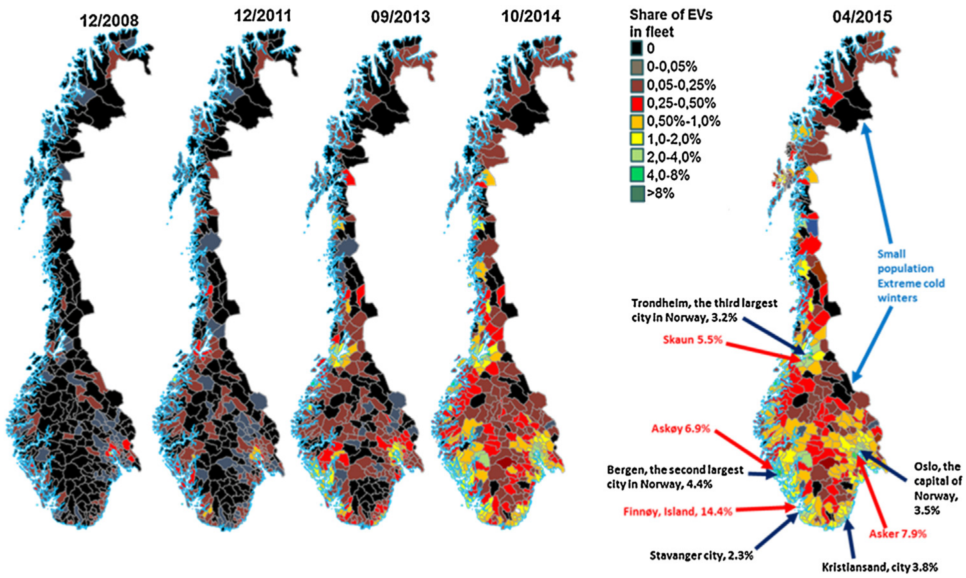


Fig. 8. Geographical diffusion, BEV share of fleet in municipalities in Norway 2008–2015; source: TOI (2015).

continue buying BEVs, then the market will expand over time through a cohort effect. On the other hand, municipalities and businesses have been slow in including BEVs in their fleets, thereby resulting in a weaker fleet market (Assum et al., 2014). Leasing, the preferred BEV ownership form, was not exempted from VAT until the summer of 2015.

Fuel providers in the ICE regime, such as Statoil Fuel and Retail, joined the party in late 2015, and will install 40–50 fast chargers at their petrol stations (Elbil, 2015) in 2016. New actors install home chargers that dealers sell as options with vehicles (VW, 2015).

Since 2008, BEVs have spread out from the initial few cities, to their surrounding municipalities and other local niche markets, and these regions have finally expanded to the entire nation, as seen in Fig. 8. By the end of 2015, the fleet had grown to 2.8% of the total vehicle passenger vehicle fleet, some 70 000 BEVs, and 410 of Norway's 428 municipalities had BEVs (NPRA, 2016). The diffusion has been supported by new geographically dispersed toll roads being established, by peer-to-peer communication within geographical areas and to adjacent areas in larger and larger circles (Figenbaum and Kolbenstvedt, 2015a), merging to a national market.

The BEV association had by 2015 grown into a large consumer organization with eight local organizations and 8–10 full-time employees, supporting 30 000 members (EV association, 2015).

The bus lane incentive was so successful that BEVs started congesting bus traffic. From the summer of 2015, BEVs must therefore have at least one passenger in addition to the driver in the most popular bus lane (along the main southwestern road to Oslo) during rush hour. When the Tesla Model S appeared in the bus lanes, a debate heated up in the press and among drivers in general about BEV privileges being for the rich (Retriever, 2015). The free ferry incentive was downscaled in some places after a national reform in road ownership in 2010 made provinces owners of what used to be government ferry routes. The reduced rates on ferries apply to government-owned ferries, as provinces can decide on whether to keep or remove the incentive. Toll road companies have not yet been threatened by increasing BEV share, as they are allowed to increase rates 20% and prolong the tolling for up to five years. The BEV shares in Oslo's toll ring reached 5.4% in 2015 (Fjellinjen, 2016) and 4% in Kristiansand (NRK, 2016). Moreover, a BEV share of 25% was reached in an underwater toll road in October 2015 (Aftenbladet, 2016).

The government inked a new settlement in the parliament in June 2015 with the overarching principle that BEVs shall continue to be an attractive option. As seen in Fig. 9, BEVs are now an essential component in meeting the climate policy target of reducing the average Norwegian new vehicle emissions to 85 g/km as suggested by Figenbaum et al. (2013). The vehicle taxation policy is gradually being adjusted to push emissions towards that target, while providing a predictable economic framework for vehicle importers. A gradual phasing out of incentives as technology improves and costs go down is planned (TTPS, 2015), and all vehicles shall eventually be taxed based on the external costs they impose on society. The annual tax will increase to half the rate of ICEVs in 2018 and to the full rate in 2020. A low rate for BEVs on toll roads could be introduced, and the reduced rate on ferries could be phased out. Exemption from VAT could be replaced by a subsidy scheme that will gradually be downscaled. The fate of the bus lane and parking incentives will be decided locally in the future.

These developments indicate that at the start of 2016, BEVs have potentially become a regime in Norway, as one can see changes in motoring practises, in expectations of what passenger vehicles need to be able to do, in ICEV regime actors' pursuit of opportunities with BEVs and in the institutionalization of BEV activities. The emerging BEV regime consist of two parts, one being part of the ICEV regime with Nissan, Volkswagen, BMW, Kia, Renault and Mercedes/Smart as the main

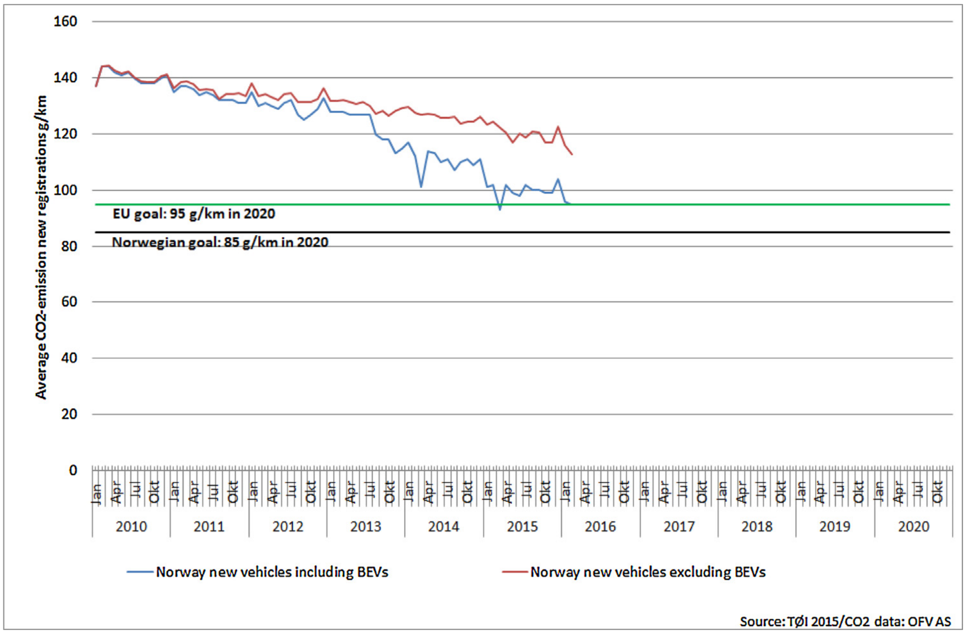


Fig. 9. New vehicle average CO_2 emissions (type approval value) with/without BEVs. Source of data: OFVAS (2016).

players, and a separate Tesla "universe". Tesla is a global niche producer, but grabbed the lead position in the large/luxury vehicle segments in Norway from 2014. Tesla Model S is compatible with 98% of the average travel needs of Norwegians, even without using Tesla superchargers (Figenbaum and Kolbenstvedt, 2015b).

4.6. Windows of opportunity and interactions between levels

Windows of opportunity have been explored many times during the BEV development, as seen in Fig. 10. After incentives intended to create opportunities were introduced, a flurry of niche activities followed. Because these activities failed to achieve sales volumes, new incentives were introduced, hence leading to further niche activities by new and existing actors. Although chaotic, the figure illustrates the most important interactions between landscape, governance, niches and markets, that over a period of 25 years culminated with the emergence of a BEV regime in 2016. It illustrates the very long timeline involved in the BEV breakthrough, and how incentives introduced quite early were kept in place long enough for actors to take advantage of them. The development accelerated when ICE regime actors came on board.

The first window of opportunity was opened when the very first BEV was imported to Norway in 1990 without a registration tax being imposed. Twenty-six years later, the high tax on ICEVs and the exemption for BEVs, has become a prerequisite for the BEV market expansion. Another prerequisite is the exemption from VAT, which was introduced 16 years ago to reduce BEV's price disadvantage, but by 2013 this led to a price advantage. The bus lane access created a successful market niche and became a display window, with BEVs easily identifiable with their specific EL number plates. Awareness of BEVs has thus spread to large vehicle using groups. Toll road users were another BEV niche which acted as a geographically expanding display window, as more and more toll roads opened across the nation. These niches were initially built up through imports of second-hand BEVs and sales of small "four wheel electric motorcycles", such as Kewet's, when no passenger vehicles were available on the market. Bus lane users not only saved time, they also saved range in the winter by not being stuck in traffic with the cabin heater draining the battery. Their experience with BEV's was therefore more positive, in effect making them BEV ambassadors.

However, it was not until the technology had matured to a level where Li-Ion batteries could be taken into use after 2009, and the traditional automakers launched production of BEVs, that the window of opportunity created by all these previously introduced incentives could be taken full advantage of. Incentives that had lured Norwegian's into buying rather small basic BEVs proved much more potent when BEVs, with the size and quality that buyers were accustomed to from ICEVs, were offered for sale in an unlimited supply from trusted dealers. One could say that ICEV importers could skip the niche market stage and go straight to the mass marketing they are experts at. BEV owners and potential BEV buyers saw the new BEVs that came on the market from 2010 as a step up from previous BEVs. The Mitsubishi I-Miev even came in second in the national "This Years Vehicle 2011" press award because the jury said it was a big step up for BEVs, offering comfort and safety details on par with ICEVs (Dagbladet, 2010). In other countries, buyers likely saw BEVs as vehicles with limitations.

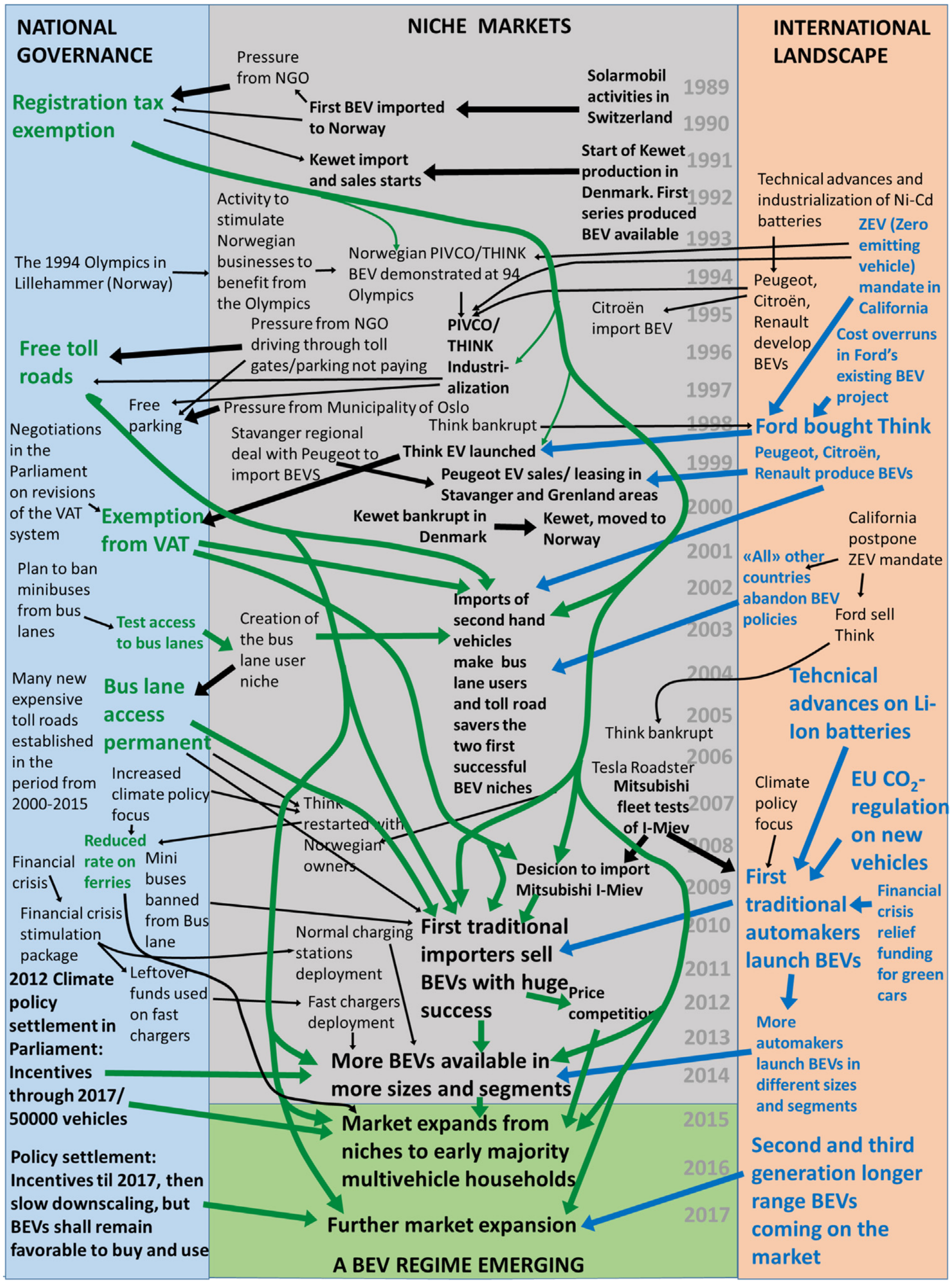
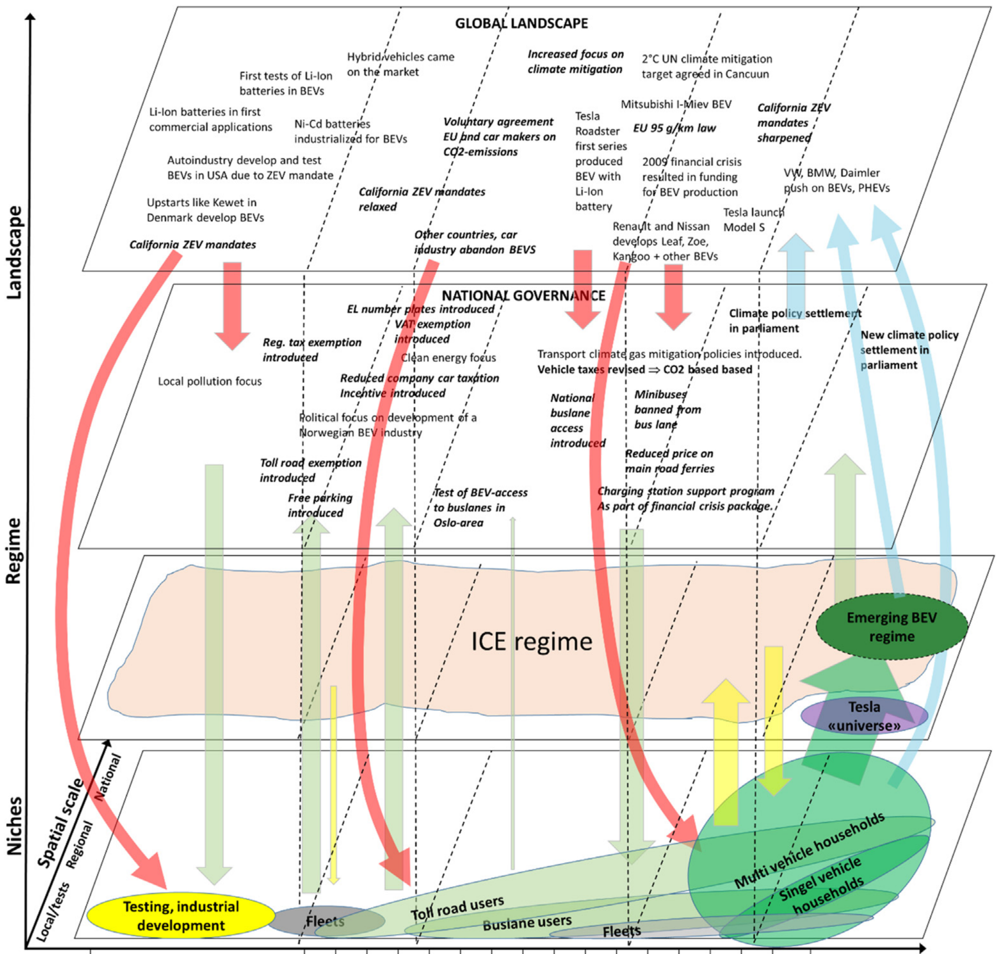


Fig. 10. Exploitation of windows of opportunity for Electromobility in Norway, to be read from top to bottom as a chain of events. Arrows indicating opportunities arising from previous events. Bold and thick arrows show essential Sequences of Events, green from national governance, blue from international landscape, black from/within niches. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

BEV niche actors, such as the EV association, embraced these new BEV actors. The EV association managed to persuade BEV dealers to give a free year of membership in the association with each BEV sale. A positive feedback loop was thus created that enabled the EV association to work effectively to improve BEV policies to the advantage of dealers.

The Norwegian BEV owners and stakeholders evaluate the incentives that led to these windows of opportunity as prerequisites for the diffusion of BEVs in Norway (Figenbaum et al., 2014; Assum et al., 2014). In particular, the incentives reducing the purchase price and access to bus lanes and free toll roads have been deemed vital (Ibid). In the book about the BEV history in Norway, BEV incentives are even termed "EV victories" (Asphjell et al., 2013). Lobbying by non-government organizations has therefore been important in the introduction of incentives. Accessible politicians in a small open country



1990 1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
BEV percentage of total fleet	0.03	0.03	0.05	0.06	0.06	0.07	0.08	0.09	0.11	0.12	0.15	0.23	0.4	0.8	1.6	2.7
BEV percentage of new vehicle sales											0.3	1.4	2.9	5.6	12	18%

Fig. 11. Multi-level perspective framework for analysing Electromobility in Norway. Red arrows: International influence on Norway, Blue: Norwegian BEV market influence on global landscape, Yellow: Influence between regime and niches, Green: Influences between governance and niches. Sources of sales volumes of BEVs: OFVAS (2015), SSB (2015a). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

like Norway may have contributed to windows of opportunity opening up more often in Norway than in larger countries with more complicated governance structures.

5. Resulting MLP framework for Norway

Table 3 shows that the validity of the four hypothesis evolves over the four periods from 1989 to 1998, 1999–2002, 2003–2009 and 2010 onwards. In total, these hypotheses seem to cover relevant aspects of the development of Electromobility over 25 years in Norway. All hypotheses seem to be supported after 2014, paving the way for a BEV regime.

Fig. 11 sums up the relevant activities in the international landscape, in national governance, in the regimes and in the niche markets discussed in earlier sections, all of which represent the proposed MLP model for the BEV market in Norway.

The thick coloured arrows and events in bold in the figure show the main influencing factors and paths leading to the large Norwegian BEV market. National characteristics, such as governance traditions, clean electricity and low speed limits on motorways, had an impact on this result. Other countries may reach other results and need other policy mixes.

6. Discussion

The niche hypothesis has found support. Combined with incentives providing owners with advantages not available to others, economic incentives that reduce user costs created effective niches. Users have experienced substantial economic

Table 3
Summary of test of different hypotheses on the factors behind the rapid development of BEVs in Norway by diffusion period; Red = not supported, Yellow = partially supported, Green = supported.

Period	**Niche hypothesis**: The rapid development of BEVs in Norway is the result of well-functioning niches for BEVs to expand in and from.	**Regime hypothesis**: The rapid development of BEVs in Norway is the result of a weak Norwegian ICE regime	**Governance hypothesis**: The rapid development of BEVs in Norway is the result of economic incentives, policy direction and visions on different scales.	**Opportunity hypothesis**: The rapid development of BEVs in Norway is the result of "windows of opportunity" opening up regimes, and niche actors taking advantage of those opportunities.
1989–1998 Test of marketability of BEVs, little pressure from governance network and landscape	Tests of marketability. Sales developed very slowly. Customers were mainly fleets testing BEVs. Vehicles were unreliable and had limited usability in normal operation. A period to find out if BEVs had a niche, what it was and if it worked in cold climates.	No ICE regime protest against incentives. BEVs were not considered a threat. One importer took in a couple electric vans as an experiment, testing the market.	No vision or policy evident. Incentives removing barriers were introduced after pressure from BEV enthusiasts to allow tests and experiments. Example: Exemption from registration tax.	Incentives were fought for over a long period before being introduced. Windows were forced open rather than opening up. However, once open, they remained so, resulting in later opportunities in the BEV diffusion process.
1999–2002 Establishment of the first BEV niches growing from initial tests. Some ICE regime support and Norwegian BEV production, and some national landscape pressure.	The main target niche was fleet vehicles, until VAT exemption made private consumers a target group. No successful niche was established due to lack of attractive and competitively enough priced vehicles. Some fleet users and a few technology enthusiasts bought BEVs.	Most vehicle importers were indifferent to BEVs, seeing no threat to sales, and did not protest against BEV incentives. 2–3 importers got involuntarily involved in servicing and selling BEVs around 2000, when municipalities and utilities entered into agreements directly with French automakers and the French utility EdF about distribution of BEVs in Norway.	Politicians reacted to requests for improved BEV policies, rather than initiating them. Policies were not anchored to a long-term national policy. The time horizon was "until further notice". The motivation was to support an emerging Norwegian BEV industry.	A window opened up when the VAT law was part of national budget negotiations in 2001. Clever lobbying resulted in VAT exemption for BEVs. In retrospect, this was the most important incentive for BEV diffusion in Norway, reducing BEV prices by 20% from then on.
2003–2009 Niches save BEVs from extinction, as political BEV support vanished in other countries and Norwegian BEV production disappeared. Incentives were, however, left in place.	A niche of importing second-hand BEVs appeared, leading to successful market niches: (1) Bus lane users, (2) toll road avoiders and (3) a few environmentalists and technologists. Public fleets were mostly not buying, as BEVs did not meet their safety requirements.	The ICE regime started voicing concern over BEV incentives in 2009, seeing signs that BEVs were coming on a larger scale. They called for technology-neutral incentives and more incentives for hybrids, but policies were not changed.	A more stable policy framework emerged when vehicle taxes were tuned to support vehicles with low CO_2 emissions. The reduced ferry rate incentive was introduced due to new possibilities for Norwegian BEV production, and to support climate policy targets.	An opportunity came when the Norwegian Public Roads Administration decided to ban minibuses from the bus lane and BEV lobbyists managed to secure access to the bus lanes for BEVs. The incentive have had a profound impact on sales of BEVs around Oslo, generating a lot of "buzz" around BEVs in the media and among people.
2010–2013 BEVs are produced by global actors. Incentives in Norway are becoming effective and influence actors. Niches are expanded regionally.	Existing niches grew, gradually emerging towards the mainstream market when more models at lower prices became available from several vehicle manufacturers having national dealer networks. Niches became regional. Fast chargers were built to help facilitate regional driving. Word-of-mouth from owners to their friends increased sales further.	The ICE regime was further weakened when some actors assimilated BEVs into their sales with success (Nissan, BMW and VW), actively supporting existing and improved BEV policies. Those with no BEVs to sell voiced concerns over incentives distorting competition, but by now it was too late. The policy was finally working, making it difficult to change.	The policy framework became anchored in a broad parliament agreement with the 85 g CO_2/km average target for new vehicles in 2020. This target is only achievable with BEVs being part of the market. The BEV incentives were to be preserved until 2017 or with 50 000 BEVs on the road according to the agreement.	The traditional car manufacturers launched BEVs into what can be seen as a giant window of opportunity. Incentives were in place and Norwegians had over two decades of acquired knowledge of BEVs and niche markets were in place, allowing them to move directly to the mass marketing of BEVs. A rapid sales increase followed.

Table 3 (*Continued*)

Period	**Niche hypothesis**: The rapid development of BEVs in Norway is the result of well-functioning niches for BEVs to expand in and from.	**Regime hypothesis**: The rapid development of BEVs in Norway is the result of a weak Norwegian ICE regime	**Governance hypothesis**: The rapid development of BEVs in Norway is the result of economic incentives, policy direction and visions on different scales.	**Opportunity hypothesis**: The rapid development of BEVs in Norway is the result of "windows of opportunity" opening up regimes, and niche actors taking advantage of those opportunities.
2014–start of 2016 A BEV regime on the horizon. Regional niches growing to a nationwide market.	The turning point is from 2014 when sales increased tremendously paving the way for an emerging BEV regime. Niches no longer have a meaning. Fast charging networks expand along main roads between regions.	BEVs are assimilated into the ICE regime and leading ICE regime actors also lead the emerging BEV regime. BEVs are now an option most buyers consider when buying new vehicles, and dominate the consumer mini, compact and large vehicle market segments.	The political will was reiterated in 2015 when the conservative government inked a new broad agreement on BEV policies in the parliament.	Incentives were kept in place and the market could utilize the earlier openings, with more and more manufacturers launching BEVs.

savings or time savings. The bus lane incentive even had to be scaled back in the first location in 2015 due to BEV congestion delaying buses. BEVs also found many owners in locations with particularly expensive road tolls. Tax reductions have gradually evened out the price difference between BEVs and ICEVs, with a cost advantage available since 2013. The concept of niches had no longer a meaning by 2015. BEVs have sold well everywhere, and are used as any other vehicle. In 2016, a BEV regime is under establishment, but without incentives no successful niche would likely have emerged initially.

The ICE regime hypothesis has been strengthened. Norway has no ICE vehicle production, which in itself is an indication of a weak ICE regime. The government had no need to consider the impact of BEV incentives on the competitiveness of national automakers and more employment could be secured with national BEV production than with imports of ICEVs. BEV niche actors lobbying for incentives were therefore positively received by politicians. The ICE regime was rather indifferent to BEVs up to 2010, and a BEV niche market was established without resistance. ICE regime auto importers who could introduce BEVs into their portfolio did so when they became available, thus assimilating BEVs into their ICE regime. These ICE regime actors profited on the BEV niche markets, which further weakened the ICE regime. As a result, ICE regime actors without BEVs lost market share, and protested against the BEV policy.

The governance hypothesis has been both strengthened and weakened. The policy goals were initially not clear, and enthusiasts, municipalities, businesses and NGOs lobbied to receive incentives to help facilitate experimentation with BEVs. Since sales were low, the government could offer incentives at barely any cost. Later, in 1998–2002, the political target was to support industrial development, with more incentives introduced when sales did not grow. The period from 2003 to 2009 left these incentives untouched, although sales remained low as only second-hand imported vehicles were available. BEVs re-emerged on the political agenda as a climate policy tool leading to the ferry incentive being introduced in 2009 and an official BEV policy in 2012, and a rapid BEV deployment followed. The incentives addressed the various weaknesses of BEVs, and taxes on vehicles and fuels evened out the ownership cost. Incentives are national and regulated by laws without end dates, thereby provided a long-term stable framework supporting niches.

Criticism of the BEV policies has mostly been absent or weak in Norway (Retriever, 2015). Incentives were introduced when sales were low, and the societal costs negligible (Figenbaum and Kolbenstvedt, 2015a,b). No apparent threat to the incumbent ICE regime was apparent for the first two decades, so automakers did not criticize the BEV incentives. Some academic criticism of BEV policies has appeared in Holtsmark and Skonhoft (2014) and in Aasness and Odeck (2014).

The window of opportunity hypothesis has been supported by the many events that seemed insignificant, but which later had a profound influence on BEV diffusion. The interaction between the layers, especially the governance network and the niche actors, laid the foundation for the breakthrough. Niche actors cleverly interacted with the governance network and regime actors to get incentives in place as opportunities arose. Each incentive had a modest effect on sales, but nonetheless remained in place as new ones were introduced when new windows of opportunity appeared. Over time, a niche market was built up, hence leading to a giant opportunity for the auto industry to launch BEVs directly into the mass market.

Norway's BEV policy would not have worked without the long-term developments in the international landscape, such as Li-Ion batteries, more stringent EU regulations on CO_2, global climate policy negotiations, with the ZEV mandate in California leading to the development of BEVs by Nissan and other traditional automakers, as well as newcomers such as Tesla. These developments made BEVs available in the market in large volume through efficient distribution channels. In the eyes of Norwegian consumers, BEVs were transformed from small basic vehicles into normal sized vehicles having the same comfort, fit and finish as ICEVs. Geels et al. (2012) state that while niche activities are important in the beginning, the traditional regime actors will be crucial in a further transition to sustainable transport due to their complementary assets, such as specialized manufacturing capabilities, distribution channels and service networks, thus giving them a competitive edge over niche actors. This point is illustrated in the Norwegian BEV market.

Norway and Sweden are neighbouring countries, yet the development of these countries' BEV markets and policies are very different. Nykvist and Nilsson (2014) found the lack of policies for BEVs in Stockholm, caused by market liberalism and poor political experience of "picking winners", such as the support for ethanol vehicles that backfired when biofuels became more controversial (IBID), to be the primary reason for the slow BEV development in Stockholm. Climate policy was only a weak driver. Norway has in its Parliament established a broad political agreement on the BEV policy framework as part of the general climate policy, whereas Sweden is still in the process of elucidating potential policy options. Norway has not had a poor political experience of "picking winners". BEV incentives have been substantial for 25 years. The result has been a flurry of niche activities gradually growing into regional and national markets. BEVs have become a prerequisite for meeting Norway's climate policy targets. The international landscape factors have been the same in both countries, though the ICEV regime is more entrenched in Sweden, with its vehicle-producing industry focusing on large vehicles. Policies have been directed at supporting this industry. The high visibility of BEVs in Norway over a long time, and the presence of national BEV producers, has given Norwegian consumers a more positive perception of BEV's capabilities than what the Swedes seem to have.

Electromobility has developed rather slowly globally in contrast to the rapid changes in Norway (Figenbaum and Kolbenstvedt, 2015a,b). The risk of international setbacks in BEV development is therefore an uncertainty for the future of Electromobility in Norway. Using the classification of Geels and Schot (2007), the international BEV diffusion seems to be on a *transformation path*. Moderate pressure on the ICEV regime is leading to the gradual establishment of a BEV regime growing within the ICEV regime through a reorientation of the powering of automobiles, while keeping other basic vehicle features unchanged. Because BEVs, PHEVs and FCEVs have now emerged as competing technologies designed to reduce greenhouse gas emissions, the global auto industry could be heading into a "*de-alignment and re-alignment path*" until a "winner" has emerged. The pressure from the governance network has been large in Norway, leading towards a niche actor-driven "*technological substitution path*" up to 2010, followed by a regime of an actor-driven "*reconfiguration path*".

As suggested by Geels et al. (2012), Norway may push Electromobility even further by increasing the pressure on the ICEV regime, now that alternatives to ICEVs exist and have expanded rapidly. Geels et al. (2012) also state that a transition policy should be seen as a process lasting five, 10 or up to 20 years, which requires leadership, persistence and the ability to deal with unexpected events. So far, there is evidence that Norwegian politicians have this ability, and the broad political agreements in the parliament in 2012 and 2015 also point at strong leadership in the future.

The adjustments of incentives represent the other major uncertainty that can impact BEV sales. It will eventually not be politically possible to recover the lost revenue resulting from increased BEV market share by taxing other vehicle owners and buyers harder. According to the latest agreement in the parliament, BEV incentives will therefore gradually be downsized from 2017, while simultaneously aiming at preserving the BEV market. A new generation and wider selection of BEVs with double range (such as the Tesla Model 3 and Opel Ampera-E) will entice existing and new consumer groups, and the BEV momentum could be maintained even if incentives are reduced. High fuel taxes (roughly 60% of the pump price) have a stabilizing effect on consumer fuel costs, and BEV demand is less influenced by oil price fluctuations than in countries with low fuel taxes.

BEVs have mainly been taken into use by multi-vehicle households. Some may therefore consider BEVs to be add-ons leading to increased vehicle ownership. Figenbaum and Kolbenstvedt (2015b) estimated that some 60 million European households own more than one vehicle, thereby providing a solid foundation to build a BEV market from. A longer range of existing and future models, such as BMW's i3 and GM's Bolt (GM, 2015), with an over 300 km range, which will be released in the fall of 2016 and first half of 2017, will increase marketability towards single-vehicle households, thus suggesting that this issue might be temporal. The case of how Norwegians use the Tesla Model S points at a plausible future, in which BEVs with a winter range of some 300 km, mixed with shorter range BEVs, could take over most of the Norwegian automotive market.

Within the MLP framework, there is little guidance on when a new technology becomes a "regime". The analysis in this article points in that direction, but one cannot be certain that a "BEV regime" has been established in Norway by 2016, and will likely not be the case for some time. BEVs do dominate segments they are sold in, users have few challenges using the vehicles and they are being assimilated into the society at large. However, the share of the total fleet is still modest because of the slow fleet turnover. The market is heavily incentivized, and the removal of incentives could lead to setbacks.

7. Conclusion

The MLP framework of analysis has proven useful in explaining the dynamics of the policy framework for BEVs on a national scale. Lifting out the governance network from the regime level, and positioning it between the international landscape and the regime levels, made the policy dynamics of the case visible. The large taxes on vehicles and fuels have given the governance network influence over the types of vehicles imported and sold. The BEV market in Norway was created when the governance network introduced incentives that enabled niche market actors to take advantage of landscape developments, while simultaneously weakening the ICE regime. The ICE regime was further undermined by ICE regime actors that took advantage of these incentives, thereby leading to a BEV regime under establishment within the ICE regime. This dynamic is clearly discernible within the MLP framework.

The MLP framework's weakness is that it is not focusing on regional diffusion mechanisms or an individual's adoption decision. The dynamics in Norway started in initial niche markets is scattered around the country in cities, and in areas where users had large toll road cost savings. BEVs spread around these initial areas and to new places where local incentives became effective, e.g. when new toll roads emerged. These niche markets eventually spread to the entire country as the market grew radially from the initial areas, then overlapped into larger regions, and finally the whole country. This finding supports the notion that niche markets should have a geographical scale. Niches emerge locally, evolve regionally and grow into a national market before potentially ending up as a regime.

The system perspective, which is central to the MLP theory, may be lost when using a specific hypothesis for each level. Nevertheless, the four hypothesis have structured the analysis. The fourth hypothesis, that windows of opportunity were essential in the introduction of efficient policies, takes the system perspective into account, and system interactions have been demonstrated between all levels.

The success of BEVs in Norway is the result of a long chain of events leading to opportunities that could be exploited more efficiently over time. The pressure and opportunities arising in the global landscape, such as improved battery technology and an increased availability of BEVs, have been amplified by Norwegian policies and incentives. These incentives have become more efficient over time, and remained in place so long that users and enterprises could take advantage of them. For instance, the VAT and registration tax incentive *lowered the price disadvantage* of BEVs up to 2013, but have since then provided *BEVs with a price advantage*. The toll road exemption was in the beginning only effective in the Oslo area, but toll roads have spread across the nation, leading to a much larger impact of the incentive over time. Norwegian actors were able to bridge the gap between the end of development of BEVs in 2003 and the global restart in 2009 by importing second-hand BEVs that became available when other countries abandoned their BEVs. The ability to offer tax exemptions has been facilitated by the very high taxes on vehicles in Norway. Other countries without taxes on vehicles may use bonus/malus systems to achieve similar effects or revert to support schemes.

A successful national BEV market, now an emerging BEV regime, is unlikely to have grown out of the niche markets by 2016 without the large vehicle manufacturers launching BEVs. Profiting on the long BEV history in Norway and using their nationwide dealer and service networks, they could go straight to mass marketing activities. Consumers in Norway have proven to have the ability to utilize BEVs with a limited range in their daily transport, contrary to a belief in other countries and in the auto industry that range must improve before consumers will buy them.

Norway has proven that BEVs are marketable with sufficient incentives in place. Other countries can be inspired by the Norwegian policies, but there is no guarantee that a transition will succeed. Niche markets may fail to build up sufficient momentum or suffer setbacks, or tensions in existing regimes may remain small so that 'windows of opportunity' for niche-innovations do not materialize (Geels, 2012). Other countries may need to follow other paths as different windows of opportunities open up and the BEV technology develops further.

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