## Document History

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<td>TNO</td>
<td>Van Goethem, Bolech, Bayings</td>
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<td>Draft 1.1</td>
<td>7 June 2012</td>
<td>TNO</td>
<td>Van. Goethem, Bolech</td>
<td>Draft report after consultation round partners and experts</td>
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<tr>
<td>Draft 1.2</td>
<td>28 June 2012</td>
<td>COA</td>
<td>Van der Giessen</td>
<td>Adjustments COA</td>
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<tr>
<td>Draft 1.4</td>
<td>7 August 2012</td>
<td>TNO</td>
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<td>COA</td>
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<td>Draft 1.6</td>
<td>30 August 2012</td>
<td>COA</td>
<td>Van der Giessen</td>
<td>MOBI.Europe format</td>
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<tr>
<td>Draft 1.7</td>
<td>1 October 2012</td>
<td>COA, TNO, INT</td>
<td>Van der Giessen, Bayings, Giordano</td>
<td>Introduction Added, adjustments INT</td>
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<tr>
<td>Draft 1.8</td>
<td>2 October 2012</td>
<td>COA</td>
<td>Van der Giessen</td>
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<tr>
<td>Draft 2.0</td>
<td>11 October 2012</td>
<td>COA</td>
<td>Van der Giessen</td>
<td>First final version</td>
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<tr>
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<td>12 October 2012</td>
<td>INT</td>
<td>Giordano</td>
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<td>15 October 2012</td>
<td>COA, INT</td>
<td>Van der Giessen, Reis, Caetano</td>
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<tr>
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<td>24 October 2012</td>
<td>INT</td>
<td>McGrath, Giordano</td>
<td>Additional contribution ESB</td>
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1 Introduction

1.1 Introduction

This document is written for the MOBI.Europe project and is the result for deliverable 2.1 “Market Review and Framework Analysis” of WP 2: “Operational View for Electro-Mobility in Europe”. This so called ‘Market Review’ applies to the first goal as defined in the “MOBI.Europe_WPdescription” document:

- To set a comprehensive overview of market trends, existing and future approaches, initiatives and technologies in electro-mobility and related services;

It also completes Task 2.1 of the MOBI.Europe project and starts with a comprehensive review of electro-mobility related markets, technologies, products and services; a review of most relevant past, existing and planned initiatives will be made, with special focus on business and policy approaches and stakeholders involved, in order to build a framework for evaluating the different local public policies and aimed at promoting electro-mobility within the geographical scope of MOBI.Europe. This market review sets the reference framework for pilot design and ICT integration.”

1.2 Approach

To get a good overview of the status of electro-mobility in Europe, The following eight countries are described individually: Spain, Ireland, Portugal, France, The Netherlands, Germany, England and Norway.

Figure 1-1: Countries covered in MOBI.Europe D2.1 “Market Review”
These countries are chosen based on electro-mobility activities and on their impact on the whole market in Europe. The writers of the review realize that one can always discuss why one country is described and another not. The number of eight countries is also based on limitations of time and effort to write this market review. Europe in general is described at the end of the document. For each country the following items are described:

- Current Situation Regarding Electro-mobility in the country
- Initiatives on Electro-mobility
- Policy / Regulation Regarding Electro-mobility
- Stakeholders Electro-mobility
- Technologies in Place

1.3 Disclaimer: Snapshot beginning of 2012

In all countries in Europe electro-mobility projects are started the last few years. It is a very dynamic market. New figures, ambitions and incentives are published very frequently and on high speed. The different levels of information vary per country and per publication. However for this review comparable data was needed. During the research many data has been looked at, but if there was no comparable data for other countries available, and did not have a high impact on the market, it has not become part of this document. This market review is a ‘snapshot’ taken of a very dynamic European electro-mobility market between April and July 2012. No rights can be obtained from the figures and numbers used in this report since the market of electro-mobility is changing rapidly.
2 Electro-mobility in PORTUGAL

2.1 Current Situation Regarding Electro-mobility in PORTUGAL

The number of fully electric vehicles in Portugal according to published figures is 539 electric vehicles. Excluded from that figure are 795 electric motorcycles. There are 539 electric vehicles on the road, which is approximately 0.098‰ (per mill) of the 5.5 Million vehicles in Portugal [1].

The overall amount of public recharging points in Portugal is estimated to be 1034[2]. Incorporated in that number of charging points are 8 fast charge facilities [3](DC, CHAdeMO protocol)[3].

2.2 Initiatives on Electro-mobility in PORTUGAL

In early 2008, the Portuguese Government launched a national Program MOBI.E which was created as an innovative electro-mobility model and is the first charging network and integrated platform in the world with national coverage. The MOBI.E platform is managing the integrated network under a centralized architecture. MOBI.E includes both building a nationwide recharging infrastructure and growing the domestic market for electric vehicles, which began commercial sales in Portugal in 2011 [25][26]. The municipalities involved are shown in Figure2.1. The management and development of the program would be assumed by INTELI, a Portuguese research organisation.

Initiatives for two-wheelers, which are recognized as being some of the main drivers for electric vehicle adoption in Portugal, include the deployment of specific charging solutions [27].
2.3 Policy / Regulation Regarding Electro-mobility in PORTUGAL

The Portuguese Government has promised that 20% of its annual public sector fleet purchases will be zero emission vehicles as of 2011 and has an objective that 10% of the cars in Portugal will be electric by 2020 [23].

According to the Portuguese electro-mobility legislation, an electric vehicle is defined as any vehicle that can be plugged into the electric grid. However, all direct and indirect incentives as outlined below are solely restricted to fully electric vehicles, i.e. plug-in hybrid electric vehicles are not included, in order to coherently maximize the incentive effectiveness and impact.

The incentives stimulating the sales/use of exclusive electric vehicles by the end of 2011 were[23][29][30]:

1. A subsidy for private users of 5000 euro’s for the first 5000 electric cars and 6500 euro’s if an old car is scrapped at the same time. This incentive is only conceded for vehicles with a price up to 50000 € of the category M1[31];
2. Electric cars do not need to pay vehicle or circulation taxes and income tax and corporate tax deductions are available;
3. Mandatory installation of electro-mobility charging infrastructure in the parking areas of new buildings (started in 2010);
4. Government purchase of 20 Electric Vehicles for awareness and advertising purposes;
5. Special electric vehicle access to priority lanes and exclusive circulation areas (article Expresso);
6. Preferential parking areas for electric vehicles in urban centres;
7. Annual renewal of State and municipalities’ fleets with 20% electric vehicles;

The subsidy for private users of 5000 euro’s for the first 5000 electric cars and 6500 euros for scrapping of old cars (with over ten years) was introduced in 2009 but was eliminated by the current government following the cuts introduced in its 2012 budget [32]. The current trend is towards indirect support.

As a consequence of the direct incentive for electric vehicle acquisition and the strong disincentive against combustion engine based vehicles in favour of electric vehicles for company fleets, it was expected that the number of electric cars on the road by the end of 2012 would be over 10.000 [27]. With this objective, the country could assume itself as being one of the leaders in electro-mobility and renewable energies, creating opportunities and new products for its companies.
The current government has announced recently the possibility of electric vehicles having free parking costs in the urban centres as a measure included in the review of the National Plan for Renewable Energy and Energetic Efficiency[33]. This additional measure may be related to the fact that the transportation area is the sector with the lowest renewable energy share[34].

2.4 Stakeholders Electro-mobility in PORTUGAL

There are around 50 companies working in the field of electric cars in Portugal which varying in terms of components, producers and distributors of energy, technological enterprises, research centres, etc. The following companies are examples[23];

1. There are currently 3 operators for charging: EDP MOP, Galp, and PrioÉ;
2. EFACEC is developing a full range of electric vehicles charging solutions from AC normal charging to DC fast charging. They are now exporting EVSE to countries such as Spain, The Netherlands, Turkey and the USA;
3. Caetano Bus is developing two 50-70 seats electric bus prototypes designed for big cities and airports;
4. Felmica is the biggest lithium producer in Portugal (5th in the world);
5. Peugeot-Citroën produces electric versions of Berlingo and Partner in the Mangualde factory from as the second half of 2011;
6. Magnum Cap is an electronics company partly owned by the Martifer Industrial Group, which is developing charging stations for diverse applications;

7. Siemens is developing charging point prototypes for home-charging in its Portuguese unit. Also new charging solution are being developed in cooperation with CEIIA (Portuguese automobile research centre)\[38]\;

8. Other individual inventors have been developing new electric vehicles, such as the “Futi”, of António Febra, an entrepreneur, the “Mega” of Paulo Carvalho, a technician and a sport prototype has been developed by VE (Fabricação de Veículo sem Traccão Eléctrica, Lda.) and the ISEL (Instituto Superior de Engenharia de Lisboa) \[39]\;

9. INTELI, which manages the MOBI.E platform through the Mobility Intelligence Center (MIC), has signed a cooperation agreement with Renault to further develop services of its network, such as charging, energy and parking management solutions \[40]\.

![Figure 2-3: Overview of stakeholders in the MOBI.E project \[41\]](image)

Efacec, the largest Portuguese industrial group in the field of electricity, in cooperation work with Siemens, is the charging point supplier in the first phase of MOBI.E 1300 charging points. However, private operators are free to choose any supplier, where MIC coordinates the homologations and integrations of different suppliers’ equipment into the network \[23]\[37]\.

At the end of 2011 an important downturn occurred in the Portuguese electric vehicle technological expansion, Renault-Nissan abandoned the project of setting a factory for battery production in Cacia (Aveiro). This production unit would have started operating in 2012, creating 200 jobs in a total investment of 156 million euros. The production capacity was projected to be
of 50,000 lithium batteries per year, which would be installed in the Renault-Nissan electric vehicles.[42]

### 2.5 Technologies in place in PORTUGAL

Currently, the two predominant types of charging stations are ‘normal’ (single phase 16A, 3.6kW) charging stations (6-8 hours): At home, for fleets, on-street and off-street parking, and ‘fast’ charging stations (30 minutes): on main roads and highways, in service stations and other strategic urban locations [26][23]. Fast charging stations operate according to the CHAdeMO protocol [8]. For normal charging, the Portuguese government has decreed that the plug to be used is the Type 2 (Mennekes). Existing charging stations are being retrofitted in order to comply with this requirement.

For recharging, electricity retailers interact with the operators through the managing authority. An example of a transaction in the MOBI.E (Electro-mobility network) system is that the electric vehicle user pays a total fee to the electricity retailer for three parts; electricity, charging service, and MOBI.E central system costs. The electricity retailers pay the electro-mobility operators for the use of the charging point. There is a ceiling limit currently set by government legislation for the maximum charging service fee to be paid which is €0.03 to €0.07 per kWh for normal charging and €0.20 per kWh for fast charging. Electricity is to be offered at a non-regulated market price where all fees received by the managing authority for system access and usage (paid by the electricity retailers and electro-mobility operators) are regulated by the ERSE (the Energy Services Regulatory Authority) [29].

The MOBI.E pilot phase will be in place until the end of 2012. During the pilot phase any EV user can request a MOBI.E card and charge on the network free of charge. After the end of the pilot phase, MOBI.E users will need to acquire a card from the electricity retailer and can then charge in any point of the network. Pre-paid and post-paid options will be available [23].
3 Electro-mobility in SPAIN

3.1 Current Situation Regarding Electro-mobility in SPAIN

The number of registered sales of fully electric vehicles between 2008 and May 2012 in Spain is 1,066. The 1,126 electric vehicles on the road is approximately 0.04‰ (per mill) of the 27.7 Million vehicles in Spain[1]. There were 377 full electric vehicles sold in 2011. During the first few months of 2012 667 electric vehicles were sold in Spain.

The overall amount of public charging points registered in Spain is estimated to be 777 units[2]. Incorporated in that number are 76 fast charge facilities.

3.2 Initiatives on Electro-Mobility in SPAIN

A considerable part of the activities surrounding electro-mobility in Spain have been supported and coordinated by the national government, with support from local governments, R&D institutes and market initiatives.

The Spanish Strategy for Energy Savings and Efficiency 2004–2012 efforts, frequently referred to as E4, is designed to support the acquisition of alternative vehicles based on fuel type and vehicle type. Incentives are offered to public and private transport fleets, companies, and individual citizens, and are available also for financial arrangements including leasing and renting[4].

In April 2010, Spain’s national government and the Institute for Energy Diversification and Saving (IDAE) presented the “Integral Plan for the Promotion of Electric Vehicles” (subject of the E4), which includes an “Integrated Strategy for electric vehicles 2010–2014” promotion with the target of one million electric vehicles, including 250,000 ‘plug in’ hybrid and battery electric vehicles, on the Spanish roads by the end of 2014, which could be charged at 343,510 charging points throughout Spain[5].

The “Integrated Strategy for electric vehicles 2010–2014” itself consists of two action plans. These are “Plan of action 2008-2010” and “Plan of action 2010-2012” also better known as plan MOVELE.

MOVELE consists of a series of measures to be implemented over the two years (2011 and 2012) to encourage the introduction of electric vehicles. There was 590 million euro of public funding for this action plan. Some of the measures are described briefly hereafter.

- Municipalities having more than 50,000 inhabitants (145 cities) could offer a reduction in the acquisition of electric cars to a maximum of 6,000 euros per vehicle (for which 240 million euros of subsidy were allocated).
Creation of a special tariff for charging at night, to promote charging

Investment of 35 million euros in communication systems between the electric grid and the vehicles for optimizing charging

An extra of 173 million euros was invested in R&D: EVs (140 M€), ICT for EVs (35 M€), and R&D on priorities for EVs

For marketing and communication a contribution of 2 million euros was allocated

Further actions or attention was given on the creation of a “charge manager”, homologation of vehicles and components, and manufacturing, maintenance and repair training

MOVELE provided also a platform for the e-mobility in Spain. Actions and initiatives related to e-mobility are put together on the MOVELE website. Overview of the e-mobility in Spain is archived to a certain level of detail and some regional, local and market initiatives are not registered within the platform of MOVELE.

Based on the national approach of the “Integral Plan for the Promotion of Electric Vehicles”, the largest local governments can promote the purchase of an electric car with a cost reduction. These regions are Andalucía, Castilla León, Castilla-La Mancha, Navarra, Cataluña, Madrid.

With the change of national government and in the current European recession, activities on e-mobility have a lower priority at the moment.

There are also other national on-going demonstrative and R&D electro-mobility initiatives. The most relevant are:
SMARTCITY (2009-2012)

SmartCity will prove key factors in Smart Energy and will contribute to the 20-20-20 objectives in 2020. The project objective is to develop a demonstrator for the next generation grid for electricity distribution. Within this new Grid, customers and Distribution companies cooperate for the achievement of the energy challenge; optimizing the usage of renewable energy sources.

VERDE (2009-2012)

The aim of the project VERDE is to research and develop technologies which allow the production and commercialization of electric vehicles in Spain. VERDE must be the driving force of future individual and cooperative projects to introduce the new developed technologies in the next generations of vehicles. The accomplishment of these objectives would allow Spain to reduce its energy dependency from the oil, to reduce the CO2 emissions in the transport sector and to favor the penetration of renewable energy as established in the EU energy policy for 2020, and, last but not least, to guarantee the future of the industrial sector and the automotive R&D in the country.

MOBI2GRID (2010-2012)

The main purpose of MOBI2GRID is to position the Euro region of North Portugal-Galicia as pioneer in the adoption of electro-mobility based on renewable energy sources through the implementation of an integrated and interoperable system between both regions performing a pilot test with electric vehicles in the electro-mobility corridor Vigo-Porto, the first transnational electro-mobility corridor in Europe.

Electro-mobility can have a positive impact on the economic development of Galicia, as it has one of the largest automotive poles in Spain.

At a regional level, Galicia has launched R&D, innovative and policy initiatives, aligning regional priorities with European and national priorities, as shown since the start of charging infrastructure policy approach. In line with these provisions, the Galician government has launched the regional electro-mobility pilot project, the MOBEGA Plan, which has started in December 2011 and will finish in December 2012.

3.3 Policy / Regulation Regarding Electro-mobility in SPAIN

Part of the promotion and stimulation of electric and plug-in vehicles in Spain is to reduce the costs of acquiring hybrid and battery electric vehicles with incentives. An overview of these incentives is shown in Table 3-1. The main differences between the year 2011 and 2012 is that the subsidy has decreased for electric and plug-in vehicles, and the minimum of electric range requirement has risen from 20 to 90 kilometres.

Regulation in the electricity sector (Law 54/97) has been adjusted to enable electricity consumers to sell electricity to charge vehicles to promote the placing of recharging points in public like parking lots and shopping malls, and private (homes).
A special low tariff of electricity has been introduced for recharging over-night.

<table>
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<tr>
<td>Motorbikes</td>
<td>Maximum of € 750,- for motorbikes above 4 kW</td>
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<td>Passengervehicles (M1)</td>
<td>Up to 15% (25% in 2012) of market price with a maximum of € 7.000,-</td>
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<td>Commercial vehicles (N1)</td>
<td>(6000,- in 2012)</td>
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<td>Quadricycles (L7e)</td>
<td>Up to a maximum of € 2.300,- for hybrid vehicles with voluntary pure electric traction and CO2 emissions below 110 g/km in 2011. And a maximum of € 2.000,- for hybrid vehicles without voluntary pure electric traction</td>
</tr>
<tr>
<td>Hybrid</td>
<td>Up to a maximum of € 7.000,- (6.000,- in 2012) where for plug in hybrids with a minimum electric range of 20 (90 in 2012) km</td>
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<tr>
<td>Busses and Trucks</td>
<td>Up to 15% of market price, with a maximum of € 50,000,-</td>
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Table 3-1: Incentives of the Spanish government for the purchase of hybrid and electric vehicles in 2011 and 2012

Related to sustainable transport and electro-mobility in Spain, the Renewable Energies Plan 2011-2020, which continues the Renewable Energies Plan 2005-2010 and intends to reach the objectives of the Europe 2020 strategy regarding sustainable energy sources, is approved. In 2004 the contribution of renewable sources to electricity consumption was the 17,9% of total electricity sources in Spain. In 2010 it was incremented to the 33,3%, including renewable energies like wind energy, hydroelectric, photovoltaic and solar. The Renewable Energies Plan 2011-2020 emphasizes the importance of renewable technologies, with estimates for 2020 of 22.7% of the gross final energy consumption and 42.3% of the gross electricity generation.

3.4 Stakeholders Electro-mobility in SPAIN

Spain holds a strong position from electricity generation from renewable sources, which makes the electrification of road transport, eco-friendly. Spain has strongly identified the challenges of electric transport and foresees the need for the Spanish (automotive) R&D to make progress based on the following areas (and thus offering new opportunities):

- Development and manufacturing of new lightweight materials that will lead to a consumption reduction and a more efficient energy use;
- Development of components and systems for electric vehicles;
- Development of a smart grid integrating vehicle with road infrastructure;
- Integration of the electric vehicles demands in the electrical grid;
- Identification of safety standards of components, systems, and overall vehicles.

Spain is the 8th producer in the world, the EU 3rd largest passenger car manufacturing base and the 1st in the area of light commercial vehicles in the EU. Spain has respected vehicle and component designers and manufacturers.
Other stakeholders are Spain’s R&D industry which contributes to efficient vehicle manufacturer plants, vehicle component developers and producers, globally known research and technology centres, University groups and institutes, and ICT companies [6].

Endesa is one of the largest electric power companies in the world and Spain’s largest utility and the largest power supplier / provider of electric vehicle charging stations in Spain. Endesa is committed to developing electric vehicles as one of the main ways to combat climate change and to achieve the EU’s "20-20-20" targets: a 20% reduction in CO2 emissions, a 20% improvement in energy efficiency and 20% of energy coming from renewables[7].
3.5 Technologies in place in SPAIN

The IEC Type 2 socket, (commonly referred to as a 'Mennekes socket') which is a 7 pin socket, is accepted as the standard for home and public charge points with Mode 3 charging. The power varies from 230V-16 ‘normal’, 230V-32A ‘standard’ to 400V-63A ‘rapid’ according standardization which is involved internationally (EU, Japan (CHAdeMO), France/Germany)[9].

There are no standards/agreements on identification and interoperability in Spain at this moment. This means separate identification and payment systems are in place in different regions.
4 Electro-mobility in IRELAND

4.1 Current Situation Regarding Electro-mobility in IRELAND

The number of registered sales of fully electric vehicles in Sept 2012 in Ireland is 319. The electric vehicles on the road represent hence approximately 0.162‰ (per mill) of the 1.9 Million vehicles in Ireland [1].

These numbers are not close to the predictions of around 2,000 electric vehicle sales per year in the country after the first recharging station was installed in 2010. Ireland still largely prefers diesel vehicles, which constituted 71% of private sales of passenger cars last year [17]. There is a perception that diesel cars offer better value for money.

The overall amount of recharging points in Ireland, disregarding different types, public or privet stations, is estimated to be 770 units[10]. In addition to that number, there are 28 fast charge facilities (DC, CHAdeMO protocol)[3].

4.2 Initiatives on Electro-mobility in IRELAND

In November 2008 the Minister for Communications, Energy and Natural Resources and the Minister for Transport jointly announced the Irish Government ambition that by 2020 10% of all the vehicles in Ireland would be plug-in i.e. either full battery electric or plug-in hybrid. To achieve this and to ensure that Ireland pursued the full range of opportunities presented by electric vehicles, an electric vehicles working group chaired by the Department of Communications, Energy and Natural Resources, was established. This working group involved all of the relevant Government departments and agencies, and commercial semi-state bodies. This working group had a series of subgroups, dedicated to exploring different aspects of the issue including enterprise opportunities, fiscal supports and infrastructural requirements[11].

Ireland as a small automotive market (in 2007 just under 200,000 new cars were sold) is not very attractive to the Automotive industry, particularly as it is a right hand drive market. To ensure the early supply of electric vehicles it was realised that it was essential not just to provide incentives but to guarantee that a suitable charging infrastructure would also be provided. The end result was a series of tripartite memorandums of understanding (MoUs) between the Irish Government, ESB the sole Distribution Network Operator in Ireland (and 95% owned by the Irish government) and different Automotive OEMs. Under these MoUs

- The Government agreed to provide incentives
- ESB committed to providing a basic national EV charging infrastructure and
- The different OEMs agreed to guarantee supply of electric vehicles for the Irish market.
The EV charging network that was agreed as needed was 1,500 public charge points and 30 public fast charge points. Depending on the sale of cars this was expected to be required by the end of 2012 [12][13]. Separate from the agreements ESB offered to provide a free home EVSE to the first 2,000 electric vehicles sold under the MoUs.

ESB eCars is developing the supporting payment and IT systems for electric vehicles which will be operational in 2012. Until then, charging in public locations will be free. The payment system will give drivers access to the public charge point network. After registering for electric car charging, each electric car owner will receive a charge point access card, and by the use of an online account drivers will be able to pay for public charging using their debit or credit card. It is possible to check and top-up the balance at any time where the system can even recall the charging pattern and indicate, through a mobile phone, when it is advised to top-up. Also provided is the ability to check different electricity tariffs online and change energy supplier at any time with no penalty [15].

4.3 Policy / Regulation Regarding Electro-mobility in IRELAND

The target set by the Irish government in 2008 was ambitious - 10% of the transport fleet driving plug-in vehicles by 2020. If this target was to be achieved sales in 2012 would need to be of the order of 6,000 electric cars. In 2007 the annual sale of new cars in Ireland was just under 200,000. However as a result if the economic recession and the austerity programme to deal with it sale of new cars in 2009 were less than 60,000 and even in 2012 will still be under 90,000. Based on the current size of the national fleet, the 2020 target would equate to around 230,000 electric vehicles in Ireland.[11][16].
The highlights of national policy and legislation related goals are [13]:

- 10% of all passenger cars will be electric by 2020
- The mandatory European Union (EU) Renewable Energy Supply Target (RES-T) legislation requires that 10% of all transport fuels will be renewable by 2020, which includes the gearing of renewable electricity content in electric vehicles to reflect primary energy equivalence
- Currently a 5000 euro grant for plug-in hybrid and battery electric vehicles is available
- Relief from paying the Vehicle Registration Tax is available in the amounts of 5.000 euro for battery electric vehicles and 2.500 euro for plug-in hybrid electric vehicles
- Accelerated Capital Allowances are available to companies purchasing electric vehicles
- A Charge Point Infrastructure program to install 1.500 on-street chargers and 30 fast chargers
- An EV Customer Billing and Information Technology (IT) system that interfaces with existing electricity market regulations is presently undergoing testing; it will enable customers to have access to all electricity suppliers
- The parliament is as of March 2012 considering new legislation that will enable Local Authorities to designate on-street parking spaces and charging point infrastructure as being for the exclusive use of electric vehicles.

4.4 Stakeholders Electro-mobility in IRELAND

Ireland has developed a technically strong automotive component industry that currently exports more than 282 million euro of components a year to European car manufacturers such as General Motors, Daimler-Chrysler, Ford, Audi, BMW, and Renault. Ireland’s automotive component industry comprises 30 enterprises. Four of the companies are Irish-owned and the remaining are mainly German and U.S. multinationals.

The strategy of Ireland also focuses on ICT. With the move towards standardization across the sector, Ireland has the potential to claim a significant share of a global market which is estimated to be worth 133 billion euro by 2015. Experts see much future growth in the auto sector as likely to come from new operations that provide back-office services rather than manufacturing [19].

Electricity services in Ireland are provided by the Electricity Supply Board (ESB), a state body that is owned and controlled by the Irish Government. ESB owns and manages the electricity network and operates 19 major power stations throughout Ireland and a number of smaller stations in 28 sites around Ireland[20].

ESB is the sole distribution company. It is also the biggest player in the electricity generation and supply business. However there is strong competition in the generation business and particularly in the supply business. Airtricity (a wind generation company now owned by the UK company SSE) is the third significant electricity market player.

ESB is responsible for the roll out of electric car charge points in Ireland. ESB ecars, which focuses on electric vehicle charging network of ESB, is supporting payment and IT systems for
electric vehicles. After receiving a charge point access card, drivers will be able, by the use of an online account, to pay for public charging using their debit or credit card [15][12].

4.5 Technologies in place in IRELAND

The IEC Type 2 socket, (commonly referred to as a 'Mennekes socket') which is a 7 pin socket, is accepted as the standard for home and public charge points with Mode 3 charging[21].

The home charge point are usually installed on an external wall of the house where the electric car charging is facilitated through the home domestic electricity supplier through a single phase 16A (3.6kW) connection. This type falls in the category 'normal' or 'slow' charging where the full charging time is 6-8 hours.

Public charge points, which are accessible using a charge point card, are typically installed on-street and in locations such as shopping centres and car parks. They are connected to a local 3-phase electricity supply and depending on the car type and battery size, charging takes between 1 and 6 hours.

Public fast charge points are installed mainly along inter-urban routes. They are provided using 3-phase, 63A AC (44kW) or 120A, 400V DC (50kW) connection. A 50kW DC fast charge point can charge a compatible electric car up to 80% in 20-30 minutes using direct current via a special connector developed by the CHAdeMO Association [21]. The public fast charge points are installed mainly along inter-urban routes [21]. The ESB ecars website found at [22], shows nationwide all installed charging stations where it states information such as the location address, provider, the actual status and the type of charge (standard and normal/fast charge).
5 Electro-mobility in the NETHERLANDS

5.1 Current Situation Regarding Electro-mobility in the NETHERLANDS

The number of battery electric vehicles registered for admission on the Netherlands’ roads has been growing from 225 in November 2009 via 437 at the end of 2010 to just over 1250 at the beginning of the year 2012 \(^{[62]}[63]\). In this number some 75 trolleybuses (in the city of Arnhem) as well as several tens of historic museum electric cars are included. The 1250 electric vehicles on the road is approximately 0.13 ‰ (per mill) of the 9.57 Million motor vehicles in the Netherlands \(^{[64]}\). The number of plug-in hybrid vehicles is growing rapidly ever since a couple of models became available in 2011 and 2012 (GM Volt, Opel Ampera and Fisker Karma), and by beginning of May 2012 the number of plug-in hybrid vehicles in the Netherlands was 765. EV and PHEVs together represented nearly 0.6% of new car sales in the Netherlands for the first 4 months of 2012 \(^{[65]}\).

The overall number of recharging points installed in the Netherlands grew from some 400 (end 2010) to 2525 at the beginning of 2012.

![Figure 5-1: Normal charging points in the Netherlands\(^{[2]}\), divided into public, semi-public and private charge points.](image)

In addition to the normal charge facilities 15 fast charge facilities (DC, CHAdeMO protocol) were available at beginning 2012. The number of fast chargers will grow rapidly. By the end of March 2012 31 fast chargers were installed.
5.2 Initiatives on Electro-mobility in the NETHERLANDS

A considerable amount of the activities surrounding electro-mobility in the Netherlands have been initiated or coordinated by the national Government [65][66]. Demonstration field tests (for which 10 million euros of subsidy were allocated) with a total number of 220 electric vehicles have been started (eight field tests in the beginning, meanwhile nine) [67]. Also a functional field experiment with 24 EV and 2 PHEV within the central government [68][69] in the Department of Waterways and Public Works (Rijkswaterstaat) is running. The ambition of the overall government plan concerning electro-mobility is to have 200,000 electric vehicles on the road by 2020.

In order to also stimulate the electricity sector in the Netherlands to prepare for the introduction of larger numbers of electric vehicles recharging from the grid, another 16 million euros of project subsidies were distributed to stimulate ‘smart grid’ field experiments. With a smart integration of electric vehicles in the electricity grid, no substantial capacity increase of the grid should be necessary and moreover, there are good possibilities for introducing a substantial fraction of renewable electric energy in the grid without adverse effects from the intermittent power supply of renewables such as solar and wind power. Effectively the fleet of electric vehicles would form a buffer for electricity fluctuations.
The major electric power grid companies in the Netherlands formed an foundation “e-Laad” that has a mission wants to install 10,000 recharging point in the Netherlands before end of 2012. This foundation also gives a real time insight in usage of their charging points (1491 on 09 May) [70]. At this moment Stichting E-laad is reconsidering its objectives.

Further The New Motion, HVC, Greenchoice, BAM, Heijmans, MisterGreen, Greenflux, EV-Box, as well as electricity companies NUON, Essent and Eneco are active in the field of recharging facilities for electric automobiles. At present some 1007 EV recharging points in the public domain are registered at the internet site “oplaadpunten” [71], while the site “oplaadpalen” [72], an independent database for all charging points, provides data of 1517 charging points for cars (up-to date information on public and semi-public recharging points combined). The numbers of charging points given in [63] (based on government estimates) are higher: 1250 (public), 576 (semi-public) and 699 (private) in January 2012. The government numbers are likely the most comprehensive since this information comes from different administrations responsible for the installation of charging points.

With regard the manufacturing of charging points, the Netherlands is home to Epyon, a relatively young TU-Delft spin out that was acquired by ABB [77] in 2011. The fast charge technology is very interesting for overcoming range-anxiety of EV users and maximising the potential usage of electric cars. In this regard, the recent call from Rijkswaterstaat to get interested parties for the installation of a nationwide grid of fast chargers is noteworthy. Allowances for 459 in total fast chargers alongside the national motorways were awarded to the six interested parties / investors[78]. The roll-out of fast chargers has started this year (2012).

Figure 5-3: Focus areas for stimulation of electro-mobility in the Netherlands Notice the potential focus regions with semi-transparent e-mobility logo and international focus regions
At local and regional level the stimulation of electro-mobility by the large cities should be mentioned. Mostly spurred by air-quality regulation from Europe Union there was an urgent necessity to address air quality in at least the four large cities in the Netherlands (Amsterdam, Rotterdam, The Hague and Utrecht). The Hague lagged behind a little because this city opted for large scale introduction/stimulation of driving on natural gas. This policy remains in place in The Hague, but there is attention for electro-mobility as well. The initiatives of the large cities have evolved into national policy of focusing on the regions that have good potential for electric vehicles.

**Amsterdam**

The promotion of electric transport is part of the ‘Clean air for Amsterdam' action plan, drafted in order to ensure that Amsterdam meets the European Union standards for air quality by 2015. It is vital that the nitrogen dioxide and particulate pollution levels are lowered in order to help improve the health of people in the city. If the air quality in Amsterdam does not improve, a building freeze may come into effect for major projects. It is expected that by 2040, almost all car and scooter kilometers driven in Amsterdam will be electric, and the prognosis is for 10,000 vehicles by 2015.

To make this possible, a network of public charging points is installed in the city in the coming years. Anybody with an electric vehicle can charge here. Green electricity will be used for charging.

In November 2009, Amsterdam opened the first public charging points for electric transport in Amsterdam. In 2013 one thousand public charging points will be installed. Liander in partnership with Nuon installed the first 100 public charging points in Amsterdam. After this initial project Nuon and Essent are installing public charging points, which are connected to the electricity grid by Liander.

In addition to the public points, the municipality is also stimulating the creation of charging points at private places. A subsidy scheme is currently running for the construction of charging stations on private property.

Amsterdam stimulation of electro-mobility is aimed at making city traffic cleaner and more sustainable. In Amsterdam, various subsidies have been issued to buyers of electric cars. In the recent version, the stimulating subsidies are specifically aimed at professional vehicle users who drive comparatively much within the city. In the latest subsidy scheme the following contributions for purchase are available: 5 k€ for passenger EV, 10 k€ for taxi EV as well as vans (parcel distribution etc.) and 40 k€ trucks. At EVS 25 this effort was recognised with receiving an e-visionary award (Oregon and Shenzen being the other award recipients) [73].

Parking with an EV on a recharging parking spot, has been free of charge until recently (April 1st 2012), provided the electric car is connected to the recharging facility. From that moment on, the users started paying a tariff of € 0.25 / kWh of charged current (the maximum tariff allowed by the City).
As can be seen in the graph in figure above, around the end of 2011 a considerable growth in energy consumption (and thus EV use) came up. Around this time the operation of the car2go car-sharing project in the city began. Amsterdam is the first city in Europe where car2go (a Daimler subsidiary) offers an electric car sharing fleet of 300 cars. This underlines the relatively high quality of recharging infrastructure in Amsterdam.

Information about charging points is real-time accessible via an open API. This way the charging network provides this information in real-time and as open data. The data can be used by everyone for non-commercial purposes. This makes it possible to create mobile apps, in-car navigation systems and websites that show where the nearest available charging point is.

Figure 5-5: Promotion picture of the car2go car sharing operation in Amsterdam. Note the local sign for recharging point, with the electric logo (the logo originated in Amsterdam, and was later adopted in other cities). Source: car2go
Rotterdam

In the Rotterdam area several EV trials are running. From the previously mentioned nationally subsidised field tests four are also represented in Rotterdam, among which the largest one with 75 electric vehicles. Further there are explorative trials with city buses. As in the other cities, reducing pollutant emissions in the City is an important driver for this area for considering the use of electric vehicles. Rotterdam plans to install 1000 charging spots over the coming years.

Utrecht

Utrecht defined a programme action plan for clean transport for 2010-2014, and among other measures, stimulation of electric vehicles is a key component in this plan. The stimulating measures are aimed at companies and institutions who can receive subsidies for collectively used electric cars, as well as for promotion and publicity for use of electric cars. The amounts of subsidy available is € 5000 per electric car maximum.

Northern Brabant

In the province of Northern Brabant a substantial number of EV trials is running or on the way to being realised, most notably around ‘s Hertogenbosch and the greater Eindhoven area. This interest is fuelled by the high tech automotive industry and other industries historically present in this province. Being at the forefront with electric vehicle use is believed to contribute to a better chance of being industrially successful as well as sparking of synergies in other areas.

Limburg

The northern half of Limburg hosts the 12th Floriade near Venlo, and this area is experimenting with electric vehicles (cars as well as scooters). The long term ambition is to create a kind of sustainability campus on the exhibition terrain once the Floriade is ended, were sustainable transport and energy supply are further developed. The Interreg-cooperation with the North Rhine West-Falen (a large German focus area for EV) further increases chances of success and growth. Also the integration with sustainable energy supply must be mentioned. Scheuten Solar (in Venlo as well) supplies solar trees to the initiate that can take care of the energy supply for electric cars and scooters. Effectively the efforts described make the Venlo area the first large scale field test in the Netherlands outside of the larger cities.

5.3 Policy / Regulation Regarding Electro-mobility in the NETHERLANDS

In 2009, the Dutch government has formed the Formula E team. This is a collaboration of Dutch trade and industry, institutes and administration the team’s primary task was market development and remove obstacles.

In order to forcefully stimulate electro-mobility, the national government in the Netherlands has various tax exemptions for electric vehicles in place, most notably the exemption of motor vehicle duty. Further, for users that drive an EV leased by their employer, there is a tax exemption. Dependent on environmental impact, all lease cars result in an addition to the income (and thus income tax) by percentage of purchase price of the car. For EVs this
percentage is 0%. This stimulation makes a big difference in total cost of ownership for employees driving an employer-leased electric car.

At national level a purchase subsidy is being prepared for “euro 6 vehicles or cleaner”. The subsidy is available for taxi’s and delivery vans. A maximum of 5000 per electric vehicle will be available at the end of 2012. The total sum available is 25 million euro.

Also locally various stimulating measures were installed to further promote electro-mobility. For example the city of Amsterdam has had various types of subsidies in place to share the burden of higher initial investment for an electric car compared to an equivalent conventional one. At present specifically the heavy users of cars within the city can profit from a subsidy [74].

5.4 Stakeholders Electro-mobility in the NETHERLANDS

The Netherlands have no large car manufacturing industry in the province of Noord Brabant there is high tech automotive industry (parts and research) present.

All the large utility companies in Netherlands are working on electro-mobility. With the political strategic effort to become more self-supporting energy wise, as well as the termination of the nuclear energy programme in Netherlands; this has forced the utilities to prepare themselves for much more decentralized and sustainable energy generation. The rise of electro-mobility gives these companies an opportunity to create added value by installing buffering facilities and “smart grids” that can create synergy between sustainable energy and sustainable electric transport.

Charging stations for electric vehicles are located on both private as public areas. The electro-technical installation sector [75] has a strategic initiative on electro-mobility embedded in the foundation KIEN [76] (aimed at innovation for the electro-technical installation sector in the Netherlands). This foundation takes care of preparing the electro-technical installation sector for the expected large number of requests to realize recharging points in the coming years.

5.5 Technologies in place in the NETHERLANDS

In order to lend momentum to the upcoming market of electro-mobility, the Netherlands opted to adopt a uniform recharging plug (Type 2) for charging in the public domain (mode 3) long before an actual standard had been set. At the point the plug standard was adopted, also the issue of interoperability was addressed. Now the recharging facilities of the various providers are fully interoperable, and subscribers to any of the service providers will be able to charge at all charging points irrespective of who is providing that service. The recognition of users is performed with RFID identification on the issued service-cards.
6 Electro-mobility in FRANCE

6.1 Current Situation Regarding Electro-mobility in FRANCE

The number of registered sales of fully electric vehicles between 2008 and 2012 in France is 2,971. The 2,971 electric vehicles on the road is approximately 0.080‰ (per mill) of the 37.2 Million vehicles in France [1]. There were 2,629 full electric vehicles sold in 2011 alone within a total sale of 2,204,229. In 2009 only 10 electric vehicles were sold and in 2010 152 electric vehicles were sold. For the year 2012, the sales of electric vehicles are expected to increase significantly: over 6,500 electric cars should be sold in France in 2012 [44][45].

The overall amount of charging points in France, disregarding different types, public or private stations, is estimated to reach 4000 units[119]. 14 fast charge facilities are in place (DC, CHAdeMO protocol)[3].

6.2 Initiatives on Electro-mobility in FRANCE

Within the French government, the Ministry for Ecology, Sustainable Development and Spatial Planning (MEDAD) is an important stakeholder in electro-mobility. It finances the rebate for electric vehicles, sets legal standards, formulates technical recommendations for EV infrastructures and finances EV projects through calls for bids via ADEME. ADEME is the Environment and Energy Management Agency, under the joint supervision MEDAD and the ministry for Higher Education and Research. Projects are also financed via the program of research, experimentation and innovation in land transport (PREDIT). Also, state-controlled fund providing loans and investments are provided for companies which perform innovative research and design projects via Fonds Stratégique d’Investissement (FSI).[46]

Four clusters are working on projects regarding electric vehicles: Mov’eo, PôleVéhicule du Futur, IDforCAR and Lyon Urban Truck&Bus. Mov’eo was initiated in 2006 and provides €160 million in subsidies for research themes in mobility solutions, road safety, demonstration and low CO2 vehicles, vehicles environmental impact, energy storage systems, mechatronics systems and ICE powertrain. Many companies, both large corporations and small and medium enterprises, including PSA and Renault, are involved in Mov’eo. Mov’eo is also open to cooperation with other clusters within the EU.

Some initiatives (random) are mentioned from hereafter:

- The cluster PôleVéhicule du Futur was set up in 2005 and sponsored 130 projects with €154 million of state funds for research themes in smart driving systems, urban mobility solutions, urban vehicles, durable technologies for terrestrial transportations and non-technological and training projects.
• IDforCAR initiated in 2009, incorporates 21 sponsored projects in the field of product engineering and process for small volumes, vehicle components and materials, intelligent on-board equipment and specific usages and client value.

• The cluster Lyon Urban Truck&Bus was initiated in 2005, mainly by Renault Trucks. It works on research and development programs for public transports and urban transports of goods and focuses on engine and powertrain, integrated safety and security, architecture and comfort, transport system and mobility modelling and management.[46]

• Paris has launched a network of electric rental cars under the name Autolib’. In the future 3,000 cars will be available in Paris and its communes. Renting a vehicle is possible 24/7 from more than 1,000 stations. Bolloré won the contract to deploy these electric cars together with 1,120 stations with parking and charging stations [48].

• The city of La Rochelle has introduced car sharing: Yelomobile. Since 1999 electric cars have been available; recently the fleet was expanded with 20 Citroën C-Zero electric cars. [49][50]

• Auto Bleue offers 126 electric vehicles in a car sharing service. It provides Peugeot iOns and Citroën Berlingos powered by Venturi. The service started on 9 April 2011.[51]

• Freshmile provides a complete package for entering electric driving. It offers an electric vehicle, charging points at home and at work, real-time remote battery management, an end-user interface via the internet, car servicing and monthly billing.[52]

• A total of 20 large private and public companies have gathered to order 50,000 electric vehicles. Delivery of the vehicles starts in 2011. Coordination of the action is done by the ministry of Environment.[46]

6.3 Policy / Regulation Regarding Electro-mobility in FRANCE

The French government offers a rebate of €5,000 for buyers of electric cars, either being individuals of companies. Also, no registration fee is charged. This incentive stays in place for at least 2012. [45]

An investment is to be performed by the French government to improve the battery charging network as part of a broader plan to encourage the development of clean vehicle technology and battery manufacturing.

By 2015 charging sockets will be mandatory in office parking lots; new apartment blocks must include charging stations by 2012. The number of electric vehicles may reach 100,000 by 2015, stated by former Environment Minister Borloo. To reach these targets, the French government plans to reserve €1.5 billion. The number of charging stations is estimated at circa one million by 2015: 900,000 private stations and 75,000 public charging stations. By 2020, these numbers should reach 4 million private charging stations and 400,000 public stations.[53, 54]
6.4 Stakeholders Electro-mobility in FRANCE

The French automotive industry has 9 electric car OEMs, being Renault, PSA Peugeot Citroën, Heuliez, Eco&Mobilité, Lumeneo, FAM Automobiles, Venturi, Bolloré, MIA, Aixan-Mega, Yvelines and Ligier. The main player in the automotive industry is Renault, which has an alliance with Nissan, and PSA Peugeot Citroën, and has a partnership with Mitsubishi.[46]

Électricité de France S.A. (EDF), headquartered in Paris, is largest French electric utility company. EDF primarily use Nuclear power for electricity generation[55]. GDF Suez S.A. is also a French electric utility company, with approximately 64% of their electricity production originating from renewable sources[56]. E.ON is the third producer and supplier of electricity in France. [57]

Within the battery manufacturing industry in France, four major companies are active. Batscap produces both lithium batteries and super capacitors for the automotive market, but also for defence and stationary markets. Batscap is a subsidiary of Bolloré, which is a diversified industrial company. Dow Kokam is an international company that develops and manufactures battery solutions for many industries: transportation, defence, industrial and medical. One of the three owners of Dow Kokam is the French company GroupeDassault. By November 2010, a plant was set up that provides mass production of batteries for electric vehicles. The Saft Group is a world leader in designing, developing and manufacturing advanced technology batteries. Saft Group has multiple manufacturing plants in France (Bordeaux, Nersac, Poitiers) and also has a joint venture with Johnson Controls. The fourth large battery manufacturer is the joint venture Renault-Nissan/CEA/FSI. Production of batteries for electric vehicles is to be started by mid-2012. The plant is located in Flins and is capable of producing 100,000 batteries per year.[46]

6.5 Technologies in place in FRANCE

In 2010, the French government has formed a charging infrastructure working group. This group coordinates installation of a standardized national charging network. Local governments are empowered to install public charging infrastructure, but they are also obligated to provide public parking areas with charging stations. A quota is set on reserved parking areas for electric vehicles and charging stations. Also, at the request of inhabitants, builders of collective residences must install charging facilities at parking areas. [47]

A Green Book on publicly accessible charging infrastructures in France was published in 2011. Recommendations on charge stations were made. For example, for universal charging two socket-outlets should be installed into normal 3-22 kVA charging stations: an E/F type socket outlet and a 62196-2 Type 3 socket-outlet. For fast charging it is recommended that two cables are attached to the charge pole: one for DC charging and one for AC charging. [60]

Apart from the other countries in Europe, France adopted the Type 3 socket outlet, also known as the “SCAME type”, instead of the widely adopted Type 2 socket (“Mennekes” type).

At the moment, no central payment system is set up for the usage of charge stations. For each installer of charge a separate payment system is used. The lack of a central payment system is one of the barriers for electro-mobility in France.[61].
7 Electro-Mobility in GERMANY

7.1 Current Situation Regarding Electro-mobility in GERMANY

The number of battery electric vehicles driving on Germany’s roads grew from 2307 to just over 4200 in the year 2011 [79]. During the first 11 months of 2011 the number of electric vehicles sold in Germany amounted to 1808 [80]. The current number of charging stations in Germany, irrespective of the various types, public or private stations, was 935 by the end of 2010\(^1\). Currently 2313 recharging points have been registered at the “Stromtankstellennetz” [81]. However, it is quite likely the real number of recharging points is considerably higher, because many private recharging facilities (e.g. on company property) have not and will not be registered. Also for many users at home (most often company owned cars used for work-home traffic) recharging points may have been installed which again is most likely to be realised on private property.

A considerable portion of electro-mobility in Germany is part of or a direct spin-off from various large-scale field experiments in the eight elected model regions for electro-mobility in Germany. Despite considerable effort and enthusiasm, the pace of growth in 2011 was a little disappointing with the original goals set for 2020 by the German government seeming far away, and critics openly question whether it is still possible to meet those goals. The third progress report from the national platform electro-mobility still concludes that despite slightly lower than anticipated growth, progress is still good and future opportunities for Germany to become leading in electro-mobility are excellent [82].

7.2 Initiatives on Electro-mobility in GERMANY

In Germany, the federal government put in place the “National development plan Elektromobility” whose aim it is to tie together climate action and industrial politics, in order to make Germany a leading market for electro-mobility, and introduce one million electric cars on the road before 2020. Instrumental in the roll-out of the development plan is the national platform electro-mobility, in which various economic branches, research disciplines and (federal) ministries are represented. NPE put forward proposals that should help to reach the goals of the national development plan electro-mobility. The National Platform also publishes periodic notices such as[83],[84], [85], [82].

Measures to be implemented were discussed at the National Strategy Conference on Electro-mobility in 2008 [86]. Consequent stimulation programs were put in place within the framework of conjunctive package II (2009). Apart from this the innovation alliance LIB 2015 resulted in an industry consortium which pledged to spend 360 million euros over the next years on research

\(^1\) Usually with two charging points
and development of Lithium ion batteries. Industry in Germany is investing approximately 17 billion € in Research and Development in total [82], resulting in 15 electrified vehicle models to be introduced over the next two years. € 1.17M is allocated in 82 project overall that are called R&D lighthouse projects (as examples leading the way).

![Figure 7-1: Projection of number of charging points for electric vehicles in Germany [62]](image)

The Federal Ministry of Transport has declared eight model regions for electro-mobility in Germany. The selected regions were:

- Hamburg
- Bremen/Oldenburg
- Rhein-Ruhr (mit Kompetenzzentren Aachen und Münster)
- Rhein-Main/Nordhessen
- Sachsen (mit Schwerpunkten Dresden und Leipzig)
- Stuttgart
- München
- Berlin-Potsdam
The German federal government (Bundesregierung) published the National Governmental Program on Electro-mobility on May 18 2011. The newest version is finished, but the complete contents are not publicly available yet [82].

After a call for proposals the German Government communicated on April 3 2012 four selected regions for Electro-mobility receiving a total of € 180M in the coming 3 years (max 50M per region) in order to bring more focus into the ramp-up program.

The four winning regions are Baden Wuerttemberg, Bayern and Sachsen, Berlin-Brandenburg and Niedersachsen. Other regions will continue their activities as planned like North Rhine-Westphalia who will develop a 12 km long electric corridor to their RWTH campus in Aachen. The impression is that as a consequence of this E-mobil competition between the 23 regions, an increasing number of new electro-mobility activities will be developed in the coming years.

![Figure 7-3: Illustration used in presentation on 3rd NPE report[82] of “Schaufenster” that give examples of how the complete system of energy supply, electric vehicles and traffic will fit together.](image)

### 7.3 Policy / Regulation Regarding Electro-mobility in GERMANY

The government in turn announced to adopt a “Government Programme Electro-mobility” (Regierungsprogramm Elektromobilität) on 18 May 2011 based on the National Electro-mobility Initiative (Nationale Plattform Elektromobilität – NPE) second report containing an analysis of the potential of electro-mobility and strategies to achieve the government’s goal of having one million electric cars on German roads by 2020.

In its second report NPE calls electro-mobility a key element to low-emission mobility and a opportunity as well as a challenge for further enhancing Germany’s position as a leading location for industry, science and technology. The report states that electro-mobility has a potential of creating roughly 30,000 additional jobs until 2020. NPE expects only 450,000 electric cars on
German roads instead of 1 million if consumers do not get additional incentives to buy electric cars.

The government intends to allocate an additional EUR 1 billion for R&D until the end of the legislative term. Government’s activities shall be coordinated with European and international activities in the field of electro-mobility.

In addition to the R&D activities, the government wants to create a set of incentives to promote electric cars. The government programme mentions tax privileges for private vehicles and company cars as well as non-monetary incentives like priority parking. The use of special lanes, e.g. bus lanes, shall be further examined in the context of show case projects.

Regional show case projects and technical pilot projects shall inform the public about electro-mobility, provide information with respect to the mass market suitability of the technical innovations and strengthen innovation and pool competences, creating synergy effects.

The government essentially follows NPE’s suggestions without giving direct aid like providing loans at reduced rates of interest as suggested by NPE or grants as suggested by the car industry and opposition members.

Finally, the new Energy Act (and specifically paragraph 14a) in Germany helps DSO’s with options to ramp up / ramp down current for recharging electric vehicles. Factually this act may pave the way for introducing ‘smart’ grid technologies in Germany without major legal hurdles. Specifically when a mass market begins to develop (expected around 2020 in Germany), and actions to accommodate the charging become inevitable, this may be a great advantage.

### 7.4 Stakeholders Electro-mobility in GERMANY

All the large utility companies in Germany are working on electro-mobility. With the political strategic effort to become more self-supporting energy wise, as well as the termination of the nuclear energy programme in Germany, has forced the utilities to prepare themselves for much more decentralized and sustainable energy generation. Most of this decentralized and sustainable energy generation will likely be produced by non-traditional energy companies and households. The rise of electro-mobility gives these companies an opportunity to create added value by installing buffering facilities and ‘smart grids” that can create synergy between sustainable energy and sustainable electric transport.

The automotive industry in Germany is long-standing and very strong, with some of the most well-known manufacturers being German. The important German car manufacturing industry seems slightly reluctant with regard to electric vehicles. Daimler has Smart, A and Vito in the field. BMW and VAG seem slightly reluctant: quality, price, and market opportunity are apparently not as desired yet. Industry asked for government support sometime later (2013 or so) when EVs become available. Recent industry proposal for 3.8 G€ governmental EV support linked to creation of 30.000 new jobs.

Also in the electronics industry Germany has some considerable strength with players like Siemens, Robert Bosch and Continental.
The German battery industry has growing interest in traction batteries. Serious investments as well as government R&D support (mainly within universities) will likely result in a strong position some years from now.

The forerunners in the R&D field were named “Leuchttürme” (German for light houses) that may lead the way into the future of electro-mobility.

<table>
<thead>
<tr>
<th>R&amp;D “Leuchtturm”</th>
<th># projects started</th>
<th>Total budget (in M€)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery</td>
<td>21</td>
<td>601</td>
</tr>
<tr>
<td>Driveline technology</td>
<td>28</td>
<td>230</td>
</tr>
<tr>
<td>Vehicle integration</td>
<td>6</td>
<td>113</td>
</tr>
<tr>
<td>Light-weighting</td>
<td>8</td>
<td>100</td>
</tr>
<tr>
<td>Recycling</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>ICT &amp; infrastructure</td>
<td>17</td>
<td>125</td>
</tr>
<tr>
<td><strong>Grand total</strong></td>
<td><strong>82</strong></td>
<td><strong>1,169</strong></td>
</tr>
</tbody>
</table>

Table 7-1: Investments in R&D regarding electro-mobility

Charging stations for electric vehicles are located on both private as public areas. The locations are mainly hotels, camping sites, restaurants, commercial centres, EV dealers and private individuals.

### 7.5 Technologies in place in GERMANY

Technical standards for electro-mobility are covered in DKE/VDE taskforces, which cover standards and regulation in the broad field from automotive specific technique to smart grids. For the time being, the proposals on standards are made by market parties for the largest part. With regard to recharging interfaces, the German industry has hopes that original German ideas and proposals will eventually become dominant. As examples: the VDE plug (dubbed “Mennekes’) or Mode 3, Type 2, is a German standard.

For now many different charging protocols have been applied in Germany so far such as for example regarding the plug; Schuko, Mennekes and Scame. The power varies from 230V-16 ‘normal’, 230V-32A ‘standard’ to 400V-63A ‘rapid’ according standardization which has evolved internationally (EU, Japan (CHAdeMO), France/Germany. Notably the Type 2 connector as well as a future combo connector for recharging in the public domain stem from Germany. Further the widespread availability of medium high power three phase electricity supply led to a German preference for ‘fast’ charging with AC over the Japanese industry standard now known as CHAdeMO.

There are several research and development (R&D) programs in Germany which are supporting the development of electric vehicles. This is embedded in the larger renewable energy initiatives that were running in Germany for many years. The automotive industry in Germany has quite a
few development programmes aimed at electric vehicles. For the time being there are a few products that are actually introduced on the market (smart, Mercedes A and Vito, later this year Audi A1 e-tron). Instead of a frontal attack on the markets (like Mitsubishi/PSA or Renault/Nissan are doing), the approach seems a more laid-back, near reluctant one. Possibly this is also sparked by a home market that has to-date not really lived up to expectations [87][88]. Alternative drivelines in general are not popular, and electric vehicles are no exception to this. Specifically for small two-seaters like Daimlers’ Smart 4two, they cannot count on much appetite from the German market. However, in a different setting where the car is not purchased, but used in a modern type of mobility concept, such as car2go, there may be new opportunities. This company started a new branch in Berlin in April 2012. The Berlin venture started with 1000 conventional cars but once enough charging infra-structure is in place, the roll out of electric smarts will start. In 2013, 300 electric vehicles will be added to the current fleet of car2go Berlin, according to press releases at the start of the programme.

Figure 7-4: Car2go Berlin
8 Electro-mobility in the UNITED KINGDOM

8.1 Current Situation Regarding Electro-mobility in the UNITED KINGDOM

The number of fully electric vehicles in the UK according to the sales figures (2009 till 2012) is 2,149 electric vehicles. The 2,149 electric vehicles on the road is approximately 0.063‰ (per mill) of the 34.2 Million vehicles in the UK[89]. There were 1082 full electric vehicles sold in 2011[90][45].

The overall amount of recharging points in the UK, disregarding different types, public or private stations, is estimated to be 960[91]. Included in that number of charging points are 33 fast charge facilities (DC, CHAdeMO protocol)[3].

8.2 Initiatives on Electro-mobility in the UNITED KINGDOM

The government has introduced the new Office for Low Emissions Vehicles (OLEV). OLEV was established to manage a program of features. The program provides a provision of over £400 million to support measures designed to promote uptake of the next-generation of ultra-low emission vehicle technologies. [93]

The New Automotive Innovation and Growth Team (NAIGT) were established by the government and communicate via OLEV. NAIGT works with the UK’s automotive industry to identify and agree a strategic view on the innovation and growth challenges in the period to 2025.[94]

The Technology Strategy Board (TSB) was established by the government and is a business-led executive non-departmental public body. It funds technology development more generally, including the development of electric vehicles in the UK. For electric vehicles these projects are in the field of hybrid urban commercial vehicles, energy recovery, range-extended electric vehicles, emissions optimization and weight reduction.[92]

In 2009 the Mayor of London, published the Electric Vehicle Delivery Plan for London with the aim of making London the electric vehicle capital of Europe.

The aspiration is to have

- 100,000 electric vehicles on the road as soon as possible
- A network of publicly accessible charge points across London
- The ultimate aim is for every Londoner to be within one mile of an EV charge point.
OLEV has provided funding for charging infrastructure (between 50% and 75%) to 8 Plugged-in-Places (PIP) Projects across the UK. These were selected following a competitive process in two “Waves”. The first three locations listed below were in Wave 1 which started in April 2010 and the remaining 5 were added in Wave 2 which started in April 2011. These 8 locations are:

1. London
2. North East (centred in Newcastle)
3. Milton Keynes
4. East of England
5. Midlands
6. Greater Manchester
7. Scotland
8. Northern Ireland

Figure 8-1 Overview of charging points in the United Kingdom [92]

The Electric Vehicle (EV) Network supports owners of electric vehicles by maintaining a list of publicly available charge points in the UK. Also, it recognizes that the public infrastructure is small. Members of the EV Network provide access to access points at their homes or businesses to other members of the EV Network.[96]
8.3 Policy / Regulation Regarding Electro-mobility in the UNITED KINGDOM

The British government provides a subsidy on vehicles which amounts to 25% of the vehicle price, with a maximum of £5,000, provided that the vehicle emits less than 75 g/km CO2. Furthermore, electric vehicles are exempted from road tax and also from congestion charging in the city of London. [45]

The government also supports the improvement of the charging infrastructure via the Plugged-In Places program. The scheme offers match-funding to consortia of businesses and public sector partners to support the installation of electric vehicle recharging infrastructure in lead places across the UK. [100]

By the Committee on Climate Change (CCC) a target was set on the number of electric vehicles on the road in the UK by 2020: £1.7 million. [92]

8.4 Stakeholders Electro-mobility in the UNITED KINGDOM

The Energy Technologies Institute (ETI) offers technology programs in many fields, amongst which are programs in the field of transport. One of the focus areas within transport is plug-in vehicles economics and infrastructure area. Its goal is to evaluate the potential role and economics of plug-in vehicles in the low carbon transport system, and to develop the technology tool-kit for delivering an intelligent infrastructure to support plug-in vehicles. Various companies are connected to ETI as a member, e.g. BP, E.ON and Shell [101].

Cars are produced in various places in the UK. Well-known car producers are Aston Martin, Bently, Jaguar Land Rover, Lotus, McLaren and Rolls-Royce. Large production quantities are obtained by Honda in Swindon (237,783 vehicles), Mini in Cowley and Oxford (260,000 vehicles) and Nissan (480,485 vehicles). Electric vehicles are produced by for example Smith Electric Vehicles, Bee Automobiles and Modec. [102, 92]

The battery industry in the UK includes over 2,000 employees. Development of batteries is performed by Axeon, Bee Batteries and Amberjac Projects. Batteries are manufactured by Ricardo, Axeon, Bee Batteries, LithiumForce and Amberjac Projects [92].

Elektromotive is the manufacturer of the most common public charging point in the UK: the Elektrobay. The company was founded in 2003 and by the end of 2010 it was estimated that Elektromotive had installed circa 70 charging points. Chargemaster also manufactures charge stations, either being fast charge stations or home charge options. Both Vevox Systems and ATP Technologies produces charge stations. HaloIP is active in the field of wireless charging technology. Furthermore, Pod Point, Park and Power and Pavement Power operate in the field of charge station manufacturing [92].

National Grid is an international electricity and gas company. A landmark research report published by National Grid and Ricardo shows that potential is present for electric vehicles or plug-in hybrid electric vehicles to provide balancing services to the power grid, which may improve the value for vehicle owners [103].
Northern Power Grid is responsible for delivering electricity to 3.8 million customers in the northeast of England, Yorkshire and northern Lincolnshire. Northern Power Grid participated in the Switch EV trial to gain insight in how electric vehicles are used and charged by users. [104]

8.5 Technologies in place in the UNITED KINGDOM

The rapid-charging station installed by ABB makes use of the Japanese CHAdeMO standard. This makes the charging stations compatible with cars such as the Nissan Leaf. The ABB rapid-charging stations are also equipped with the Open Charge Point Protocol (OCPP). OCPP allows for the rapid chargers to connect to a back-office infrastructure such that their use can be monitored for customer billing and remote diagnostics [97].

Locations of charging points for electric vehicles are supported by satellite navigation systems of TomTom, Garmin and CoPilot. It was expected that software applications for mobile operating systems such as iOS were soon on the market [92].

There are no interoperability standards in the UK. Source London en Source East are currently working on an agreement for interoperability and roaming.
9 Electro-mobility in NORWAY

9.1 Current Situation Regarding Electro-mobility in NORWAY

The number of fully electric vehicles in Norway according to figures from December 2011 is 5,448 electric vehicles [105]. The 5,448 electric vehicles on the road is approximately 1.879‰ (per mill) of the 2.9 Million vehicles in Norway[1].

The overall amount of public recharging points in Norway is estimated to be 3,194 units[106]. Included in that number of charging points are 22 fast charge facilities (DC, CHAdeMO protocol)[3].

9.2 Initiatives on Electro-mobility in NORWAY

The City of Oslo intend to make the Norwegian capital to one of the global leader in e-mobility were it has over 200 recharging stations for e-cars. In 2010 a new lot was opened which is the largest of its kind in the world, with 50 free parking and recharging stalls [105].

A current project in Norway called GrønnBil (“Green Car”), which was set up by the association of Norwegian energy companies, is a program structure for non-commercial sub-projects that increase the phase-in rate for rechargeable cars. The project will take an active role in the interface between users and suppliers, government and power industry through the following methods[107];

- Provide practical help and information to electric car users
- Working to improve conditions for rechargeable vehicles
- Demonstrate a need above suppliers
- Work for the development of next-generation infrastructure for rechargeable electric cars

The project GrønnBil was set up by the association of Norwegian energy companies to facilitate the introduction of 200,000 electric vehicles and plug-in hybrid electric vehicle on Norwegian roads by the year 2020. In 2009 the Norwegian Ministry of Traffic and Transport formulates the aim of reaching a 10% market share of electro vehicles until 2020 which would be around 300,000 units [105].

In December 2008, “Move About” launched the world’s first corporate electric car sharing fleet in Oslo. Currently they have over 60 electric vehicles in operation in Oslo, Gothenburg (Sweden) and Copenhagen (Denmark) [108]. The principle works by logging-in on their website and making a reservation. The cars are parked at dedicated parking places located around the city and the user can go to the closest ‘station’ at the reservation time, and unlock the car with their
received personal access card. Users pay a monthly membership fee and an hourly rate to use the vehicles. There is no mileage charge, booking fee, or insurance cost [108].

Figure 9-1: Overview of charging locations in Norway [124]

9.3 Policy / Regulation Regarding Electro-mobility in NORWAY

The Norwegian government revised the car registration fee into a more environmentally friendly direction in 2010.

The government of Norway has established a comprehensive fiscal incentive schema for the purchase and use of electric cars, which gives a large reduction in the vehicle's total cost by the following terms [105];

- No VAT
- No import duty
- Reduced annual vehicle tax (390 NOK)
- Free access to public fields
- Free parking in public car parks
- Use toll roads fee
- Drive in bus lanes
- Free domestic use of ferries

Since 2011 the leasing of electric vehicles enjoys a reduced VAT class compared with conventional vehicles. There is also a full VAT exemption for the purchase of battery systems (i.e. for the replacement). Furthermore, the basis value for the annual circulation tax of companies is reduced by 75% for pure electric vehicles and 50% for other electric related
systems (i.e. hybrids). Also, the depreciation rate for electric vehicles is reduced to one year for increasing the attractiveness of replacement investments [105].

Introduction in 2011 of a general funding amount of 30,000 NOK for the purchase of an electric vehicle or hybrid vehicles of the class N1 and M1. Alternatively there is also funded the purchase of a more powerful battery system (for systems higher as 70W/kg, 1.7 NOK per W) for the purchase of a new vehicle or the exchange of an older battery system.

All the political parties in Norway have agreed to keep the incentives for five more years. Most likely the targets will be raised in 2017 after the election of a new parliament from 50 000 EVs to 100 000 pure electric vehicles in 2020[72].

There was set up a funding budget for electro vehicle recharging stations of about 100 million NOK (about 11.9 million EUR) [105].

To stimulate the increase of, among others, electric vehicles, there are ideas in Norway to pressure the automobile industry into developing technology faster than it otherwise would. An example is a proposal which was to ban sales of new gasoline-powered cars in Norway from 2015. And since 2011, to promote the e-mobility, there is a strictly preference for electric vehicles in the public procurement of central government and local administrations.[105].

Norway has not yet established any statutory basis for low emission zones. However, a new section under the Norwegian Road Traffic Law is currently being prepared for a national scheme. Norway has an advanced electronic paying and controlling system for charging toll-road projects in 40 places in Norway and the Norwegian low emission zones are as of 2010 founded on this. The low emission zones will be affect heavy duty vehicles over 3.5 tons, i.e. buses, coaches and lorries [105].

9.4 Stakeholders Electro-mobility in NORWAY

Energy Norway is a non-profit industry organization representing about 270 companies involved in the production, distribution and trading of electricity in Norway. Together the companies produce nearly 130 TWh each year, which is ca. 99% of all power production in Norway. And the members have approximately 2.5 million grid customers, which is about 91% of Norway’s grid customers [109].

Think Global, the manufacturer of the electric vehicle, the Th!nk, was located in Norway but went bankrupt in March 2011. The company had a history of producing electric cars in the past twenty years of existence.

9.5 Technologies in place in NORWAY

In Norway multiple charging technologies are applied. In 2011CHAdeMO, which is an outcome of cooperation between Japanese auto makers, is the only fast charging technology available in Norway. In Norway, like the rest of Europe, the normal voltage is 230 V and a standard circuit can handle 16 A. Electric vehicles then, can charge at a maximum of 3.6kW. Therefore the common used charging modes used are Mode 1; Normal, ‘slow charging’, with a so called ‘normal household’ socket. And Mode 2, which is the same as mode 1, but with an in-cable...
protection, to prevent damage and fire due to electrical faults related to the ground connection. This is the most common charging mode today in Norway [110].

The type of plugs used are the Type 1 plug, which is the SAE 1772 standardised plug, often called Yasaki (a large producer of this plug) and is used in several cars already. Also the Type 2, so-called Mennekes plug, which is extensively used by the German auto industry, is used in Norway. The CHAdeMO chargers use a DC type plug [110].

Interoperability of charge point infrastructure will be implemented with State support. The existing Mode 1 infrastructure, which could be accessed with a metal key, will be replaced by an electronic key. Agreements on identification with an electronic key are not yet made. [72].
10 Electro-mobility in EUROPE

10.1 Current Situation Regarding Electro-mobility in Europe

Although even within the limited group of EU countries considered in this report the differences may be considerable. It is clear that the introduction of electric vehicles in each of the countries markets is still embryonic. Until recently, sales volumes did not reach 0.01% of new car sales in any of these countries, as indicated in the various country specific chapters. It is difficult to say to what extent the economic crises has influenced the growth of the market for electric vehicles. It is however unlikely that this is the only reason why initial estimates for 2012 are not reached. Other reasons are the number of different types available as well as the technical performance (range). The new electric vehicle models that are going to be introduced into the market will quite likely change this. The introduction of plug-in hybrid vehicles (such as the Opel Ampera and Toyota Prius) may become a milestone of broader market interest for electric driving as well as for larger sales percentages.

A prerequisite for electro-mobility is of course an adequate charging infrastructure. In all the countries considered there are considerable activities to introduce charging points in the public domain. The costs related to the installation of these charge points, being relatively new products themselves, is a bottleneck to install a large number of charge facilities. Dependant on the local situation and whether private charge facilities are in place, the number of charging points per vehicle on the road can change considerably. Table 10-1 gives the relative numbers for the European countries considered.

<table>
<thead>
<tr>
<th>country</th>
<th># public charging points</th>
<th># EVs</th>
<th>Charging points / EV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spain</td>
<td>306</td>
<td>419</td>
<td>0.73</td>
</tr>
<tr>
<td>Ireland</td>
<td>770</td>
<td>319</td>
<td>2.41</td>
</tr>
<tr>
<td>Portugal</td>
<td>1034</td>
<td>539</td>
<td>1.92</td>
</tr>
<tr>
<td>France</td>
<td>n.a.</td>
<td>2791</td>
<td>n.a.</td>
</tr>
<tr>
<td>Netherlands</td>
<td>2525</td>
<td>1254</td>
<td>2.01</td>
</tr>
<tr>
<td>Germany</td>
<td>2313</td>
<td>4200</td>
<td>0.55</td>
</tr>
<tr>
<td>Norway</td>
<td>3194</td>
<td>(5448)</td>
<td>0.59</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>960</td>
<td>2149</td>
<td>0.45</td>
</tr>
<tr>
<td><strong>Total of above</strong></td>
<td><strong>11102</strong></td>
<td><strong>14328</strong></td>
<td><strong>0.78</strong></td>
</tr>
</tbody>
</table>

Table 10-1 Number of full electric vehicles and charging points per country

2 France excluded from the total due to missing data on the number of public charging points.
Of course installing a large number of charging points is a means of stimulating the market introduction of electric vehicles and can be a strategic choice as such. Further it should be noted that it is difficult to get an accurate estimate of the number of privately owned charging points. A relative small number of public charging points might be explained by a relatively large number of recharging facilities that are privately owned. The majority of EV users in Germany has possibilities to create charging points on own property. As an example contrast, in the Netherlands (especially in cities like Amsterdam) the majority of EV users does not have this possibility and therefore depends on public facilities.

There is no online overview of all charging points in Europe. The site openchargemap is the only site so far that gives an overview. As can be seen in the following figure this overview is not complete while some countries are missing and or are incomplete/outdated (May 2012). This shows the importance of open data and the need of a good overview.

Figure 10-1: Overview of charging points in Europe according to openchargemap.org. Unfortunately this overview is not complete.

### 10.2 Initiatives on Electro-mobility in Europe

So far no pan-European initiatives for electro-mobility are formed. Mostly initiatives are taken within member states or occasionally between two or three neighbouring countries within European programmes. The European Commission is stimulating the introduction of electric vehicles within different frameworks: the Green Cars Initiative, TENT, CIP/ICT and Life+. 
10.3 Policy / Regulation Regarding Electro-mobility in EUROPE

In general, the policies are being altered to enable a successful introduction of electric vehicles in the market. As little experience has been gathered so far most of the policies are exploratory or preparative for what electric vehicles could bring to Europe in terms of, for example, sustainable transport, economical opportunities or possibilities to enable a sustainable energy transition.

The electric vehicles certainly fit in the EU policy to reduce greenhouse gas emissions and the method of accounting for electric vehicles certainly helps manufacturers to overcome the large investments. With regard to energy supply for the electric vehicle there is no uniform insight yet. Two plugs for charging in the public domain (Mode 3), namely Type 2 (VDE or Mennekes) and Type 3 (SCAME) are in competition. Despite Type 2 having significantly more support, no uniform standard has been agreed on. Regulation is not yet necessary, although interoperability and charging interfaces will soon become issues when more and more electric vehicles will be able to cover larger distances by fast charging during the trip when necessary.

10.4 Technologies in place

European car manufacturers (ACEA) recommend installing Type2/Type Combo inlet/connector, as of 2017, for charging electric vehicles.

At the moment, two European infrastructural solutions exist (“Type 2” and “Type 3”), both of which have been standardized at the international level within the catalogue of IEC 62196-2 standards, approving them in terms of safety and security. A significant number of countries in Europe have accepted the IEC Type 2 socket as the standard for home and public charging with mode 3 charging.
Since different car manufacturers use different standards for high-power AC and DC charging is no recommended standard for fast charging yet.

At this moment Electric vehicle customers are not able to recharge in different locations since there are no standard for any interoperability and identification and for this reason there are billing obstacles. In countries like the Portugal, the Netherlands and Ireland there are interoperability agreements on national level.

10.5 Impact of Electric Vehicles on air quality in Europe

One aspect that has not been covered yet in the country-specific sections of the report is the absence of pollutant tailpipe emissions on an electric vehicle. In certain places this advantage can become a very significant driver for electro-mobility. Note that due to introduction of cleaner vehicles with combustion engines, the EU emissions will decrease anyway, and that contributions due to the introduction of relatively small numbers of electric cars only starts to show sometime after 2020. Then speed of market uptake will decide how much additional reduction can be achieved with electric vehicles. In the scenarios given in the cited report [111] three scenario’s are mentioned: a realistic replacement of ICE by EV cars (scenario 1), an ICE breakthrough (scenario 2) and an EV breakthrough (scenario’s). In figure 10-3 and figure 10-4 the influence on air quality of the different scenarios is shown.

Specifically in densely populated areas with current problems in fulfilling air quality targets (for example such as those set by the EU), the introduction of a certain fraction of electric vehicles in the fleet can make a serious difference. In general it is very difficult to predict the specific impact on local air quality though, mainly because it depends on what type of conventional...
vehicle (in a specific usage) is being replaced by an electric type. A further complication for this moment is that not for all types of vehicles an electric alternative is available (e.g. a heavy duty truck). Automobile users that drive many yearly kilometers in the city include for example taxi’s, parcel delivery services, distribution vehicles and city buses. If specifically such types of vehicles that contribute much to the local emissions are replaced by zero emission (locally at least, and ignoring remaining tyre-pavement particulate emissions) vehicles, considerable impact on local emissions can be made.

Figure 10-3: NOx exhaust emissions of the total fleet of passenger cars in the EU, in three EV introduction scenarios and the Reference Case

Figure 10-4: PM10 emissions of passenger cars in the EU, in the three scenarios and the Reference Case (exhaust plus tyre/vehicle emissions) [111]
ANNEX I – Bibliography


[41] A. Dias, A. Giordano, INTELI.


[86] Nationale Plattform Elektromobilität, “Zweiter Bericht der Nationalen Plattform Elektromobilität Anhang”.


Market Review
15.10.2012

[Accessed 1 May 2012].


TNO, RDW cijfers elektrische voertuigen., 2012.


Cijfers Elektrische rijden, Agentschap NL, Juli 2012.


http://www.mobie.pt/en/postos-de-carregamento


http://www.investinspain.org/

http://www.ladestasjoner.no/