REZIPE

RENEWABLE ENERGIES FOR ZERO EMISSION TRANSPORT IN EUROPE

WWW.REZIPE.EU

REZIPE VISION DOCUMENT

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Project Coordinator:

Municipal Authority of the provincial capital Klagenfurt

Mr. Wolfgang Hafner
wolfgang.hafner@klagenfurt.at
Tel. +43 463 537 4885

Ms. Gudrun Treffer
gudrun.treffer@klagenfurt.at
Tel. +43 463 537 4284

Authors of this document:

FGM-AMOR:

Michaela Kargl

Susanne Loch

Iris Pein

Peter Wintersteller

Doris Wiederwald
wiederwald@fgm.at
+43 316 81045 55

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1 ABOUT THE REZIPE PROJECT

1.1 Project Summary

REZIPE shows methods for reducing the emissions of carbon dioxide (CO_2), nitrogen oxides (NOx) and fine dust (PM10) by introducing zero emission vehicles (ZEV) in urban environments. The energy used in ZEV derives from renewable and clean energy sources. The vehicles are tested in pilot project implementations in six European cities.

Furthermore REZIPE will

- Create a momentum for zero emission vehicles fed by renewable energy
- Validate policy tools
- Test innovative approaches for public vehicles or joint Public-Private-Partnerships
- Show case pilot implementations in the field of electric mobility in five regions. The regions will demonstrate the setup of the whole system: from the production and usage of renewable energy, to the establishment of concepts for commercial infrastructure and the procurement of vehicles for privates and commercial fleets
- Produce guidelines, a toolbox and template for follower cities to help cities/regions implementing ZEV in various other locations

1.2 The REZIPE consortium

Coordinator	
Municipal Authority of the provincial capital Klagenfurt	(AT)

Project Partners	
Austrian Mobility Research, FGM-AMOR	(AT)
Province of Reggio Emilia	(IT)
Institute of Traffic and Transport Ljubljana l.l.c.	(SI)
Institute for Social-Ecologial-Research ISOE	(DE)
Municipality of Bolzano	(IT)
Upper Austrian Academy for Environment and Nature	(AT)
Elaphe ltd.	(SI)
Pannon Novum Nonprofit Ltd.	(HU)

2 SUMMARY

The REZIPE Vision Document gives an overview:

- on the state of the art of technological developments in e-vehicles and charging
- as well as current policies in relation to e-mobility (from renewable sources) in general and in the CENTRAL EUROPE Programme countries in specific.

Additionally, to specify details and provide examples, the major achievements and evaluation results of the REZIPE pilots are presented (chapter 3.1.4.).

In chapter 3.2 relevant factors for the further implementation of e-mobility in Europe are depicted and assumptions for 2020 are set up based on EU-policies to be implemented.

3 VISION DOCUMENT

3.1 State of the art on e-mobility

3.1.1 Technological state-of the art

Over the last years on EU-Level and in several EU-countries strategic discussion and funding of e-mobility for pilot activities to test viability and day to day usability increased strongly and steadily – generally with a view to improve air quality and other transport-induced emissions.

Several technological innovations have been set up and been tested in real life conditions.

For the present vision document following main points in terms of state of the art und current challenges can be identified:

3.1.1.1 E-mobility and energy from renewable sources

There is consensus on the fact that the origin of energy plays a very important role when e-mobility shall make a significant sense in environmental terms, notably for reduction of CO_2 and particulate matter.

Therefore many countries combine efforts in the roll-out of e-mobility with plans for a higher share of renewable energy in their current energy mix, thus also reaching for the achievement of the 20-20-20 targets[i] and opening up new fields of economic growth and “green” jobs.

3.1.1.2 Battery systems

The battery system is the key element within an electrified drive train as it determines electric vehicle efficiency and cost-effectiveness of e-mobility. The battery is the crucial point where the most progress has been achieved in the last decade and because of that the day to day use for electric mobility in urban areas is feasible nowadays. Therefore electric mobility is now one of the key technologies for the replacement of fossil energy sources in transport in the long term.

Current challenges comprise:

- A variety of battery types is in use, with Lithium-ion batteries being the market leader, but with remaining concerns on the supply of Lithium, being a so-called rare-earth. Recycling of Li-Io-batteries is still in its infancy but is expected to rise with increasing demand in Lithium and accordingly higher prices.[ii]
- The driving range for a fully loaded battery is about 100-300 km, depending on battery type, e-vehicle and driving conditions. Although a great part of car journeys (e.g. in Austria 50 %)[iii] are under 5 km, many drivers still have a psychological barrier to rely on e-mobility (so-called range anxiety).

- The battery cost form a significant share of the e-vehicle cost, being still a major barrier to e-vehicle purchase. While currently manufacturers, e.g. Renault, provide leasing batteries lowering initial purchase cost, it is expected that battery cost will decrease until 2020 with increasing production volumes.
- "Normal" charging requires several hours, which is suitable for e.g. charging at night or at work. Fast charging stations, important for wider acceptance of e-mobility is slowly but steadily increasing in number are spreading. According to an IHS report from August 2013 the number of fast-charge networks is expected to grow from 1,800 last year to 199,000 by 2020 [iv] (see table 1).

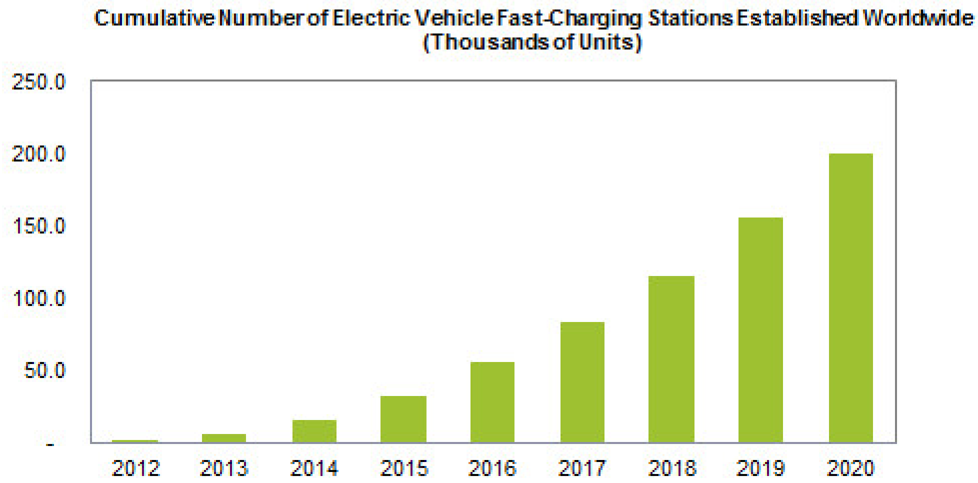


Table 1: Expected rise of Fast-Charging Stations until 2020 (source: IHS Inc. August 2013)

- Inductive resp. wireless charging of e-vehicles using an electro-magnetic field as well as related business models are currently in the stage of development, testing and first market releases [v] [vi] [vii]
- Vehicle-to-Grid systems (i.e. e-vehicles communicating with the power grid – either delivering electricity to the grid or slowing down charging when electricity need somewhere else needs to be responded to or to be flexible with changing power supply e.g. by solar- or wind-based electricity supply) are part of current and future smart-grid-developments. They are considered to be of economic and technical significance once a certain amount of e-vehicles is in use[viii] [ix].

3.1.1.3 Standardisation

Another very tricky but essential part is the standardisation. An international harmonisation of regulations and norms and standards for electro-mobility and infrastructure would help establish electro-mobility in the whole Central Europe region.

Decision makers and key players (different industry sectors that are a part of the electro mobility industry) play a very important role in this process and therefore need to be bound by national authorities to work together. In order to properly integrate electric vehicles into the power grid, the establishment of interface and protocol norms and standards is imperative.[x]

Standards for the industry will ensure that electric mobility is not detained by national boundaries and is able to spread over borders in the Central Europe region.

Standards would especially be needed in the following fields:[xi]

- Energy storage unit: Key from the technological side to the success of electro-mobility on the market and for the acceptance from the public. One of the most common cons of electro-mobility is the range of the vehicles. Standard needs to be set in terms of capacity, wear and also for safety requirements.
- Standards for components and interfaces: Will create an open market and open new niches. Through a standardisation in this field also prices will drop and dependences among market players will be reduced and out of these points new technologies will be introduced to the market more efficient.
- Charging Station and Plug standardisation: Not only technical standards need to be introduced, this also includes metering technologies and billing systems. Plugs need to be standardised, so that not every energy supplier or car manufacturer has its own technology. A common billing system also could help with public charging stations no matter which electricity supplier runs it.
- It is imperative that it is possible to charge electric vehicles within the Central Europe region everywhere and at all times. Vehicle interoperability with infrastructure must be guaranteed.

3.1.1.4 Electric mobility supply and value chain

The main three parts of the supply and value chain are the battery, the vehicle and the infrastructure. With the introduction of electro-mobility on a big scale new challenges arise, first of all the automotive and energy supply order. All these new introductions demand new approaches, new actors and new modes of cooperation's on different levels.[xii]

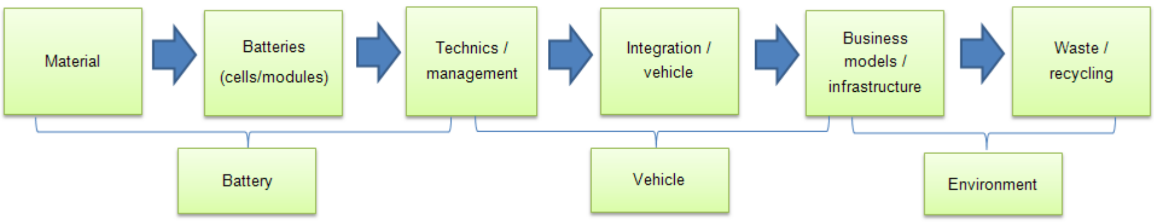


Figure 1: Automotive and energy supply chain

E.g. it would be good to move away from the existing automotive models and move towards an approach that includes all areas of the supply chain. This includes everything from materials and raw materials for e.g. lithium-ion batteries and electric motors and overall energy management. Most important in this challenge is the need to create new vehicle concepts and energy supply systems as well as to build the power supply infrastructure and business models required to make the transition to electric mobility in the Central Europe region possible. The individual countries are on different levels of transition, on the vehicle side (number of vehicles in use and produced), the political / policy side (funding, national strategies), the infrastructure side and knowledge side (researchers and also specialists for the market are key players).

3.1.2 State-of the art – policies, research, support measures

3.1.2.1 Policies and Funding Programmes

On EU-Level – together with the EU 2020 strategy - with the White Paper 2011 on Transport "Roadmap to a single European Transport Area – Towards a competitive and resource-efficient transport system", targets were set for reaching a reduction of minus 20% of GHG-emissions by 2030 (from the 2008 level). To reach that, among others, policies and funding programmes are to be targeted to halve the use of conventionally fuelled cars in urban transport by 2030 and phasing them out by 2050.[xiii]

Examples for national policy approaches and strategies in the CENTRAL EUROPE Programme countries and beyond will be explained further below (3.1.3 and 3.2.1)

Additionally in times of the economic crisis e-mobility has been considered to be an alternative to the falling sales volumes of conventionally fuelled cars and a chance for new markets (e.g. China).

In line with that, e-mobility and its related developments in vehicle manufacturing, pilot projects, programmes, initiatives and strategies have been an extremely dynamic issue in the recent years.

According to the “Roland Berger E Mobility Index Q3 2013” [xiv] governments now shift their focus from only funding technological research to providing funds and incentives to stimulate sales volumes of e-vehicles and to anchor the value added generated within the own country. Table 2 shows the current funding volumes for R&D in different countries:

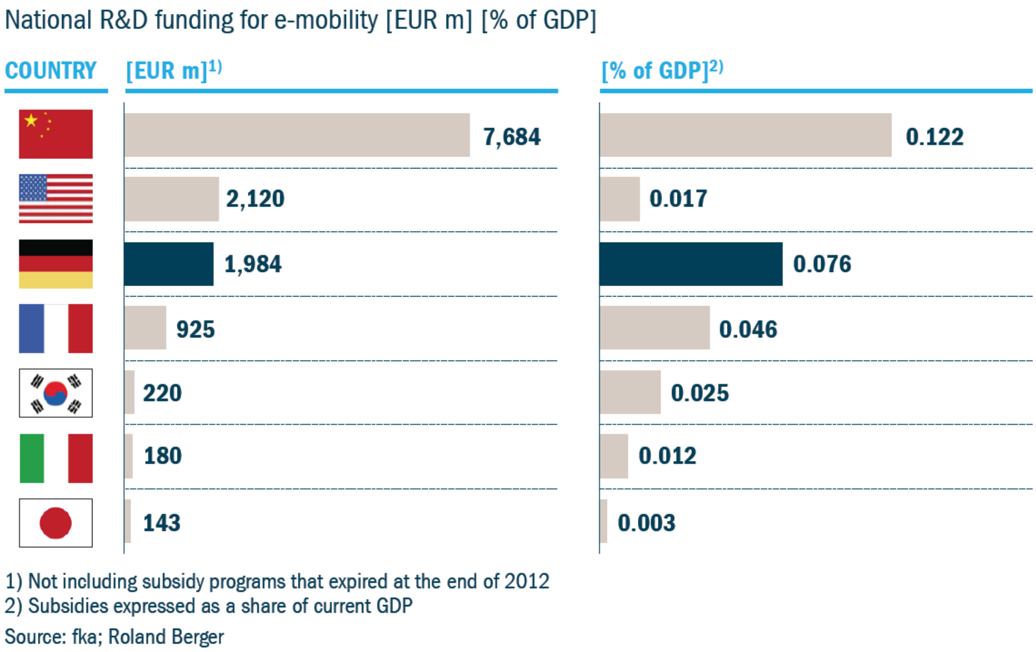


Table 2 R&D funding in relation to GDP (Source: Roland Berger E-Mobility Index Q 3, 2013)

3.1.2.2 Support measures

To support a further roll-out of e-vehicles different types of technological positioning and business models emerge. Table 3 shows the various strategies and market positioning approaches followed in different countries:

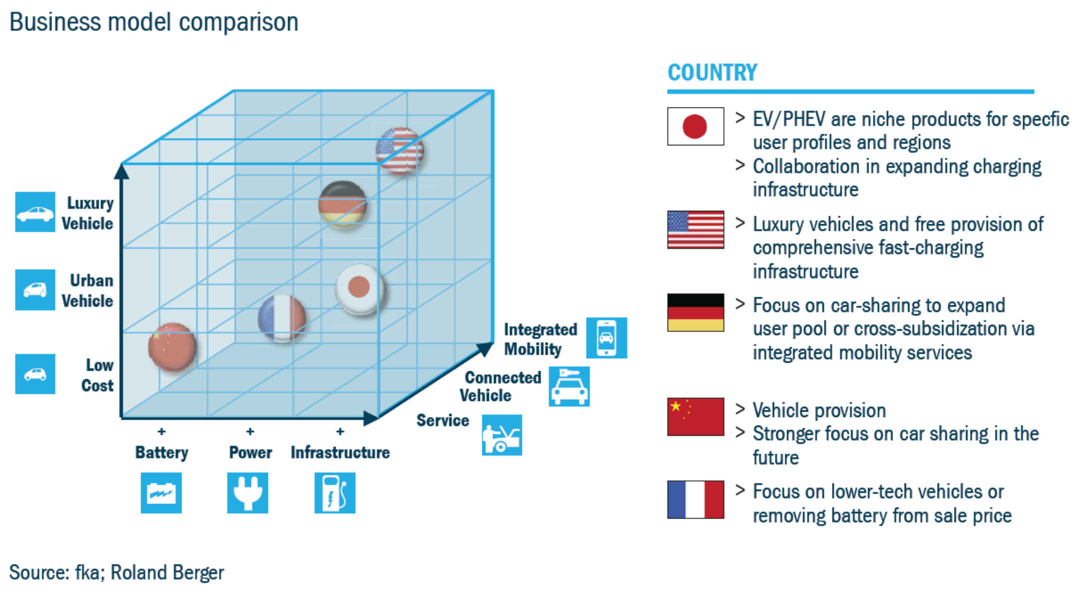


Table 3: Different manufacturer's models to support roll-out of e-mobility in different countries (Source: Roland Berger E-Mobility Index Q3 2013)[xv]

Thereby the role of car producers as mobility providers and their integration in public private partnerships will increase. This trend is already tackled with now e.g. with e-vehicle producers providing conventionally fuelled cars for a certain time per year to meet the issue of range anxiety when people go on vacation for free or for a comparable lower rent. Additionally e-car producers provide intelligent systems to check charging status of the batteries or GIS-systems providing information on the next charging spot[xvi].

Another emerging issue is car sharing with e-vehicles, especially interesting for urban areas (e.g. Respiro Car-sharing in Madrid, providing also Nissan Leaf).[xvii xviii].

Together with public authorities public private partnerships are being developed, be it with e-vehicle testing and renting schemes for a low-threshold "e-mobility-phasing-in" organised either by public or private institutions (e.g. in Reggio Emilia, Italy [xix]) or in combination with setting up solar power stations to provide for a clean energy source for the e-vehicle (e.g. CEMOBIL-project in Klagenfurt, Austria)[xx]. Another challenge for public-private-partnerships will be the standardization of charging procedures and billing/payment systems to ensure (Central) Europe wide barrier free e-mobility. User interests need to be put above interests of industry and have absolute priority.

In order to reach not only targets of lower CO_{2}- and particulate matter-emission but also to solve other problems in the context of urban mobility (land-take by parking, congestion, etc.) it is widely agreed that e-car should not directly replace conventionally fuelled cars in an 1:1 manner.

Rather following approach should be followed:

Avoid: Avoid not necessary (car) trips, be it to shopping malls on the urban fringes or commuting alone (and rather foster car-pooling)

Shift: As many necessary trips as possible should be shifted to other modes of mobility, walking, cycling and public transport (which is/can be powered by electricity)

Substitute: Individual car-based mobility should be substituted to the greatest possible extent by non-conventionally fuelled vehicles, e.g. biogas and e-vehicles.

Therefore it is necessary to integrate e-mobility into a net of different mobility options, be it bike, walking or public transport.

An example for that can be found with the “yelomobile”-Initiative in La Rochelle, France, where – with a “smart-card” e-cars can be rented. Additionally this smart-card provides also discounts for public transport, taxis and parking and allows renting e-bikes for free.[xxi]

Other incentives for shifting to e-mobility is the setting up of environmental city zones that e.g. can be accessed by e-vehicles alone, free parking for e-vehicles, free public charging spots etc. Some of them are under discussion as urban land-take is the same as for conventionally fuelled cars.

Both for funding programmes and supporting measures discussions show that there is a need for stable funding, supporting programmes as well as legislative and regulative frameworks (e.g. for the homologation of new e-vehicles, common safety standards and liability issues) to allow to get the e-mobility technology and its application in day-to-day mobility more mature – and not to shift to other fuel options and models (as it happened e.g. with biofuels).

3.1.3 E-Mobility in countries outside the CENTRAL EUROPE Programme area

As outlined above, (3.1.2.1.) in the last years e-mobility has experienced a very dynamic development in terms of initiatives, funding and programmes. Therefore, in the following, only three examples of national approaches to e-mobility (outside the CENTRAL EUROPE Programme area) are described, due to their specific national strategies and Norway’s goals achieved.

3.1.3.1 Portugal

Together with setting new targets on a higher share of renewable energies in the Portuguese energy mix Portugal started in 2008 the MOBI.E programme, following a coherent top-down approach.

Thereby a MOBI.E-network was set up, comprising 1,300 normal charging stations and 50 fast charging stations with public access throughout Portugal. Additionally the MOBI.E-network integrates a payment system and supports other services as selecting charging locations and planning routes accordingly.

Further MOBI.E provides financial incentives for the purchase of e-vehicles, with higher contribution when replaced with an end-of-life conventionally fuelled vehicle as well as tax exemptions and reductions.[xxii]

3.1.3.2 Ireland

In Ireland a national e-mobility initiative, called “e-car Ireland” is implemented. In 2010 the energy provider “ESB”, established a subsidiary called “ESB e-cars” which is responsible for setting up 6,000 charging stations by 2015 across the country and to support the roll-out of e-mobility in Ireland. The target set by the national government is to reach for a 10 % share of e-vehicles in the Irish motor fleet by 2020.[xxiii]

3.1.3.3 Norway

Norway has the highest share of e-vehicles per capita in the world, with 13,877 electric cars registered in August 2013, with 99% of the energy coming from Hydropower.
Following the target to reach 50,000 zero emission vehicles by 2018, this success can be based on several incentives with fuel taxes being higher in Norway than in other parts of the world. Also e-vehicles are permitted to drive on bus and taxi-lanes, have a free use of toll-roads and have access to free parking on public parking.
Tax incentives are an additional important element in the increase of e-vehicles purchase in Norway. Exemptions from VAT and purchase taxes make e-vehicles very competitive to conventionally fuelled cars there.[xxiv] [xxv] [xxvi].

3.1.4 Achievements of the REZIPE-project

In 42 months of REZIPE implementation in six demonstrator regions, the project could achieve emission savings as well as achieved results suitable for transfer to other regions and further know-how exchange.

3.1.4.1 Emission savings during REZIPE project duration

In the 42 months of REZIPE implementation in six demonstrator sites in total nearly 150,000 km were driven with e-vehicles (see also table 4). These trips mainly replaced journeys which would have been otherwise made by conventional combusted cars. For a detailed description of the demonstrator sites and the measures implemented see http://www.rezipe.eu/index.php?id=6&ID1=4.

City/Region	Kilometres made with REZIPE E-vehicles			
	E-bicycle	E-car	E-delivery vehicle	Total
Bolzano	1,026			**1,026**
Klagenfurt		66,018		**66,018**
Ljubljana	8,468	2,270		**10,738**
Reggio Emilia			70,941	**70,941**
Upper Austria	1,980			**1,980**
Györ				**0**
Total	**11,474**	**68,288**	**70,941**	**150,702**

Table 4: Kilometres driven with E-vehicles in the REZIPE demonstrator regions (Source: www.rezipe.eu, Institute of Traffic and Transport Ljubljana)

Direct emission savings from REZIPE demonstrators (until July 2013) are the following:[1]

Vehicle type	CO_2 (kg)	CO_2 (%)	CO (kg)	No_x (kg)	PM10 (kg)
Electric bike	1,019.62 kg	6.8%	13.13 kg	1.37 kg	0.21 kg
Electric car	8,069.84 kg	53.7%	184.91 kg	11.92 kg	3.14 kg
Electric delivery vehicle	5,927.29 kg	39.5%	89.16 kg	10.48 kg	2.04 kg
TOTAL	**15,016.74 kg**	**100,0%**	**287.20 kg**	**23.77 kg**	**5.39 kg**

Table 5: Distribution of direct energy savings with REZIPE e-vehicles by the type of implemented vehicles and pollutants (CO, NOx, PM10 and CO_2) - (Source: www.rezipe.eu, Institute of Traffic and Transport Ljubljana)

From the table it can be seen that the potential of CO_2 savings by e-mobility is quite substantial. On the other hand it is worth noting that due to further development of combustion engines and the strengthening of emission standards the potential for reduction of PM10 due to e-mobility is comparably low.

3.1.4.2 Long-term emission savings by REZIPE

In the course of the REZIPE project evaluation long-term impacts were measured in future use of e-vehicles - encouraged by the REZIPE pilot testing in the demonstrator regions. Thereby notably e-car and e-delivery car users claimed that the REZIPE experience influenced their future use of e-vehicles (see table 6).

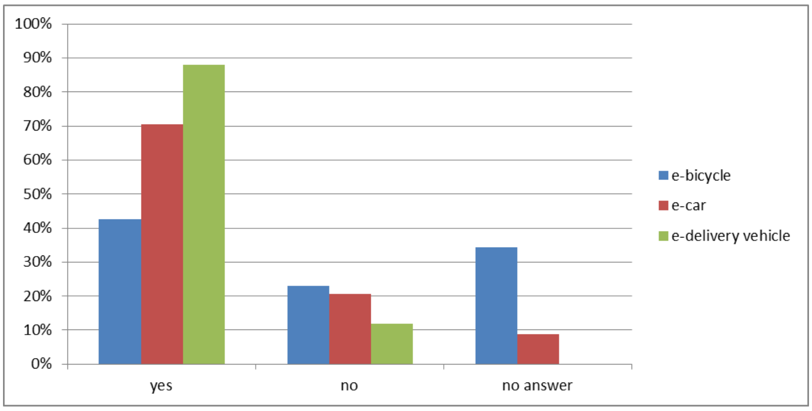


Table 6: Influence of REZIPE pilot testing on the decision about future use of EV (Source: www.rezipe.eu, Institute of Traffic and Transport Ljubljana)

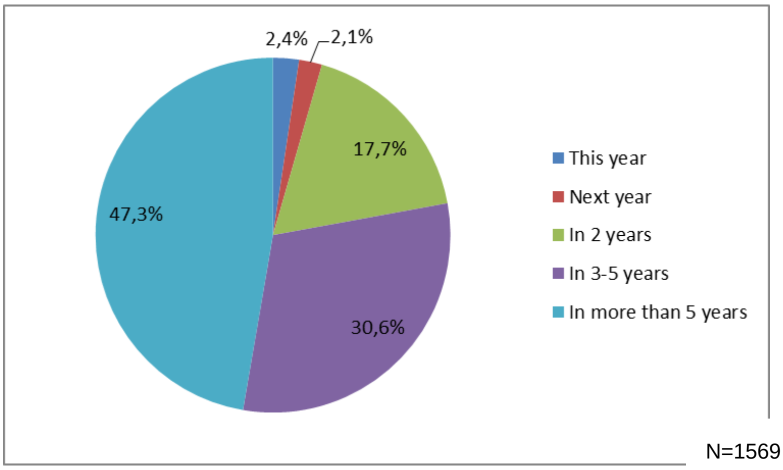
1 Calculation based on the formula: Emission saving* = (kms tested) x (emission per km)**

* Only for users that (in case of not testing) would use less environmental friendly mean of transport

** Emission of alternative transport (emissions prevented)

This shows the significance and positive long-term impact by the provision of pilot testing, also in day-to-day mobility, letting test users getting acquainted with e-mobility and lowering the threshold for trying it.

As regards the actual buying and regular use of an e-vehicle it can be seen (Table 7) that only a small share of test users would consider it in the short term but about half of them within the next five years. The most frequent reasons for not buying an e-vehicle mentioned were the high purchase price and the short range (mainly for e-cars).



N=1569

Table 7: Timeframe of start using the EVs (Evaluation Questions: When would you buy/regular use an EV?) - (Source: www.rezipe.eu, Institute of Traffic and Transport Ljubljana)

Provided an e-vehicle is purchased to replace a conventionally fuelled vehicle and provided that those potential buyers were positively influenced by the REZIPE-pilot testing, the impact of REZIPE within the next five years can be estimate as follows:

Reggio Emilia	Klagenfurt	Bolzano*	Ljubljana	Györ**
34.81	117.4	n.a.	106.2	n.a.

Table 8: Estimation of long-term impacts in REZIPE cities/regions (CO2 emission savings in tonnes) - (Source: www.rezipe.eu, Institute of Traffic and Transport Ljubljana)

*The collected data were not representative enough for reliable estimations

**Pilot not finalized at the time of the evaluation

3.1.4.3 REZIPE Know-How and experiences made in the implementation of e-mobility for transfer and the future

A lot of know-how and experience could be generated which the project consortium is keen to transfer to interested people, experts and potential follower regions. Therefore the REZIPE transfer toolbox with the most important transferrable experiences was developed (see http://www.rezipe.eu/guide_ebook/)

For on-going exchange and further development of e-mobility know-how beyond the project end the REZIPE Zero Emission Platform (ZEP) was set up (see http://zero-platform.rezipe.eu/login.phtml). This platform serves as an online database for registered users wanting to exchange ideas and know how. Access to the platform is provided after the potential user has signed the Memorandum of Understanding with the City of Klagenfurt (Lead Partner of the REZIPE project). Access is free; each member of the ZEP is requested to upload documents of interest to the platform as well. The ZEP allows to raise questions to all or specific ZEP-members or to look for partners if an EU-project should be initiated.

3.2 Scenarios to 2020

3.2.1 Policies and strategies in CENTRAL EUROPE programme countries

The following chapter provides an overview about federal plans, framework conditions and strategies of the Central European countries with regard to (renewable) energy and electric mobility.

3.2.1.1 Germany

According to the “Energieplan”[xxvii] the German government has high aims to change the energy mix: expansion of renewable energies to 80% and phase out of nuclear energy Furthermore the “National Development Plan for Electric Mobility”[xxviii] sets the number of electric vehicles to one million until 2020. To achieve these goals, the Government Programme for Electric Mobility[xxix] was adopted in 2011 which includes the following key incentives and measures:

- “Increase of research and development funding by an additional 1 billion euro by the end of 2013
- Establishment of regional "showcases" and technical "lighthouse projects"
- 10-year vehicle tax exemption for cars with CO2 emissions of less than 50g/km and bought by 31 December 2015
- Adjustment of the taxation on company cars in order to eliminate present taxation disadvantages of electric vehicles as compared to conventional vehicles as company cars
- Gradual switch over of the vehicle fleet of the Federal government to electric vehicles (target value: as of 2013 onwards CO2 emissions of 10 per cent of all new cars to be less than 50 g/km)
- Special parking areas and less rigid access prohibitions
- Use of bus lanes

- Introduction of a special label for environmentally friendly cars within the framework of the 40th Ordinance on the Implementation of the Federal Immission Control Act (so-called "blue label")."

Major funding programmes currently in place are large regional demonstration projects /showcase regions (German: "Schaufenster"), pilot regions for electric mobility as well as regional demonstration projects and a special programme for hybrid busses[xxx].

3.2.1.2 Poland

According to the "National Renewable Energy Action Plan (NREAP) of Poland"[xxxi] the country aims for 15% energy out of renewably resources in 2020. Furthermore the "Transport Development Strategy by 2020"[xxxii] sets targets to promote environmental friendly vehicles and to reduce greenhouse gases to a level of maximum of 45,455.14 thousand tons by 2020. According to a Roland Berger-Study on "E-mobility in Central and Eastern Europe"[xxxiii]there is no national strategy for electric vehicles although a high potential (compared to Austria) is seen. The „Green Cars Klaster"[xxxiv] is a cluster of companies and is currently the biggest organisation promoting electric vehicles in Poland. In terms of national funding programmes[xxxv], the Regional Development Agency „Mielec" disposes over 5 million € for „Building the electric vehicle market and charging point infrastructure as the basis for energy security". Mielec coordinates five pilot projects in major cities with the aim to build 330 charging points, deliver 20 test e-vehicles and gather information on user behaviour.

3.2.1.3 Slovakia

According to the Ministry of Economy Slovakia will increase its share of energy from renewable sources in gross final consumption of energy to 14% by 2020. Biofuels will predominate in the transport sector. Therefore electric cars are expected to account for a small share, which means that the use of electricity from energy from renewable source for transport purposes is expected to be around 200 GWh. [xxxvi]

According to the Roland Berger-Study [xxxvii] there is little public interest in electric vehicles, no further events, formal associations or similar actions have been undertaken so far. The Government is described to be contemplating e-mobility support opportunities but has not started its actions so far either.]

3.2.1.4 Austria

There are some possible quantities of renewable energy to achieve the 34% target for renewable energies in 2020 in Austria. In addition to water, wind and solar power, also biomass is an important topic. The efficiency scenario according to the specifications of the Austrian Energy Strategy proposes the following for 2020: final energy consumption is limited at 26,273 million toe (1 100 PJ) and allowing for own use and losses during transport, this results in a gross final consumption of energy of 27.109 million toe (1 135PJ) (Instead of 30.6 million toe in the reference scenario in 2020 with fossil energy).

The Austrian Government supports e-vehicles in different ways – the Austrian climate protection initiative (klima:active) supports promotion and acceleration of the use of RES (Renewable Energy Sources). The Acceleration of a gradual, comprehensive introduction of electromobility in Austria forms a strategy regarding tax incentives, information, awareness-raising and others to increase the share of renewable energy in private transport. The Green Electricity Act (ÖSG) promotes green electricity[xxxviii].

According to the Energy Strategy Austria a promotion of a gradually nationwide implementation of e-mobility in Austria is taking place. The target is defined with the achievement of a share of 10% renewable energy in the transport sector by 2020. The amount of electric vehicles in use in Austria by 2020 is thus 250,000 (e-vehicles, plug in hybrid vehicles, not considering single-track vehicles); this corresponds to a share of almost 5% of the total vehicles estimated in use by 2020. [xxxix]

3.2.1.5 Hungary

Today electric power generated from wind and solar energy sums up to around 1% of the total production. These two types of energy would be worth exploiting in the future for zero emission transport in Hungary. There are no national economy plans existing regarding e-mobility at present. The National Climate Change Strategy determines the expectations for the period of 2008-2025 on a political level.

According to the National renewable energy Action Plan, Hungary wants to target energy consumption from renewable sources in gross final consumption of energy in 2020 15%. [xl]

3.2.1.6 Slovenia

Slovenia's energy policy for renewable energy sources focuses on ensuring a 25% share of renewable energy sources in final energy consumptions and a 10% share of renewables in transport by 2020. This reflexes a doubling of energy generated from renewable sources relative to the baseline year of 2005. Implicit in meeting this target is a precondition of reining in the growth of energy consumption. This is guided in part by the national energy policy in the area of transport as well as by the European transport policy and national development policy.[xli]

There is no specific and general strategy towards e-mobility in Slovenia.[xlii]

3.2.1.7 Italy

According to Directive 2009/28/EC, in 2020, 17% of Italy's final energy consumption must be covered by renewable sources.[xliii] At the beginning of 2013 a national energy strategy has been passed, giving an increase of the national final energy consumption to 20%.[xliv]

There is interest in several initiatives aiming to strengthen the role of electric mobility, even though there is still a lack of an integrated national strategy.

Yet there is a high potential for the diffusion of electric vehicles. 14% of young people and 12% of adults declare to consider buying an electric vehicle.[xlv]

Some regions have already developed own funding programmes, implemented above all in northern and central parts of Italy. In a lot of cities the infrastructure for e-vehicles is already given. Italy has defined 2012 a new law (134/12) that directs the context for the development of e-mobility in national level. With this law e-mobility and e-vehicles especially got new attractiveness. E-, hybrid-cars as well as low-emission-vehicles (under 120g/km) powered by CNG, biogas or LPG are funded and supported. [xlvi]

3.2.1.8 Czech Republic

The Czech Republic envisions a share of energy from renewable sources in gross final consumption of energy in 2020 of 14%.[xlvii]

The governmental energy concept for 2004-2050 currently includes considerations for the implementation of instruments stimulating electric mobility. There are planned investments in public infrastructure (recharging points), direct subsidies, fiscal incentives for the supply and operation of recharging systems and for the purchase of electric vehicles etc.

A funding of the purchase of environmental friendly vehicles for public transport can be received from the INTERREG IV programme until 2013. There is also a road tax for vehicles used for business purposes from which electric, hybrid and other alternative fuel vehicles are exempted from.[xlviii]

3.2.2 Influencing factors for e-mobility development

The development of the roll-out of e-mobility in the countries of the CENTRAL EUROPE Programme until 2020 will depend on several factors, outlined below.

3.2.2.1 Framework conditions

General framework conditions influencing the further market launch of e-vehicles comprise the development of

- Crude oil prices – Naturally the higher they get the more favourable are the conditions for purchasing e-vehicles (with comparably lower running costs)
- Electricity prices – as running cost of e-vehicles depend on them
- Development of renewable sources of electricity – as there is common agreement that e-mobility makes sense only in connection with electricity from renewable sources.
- Further implementation of 20-20-20 targets and political prioritisation – as political agenda setting and prioritisation will influence the willingness of the policy level to support development and standardization of the legislative and technical framework as well as other favourable contexts for a further roll-out of e-mobility

(e.g. smart-grid and smart-city approaches, and planning, incentives such as environmental zones, etc.)

- The general economic situation – regarding the purchasing power of consumers but also regarding the financial power of the EU and public authorities to provide funding and financial incentives (tax exemption, road toll release, free parking etc.)
- Continuity of providing policy incentives in e-mobility – no sudden changes between hybrids, biofuels and e-vehicles to ensure full marketability of e-mobility.

3.2.2.2 Favouring technological developments

As described in chapter 5.1.1. several technological challenges exist that can further influence the roll-out of e-mobility positively:

- Batteries: this concerns the enhancement of battery capacities for extended driving range, the decrease of the battery price, the provision of raw material and lithium recycling efforts as well as the standardization in wear and safety requirements.
- Charging: Intelligent charging stations are rising in numbers, fast charging is expected to spread widely until 2020, inductive charging is in its starting phase; standardization of charging technologies and billing systems as well as a widespread set up of charging facilities. Another important development is the vehicle-to-grid-technology.
- Standardization of components and interfaces – for economies of scale and thus cheaper e-vehicles, reducing dependencies and more efficient roll out.
- Further development of e-vehicles to have a broader offer on the market tailored to special user needs and behaviour patterns.
- Further development and roll-out of ICT-services e.g. for info on charging level, location of the next suited charging station etc.

3.2.2.3 Availability of incentives and awareness raising

An important part for a further roll-out of e-mobility is the provision of incentives and awareness raising:

- The further development and implementation of user-oriented business models for an enhanced leasing and/or purchase of e-vehicles together with the provision of renewable energy will be key to a further spreading of e-mobility. Along with that customer/driver behaviour and expectations with regards to new business models (e.g. leasing vs. buying) is expected to change.
- Integration of pilot projects as well as test and promotion events in local mobility, climate protection and energy strategies and action plans. More testing opportunities are important factors to get potential users acquainted with e-vehicles and their driving characteristics. The longer the testing period the better

users can experience day-to-day and weekend mobility with the e-vehicles – and the more open they get to lease/purchase one.

- The provision of target group oriented marketing and positioning of e-vehicles on the market. From surveys and pilot activities it can be seen, that there are already groups interested in e-mobility: fleets (that can make e-cars more cost-effective with high mileages driven), e-cars for the luxury sector, transport vehicles for commercial use, etc. Studies show that the positive eco-balance and societal benefits are important factors – but not influencing the actual purchasing decision. Conventional car commercials work with emotions, driving experience and suitability for specific needs of the potential users – the more this is taken up in advertisement for e-mobility the better.
- Sound target-group oriented awareness raising on e-mobility, its possibilities and its offer, e.g. in terms of comparably lower running cost, as well as advise for handling and testing
- Further integration of e-mobility into the overall mobility chain and services – integration with car-sharing into public transport systems, smart cards for mutual user incentives, provision of suitable vehicles and transport offers for the specific need of users (e.g. for transport of goods, for small errands, etc.)
- Further and more wide-spread provision of after-sale-services, e.g. support services for the first months, support with charging questions, provision of ICT-services, and also provision of a replacement vehicle longer drives if needed (beyond available range of e-vehicle, e.g. in vacations)
- Extension of charging infrastructure, on public as well as private land e.g. at companies, commercial parks and in housing estates.
- Further development of target-group oriented incentives, e.g. specific ones for fleets, commuters, car-sharing use – be it free or priority parking, access constraints for conventionally fuelled vehicles, free charging, grants for buying e-vehicles, etc. [xlix l li]

3.2.3 Scenario for 2020 based on the European Strategy and Legislation

European Union legislation adopted in 2009 sets mandatory emission reduction targets for new cars. This legislation is the cornerstone of the EU's strategy to improve the fuel economy of new cars sold on the European market. The law is similar to that for new vans.

Under the European Union's Cars Regulation, the fleet average to be achieved by all new cars is 130 grams of CO2 per kilometre (g/km) by 2015 – with the target phased in from 2012 - and 95g/km by 2020. The regulation is currently undergoing amendment in order to implement the 2020 target.

The 2015 and 2020 targets represent reductions of 18% and 40% respectively compared with the 2007 fleet average of 158.7 g/km.

In terms of fuel consumption, the 2015 target is approximately equivalent to 5.6 litres per 100 km (l/100 km) of petrol or 4.9 l/100 km of diesel. The 2020 target equates to approximately 4.1 l/100 km of petrol or 3.6 l/100 km of diesel.[lii]

In the Central European countries more than $2*10^{12}$ passenger kilometres have been travelled by car in 2010[liii] , this is about 44% of the amount of passenger kilometres travelled by car in the EU-27.

According to the European Union's "Transport in Figures, Statistical Pocketbook 2012" CO_2 emissions generated by road transport in the EU-27 amounted to about 868 million tonnes of CO_2 in 2009. Thus, if we assume that about 44% of the EU-27 road transport kilometres are driven in the Central Europe Programme countries (as stated above), the amount of CO_2 generated by road transport in the Central Europe Programme countries was about 381 million tonnes of CO_2.

Taking into account the European Union Cars Regulation adopted in 2009 of reducing the new cars' emissions of CO_2 to 130g/km by 2015 and 95g/km by 2020, and assuming an average vehicle lifetime of about 8 years[liv], we assume that the average CO_2 emissions from cars will still be just a bit less than 130g/km in 2020. According to forecast-studies (e.g. Emissionsprognose Verkehr of Technical University of Graz[lv]), the reduction of fuel consumption (and related CO_2 emissions) per vehicle-km will be out-weight by the envisaged increase of vehicle kilometres driven. Thus in 2020 the amount of CO_2 generated by road transport in the Central Europe Programme countries is assumed to be about 381 million tonnes of CO_2 in 2020, if the "business as usual-scenario" is applied.

If measures to foster e-vehicle uptake are implemented and framework conditions are favourable ("Introducing new forms of vehicle ownership and use"-scenario), we assume that about 10% of CO_2 emissions from transport can be saved in 2020.

4 LIST OF TABLES

5 REFERENCES

- Information in this document was retrieved by references mentioned below and from the REZIPE project experiences.
- Website information mentioned was retrieved in September 2013.

[i]More information on the 20-20-20 targets under: http://ec.europa.eu/clima/policies/package/index_en.htm

[ii]http://www.waste-management-world.com/articles/print/volume-12/issue-4/features/the-lithium-battery-recycling-challenge.html

[iii] Herry Max Dr., „Verkehr in Zahlen“, 2011

[iv]http://ihs.newshq.businesswire.com/press-release/design-supply-chain-media/number-fast-charging-stations-electric-vehicles-set-rise-nea

[v] http://www.eon.com/en/business-areas/sales/mobility/e-mobility/inductive-charging.html

[vi] http://www.qualcommhalo.com/index.php/advantages.html
[vii] http://www.bbc.co.uk/news/technology-18984160
[viii] http://en.wikipedia.org/wiki/Vehicle-to-grid

[ix] EMAS-Vienna, 2013, Conference Proceedings, Article by Roman Bartha, Siemens AG

[x] Zweiter Bericht der Nationalen Plattform Elektromobilität, Berlin, Mai 2011
Herausgeber: Gemeinsame Geschäftsstelle Elektromobilität der Bundesregierung (GGEMO)
http://www.bmbf.de/pubRD/zweiter_bericht_nationale_plattform_elektromobilitaet.pdf

and

Fortschrittsbericht der Nationalen Plattform Elektromobilität (Dritter Bericht)
Berlin, Mai 2012
http://www.bmwi.de/BMWi/Redaktion/PDF/Publikationen/fortschrittsbericht-der-nationalen-plattform-elektromobilitaet,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

[xi] Electromobility in Germany: Vision 2020 and Beyond, Marko Kolbe, Stefan Di Bitonto
Germany Trade & Invest
http://www.gtai.de/GTAI/Content/EN/Invest/_SharedDocs/Downloads/GTAI/Brochures/Industries/electromobility-in-germany-vision-2020-and-beyond.pdf

[xii] Fortschrittsbericht der Nationalen Plattform Elektromobilität (Dritter Bericht)
Berlin, Mai 2012

[xiii] White paper, EC, 2011
http://ec.europa.eu/transport/themes/strategies/2011_white_paper_en.htm

[xiv] Roland Berger E-mobility Index Q3 2013
http://www.rolandberger.com/media/pdf/Roland_Berger_E_Mobility_Index_Q3_E_20130905.pdf

[XV] Roland Berger E-mobility Index Q3 2013

http://www.rolandberger.com/media/pdf/Roland_Berger_E_Mobility_Index_Q3_E_20130905.pdf

xvi http://www.renault-ze.com/de-de/elektrofahrzeug-im-alltag/z.e.-box-65564.html

xvii http://www.respiromadrid.es

xviii http://www.autorevue.at/aktuelles/renault-plant-e-carsharing-system.html

xix www.til.it

xx http://www.cemobil.eu/index.php?ID1=6&id=68&sprache1=de

xxi http://yelo.agglo-larochelle.fr/

xxii http://www.mobie.pt/en/mobilidade-electrica

xxiii
http://www.mobieurope.eu/the-project/ongoing-initiatives/e-car-ireland/
http://www.esb.ie/electric-cars/about-esb-electric-cars.jsp
http://www.cleanvehicle.eu/startseite/

xxiv http://www.gronnbil.no/index.php

xxv http://en.wikipedia.org/wiki/Plug-in_electric_vehicles_in_Norway

xxvi http://www.emc-mec.ca/files/Electric_Mobility_Canada_2008_open.pdf

xxvii "Energiekonzept", Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, Bundesministerium für Wirtschaft und Technologie, September 2010 http://www.bmu.de/fileadmin/bmu-import/files/pdfs/allgemein/application/pdf/energiekonzept_bundesregierung.pdf

xxviii "National Development Plan for Electric Mobility", Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, 2009 http://www.bmu.de/fileadmin/bmu-import/files/pdfs/allgemein/application/pdf/nep_09_bmu_en_bf.pdf

xxix Government Programme for Electric Mobility, Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, 2011 http://www.bmu.de/en/topics/air-mobility-noise/mobility/electric-mobility/government-programme-for-electric-mobility/

xxx Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, Förderprogramme http://www.erneuerbar-mobil.de/foerderprogramm/foerderung-im-bereich-der-elektromobilitaet-ab-2013
and
"Showcase Region for Electric Mobility Strategies and Activites in Baden-Wuerttemberg", Fischer Wolfgang, e-mobil BW GmvbH, Presentation at the REZIPE Final Conference, September 2013 http://www.rezipe.eu/docs/105/130911_Showcase_Region_Baden-W_rttemberg_WF_Versand_Kompatibilit_tsmodus_.pdf

xxxi "National Renewable Energy Action Plan (NREAP) of Poland", Minister of Economy, Warsaw 2010
ec.europa.eu/energy/renewables/transparency_platform/doc/dir_2009_0028_action_plan_poland.zip

xxxii Transport development strategy by 2020", Warsaw 2013, https://cms-en.transport.gov.pl/files/0/1796136/130122TransportDevelopmentStrategyby2020withperspectiveby2030.pdf

xxxiii "E-mobility in Central and Eastern Europe", Roland Berger, Strategy Consultants, 2011l http://www.rolandberger.com/media/pdf/Roland_Berger_E_mobility_in_CEE_20111021.pdf

xxxiv Green Cars Cluster http://www.gc.greenpl.org/en/about_us

xxxv "E-mobility in Central and Eastern Europe", Roland Berger, Strategy Consultants, 2011l http://www.rolandberger.com/media/pdf/Roland_Berger_E_mobility_in_CEE_20111021.pdf

xxxvi "National Renewable Energy Action Plan (NREAP) of Slovakia", Minister of Economy, and Construction of the Slovak Republic, 2010 ec.europa.eu/energy/renewables/transparency_platform/doc/dir_2009_0028_action_plan_slovakia.zip

xxxvii "E-mobility in Central and Eastern Europe", Roland Berger, Strategy Consultants, 2011l http://www.rolandberger.com/media/pdf/Roland_Berger_E_mobility_in_CEE_20111021.pdf

xxxviii "National Renewable Energy Action Plan 2010 for Austria (NREAP-AT)", bmwfj, 2010 ec.europa.eu/energy/renewables/transparency_platform/doc/dir_2009_0028_action_plan_austria.zip

xxxix "Erneuerbare Energie 2020" BMLFUW, 2009 http://www.energiestrategie.at/images/stories/pdf/02_bmlfuw_09_erneuerbare2020.pdf

xl "Hungary's renewable energy utilization action plan in trends in the use of renewable energy sources until 2020", Deputy State Secretary, 2010 ec.europa.eu/energy/renewables/transparency_platform/doc/dir_2009_0028_action_plan_hungary.zip

xli "National Renewable Energy Action Plan 2010-2020 (NREAP) Slovenia", Ljubljana, 2010 ec.europa.eu/energy/renewables/transparency_platform/doc/dir_2009_0028_action_plan_slovenia.zip

xlii http://www.delo.si/clanek/138345

xliii "Italian National Renewable Energy Action Plan 2010", Italian Ministry for Economic Development, 2010 ec.europa.eu/energy/renewables/transparency_platform/doc/dir_2009_0028_action_plan_italy.zip

xliv „Ausbau der Infrastruktur für Elektromobilität schreitet in Italien voran.", Robert Scheid, 12.07.2013, http://www.gtai.de/GTAI/Navigation/DE/Trade/maerkte,did=842448.html

xlv Research by Gfk-Eurisko for Renault, 2010

xlvi „Ausbau der Infrastruktur für Elektromobilität schreitet in Italien voran.", Robert Scheid, 12.07.2013, http://www.gtai.de/GTAI/Navigation/DE/Trade/maerkte,did=842448.html

xlvii "National Renewable Energy Action Plan of the Czech Republic", Ministry of Industry and Trade, 2012 ec.europa.eu/energy/renewables/transparency_platform/doc/dir_2009_0028_action_plan_czech_republic.zip

xlviii Clean Vehicle Europe: www.cleanvehicle.eu/index.php?id=284

[xlix] Fraunhofer Institute „Markthochlaufszenarien für Elektrofahrzeuge“, 2013 http://www.isi.fraunhofer.de/isi-media/docs/e/de/publikationen/Fraunhofer-ISI-Markthochlaufszenarien-Elektrofahrzeuge-Zusammenfassung.pdf

[l] Presentation Daimler AG “Vehicle Innnovation: Technologies and Concepts”, International Conference on Electric Mobility http://www.konferenz-elektromobilitaet.de/programm/vortraege/Weber.pdf

[li] Fraunhofer Institut, Study „Elektroautos in der Wahrnehmung der Konsumenten“, 2011 http://www.isi.fraunhofer.de/isi-media/docs/service/de/presseinfos/FSEM_Kurzbericht_Online-Befragung_2011.pdf?WSESSIONID=88d0c437d5655336badf84fc36684e54

[lii] http://ec.europa.eu/clima/policies/transport/vehicles/cars/index_en.htm

[liii] Source: EU transport in figures – Statistical Pocketbook 2012, Publications Office of the European Union, Luxembourg, 2012; doi: 10.2832/52252

[liv] http://www.eea.europa.eu/data-and-maps/indicators/average-age-of-the-vehicle-fleet/average-age-of-the-vehicle-3

[lv] Update der Emissionsprognose Verkehr Österreich bis 2030, TUG Institut für Verbrennungskraftmaschinen, Graz, 2011