NATIONALE
PLATTFORM
ELEKTROMOBILITÄT

Second Report of the National Platform for Electromobility

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Executive summary

1 Executive summary

Electromobility is the key to climate-friendly mobility. It is an opportunity, and a challenge, to further consolidate Germany as a cutting-edge location for industry, business, science and technology. The effort to achieve this goal is well worthwhile. If we succeed in joining forces to exploit the opportunities presented by electromobility, there will be a potential to create around 30,000 additional jobs over the period to 2020.

The representatives of industry, academia, government, unions and society in Germany in the National Platform for Electromobility (NPE) who meet at the invitation of the Federal Government have agreed to pursue a systemic, market-focused and technologically neutral approach with the aim of developing Germany into a **lead provider** of and a **lead market** for electromobility by 2020. "Electromobility made in Germany" stands for systemic solutions that combine action to tackle climate change and conserve resources with technological leadership and new wealth creation.

The German industry has already taken necessary investment decisions. In the market preparation phase, it will invest up to 1.7 billion euros in research and development in all fields of electromobility – a significant contribution towards achieving the goal of becoming a lead provider. In addition, realizing this objective also requires political support to provide manufacturers and users with the ability to plan with confidence. A comprehensive package of coordinated measures to boost research and development and to support market ramp-up and the use of innovative technologies in showcases is required if we are to make a joint effort to achieve our objectives of making Germany a lead market and having one million vehicles on the roads by 2020.

These objectives will be pursued in three phases:

1. Market preparation over the period to 2014, focusing on research and development and showcase projects
2. Market ramp-up over the period to 2017, focusing on the commercialization of vehicles and infrastructure
3. Launch of mass marketing over the period to 2020 with viable business models

Figure 01:
Development phases of the lead market

To develop Germany into a lead provider of electromobility, the NPE suggests the following measures:

- Promote research and development and networks in the following “lighthouses”: battery, drivetrain technology, lightweighting, information and communications technology (ICT) and infrastructure, recycling and vehicle integration focusing on production research, including in pilot plants.
- Launch a cross-departmental financial assistance programme based on the lighthouses and their thematic clusters which is administered by a project management agency.
- Speedily develop the necessary key technologies, the cross-sectoral and cross-technology integration aspects and intermodal services.
- Provide (further) training and skills to the necessary specialists and managers on the basis of the skills roadmap in the academic and vocational spheres.
- Provide standardization with a strategic and global direction on the basis of the electromobility standardization roadmap.

The total level of funding for the aforementioned projects, developed within the framework of the NPE, for the market preparation phase is around four billion euros.

To demonstrate Germany’s lead provider role to international demand, the industry’s potential will be implemented in a German lead market for electromobility. This will be characterized by systemic linkages between the electric vehicles, the transport system and the energy system.

In concrete terms, a small number of large-scale electromobility **showcases** are to be established to succeed the pilot regions. By doing this, government and industry will be able to pool resources, meaning that innovative technologies and solutions along the entire system chain – from the energy system through the vehicles to the transport system – will become nationally and internationally visible and thus easier to market.

A key component of the lead market for electromobility that Germany aspires to be is an intelligent energy system:

- The integration of electricity from renewable energy sources will play a major part in tackling climate change. The infrastructure and vehicle-related conditions must be created at an early stage.
- Public charging infrastructure will be installed as demand requires and with a sense of proportion. Specific installation targets will be agreed for the market preparation phase, which will run until 2014.
- An innovative charging infrastructure and business models will be developed to ensure that the provision of public infrastructure breaks even in the long run.

The common objective of the National Platform for Electromobility is to develop a self-sustaining market for electric vehicles. However, the plan to sell one million electric vehicles by 2020 will not succeed without **incentives**. Studies predict that 450,000 electric vehicles would be sold if there were no incentives. To compensate for the gap in costs and stimulate demand for electric vehicles, the NPE presents a comprehensive package of measures:

- Provide priority parking for electric vehicles, allow them the use of bus lanes within the framework of the showcases and promote new, intelligent car-sharing schemes.
- Offset the disadvantage experienced by people using electrically powered company cars for private purposes.
- Provide special depreciation allowances to persons purchasing electric vehicles for commercial use.
- Provide low-interest loans from the Kreditanstalt für Wiederaufbau to persons purchasing electric vehicles for private use.
- Grant an annual fiscal incentive, based on the storage capacity of an electric vehicle.

It is imperative that the **uptake** of the new technologies and solutions be consciously enhanced. Moreover, electromobility provides an opportunity to expand the German transport system, which is one of the leading systems in the world, into a modern and efficient intermodal range of mobility services. One of the key prerequisites of success will therefore be a common communications strategy among all the parties involved regarding the opportunities, benefits and visions of electromobility in order to achieve the objectives of becoming a lead provider and establishing a lead market.

The National Platform for Electromobility will monitor the implementation of all the aforementioned projects and measures. The assumptions on which they are based will be reviewed annually and the recommendations derived from them will be adapted if necessary. To this end, the NPE will prepare an annual progress report. When the market preparation phase comes to an end in 2014, the issues of market ramp-up, need for public infrastructure, costs and funding approaches for market ramp-up, and research and development, in particular, will be reassessed.

2
Visions and values of the National Platform for Electromobility

2 Visions and values of the National Platform for Electromobility

The National Platform presents the results of a year's joint activities. The projects and recommendations presented in the November 2010 Interim Report and in this Second Report will form the basis for realizing our common objective:

Making Germany a lead provider of and a lead market for electromobility by 2020.

The experts from industry, academia, government, trade unions and society are convinced that sustainable mobility will help to safeguard employment and wealth creation in Germany on a long-term basis.

The members of the NPE believe that the key to the success of electromobility in Germany lies in cross-sectoral cooperation between all the stakeholder industries. The seven working groups of the NPE have developed research and technology roadmaps covering the key issues in the following thematic areas: battery, drivetrain technology, lightweighting, information and communications technology (ICT) and infrastructure, recycling and vehicle integration. The experts will also present roadmaps covering international standardization and training/skills. Standardization is an important cornerstone for the successful marketing of German products on international markets.

Given the objective of having one million electric vehicles on German roads by 2020, the NPE presents a joint forecast on the market ramp-up for electric vehicles and the infrastructure that will be required. Specific recommendations will pave the way for the implementation of a viable package of measures to support the installation of infrastructure and the commercialization of electromobility. This will also involve focusing the German energy system more on renewable energy and creating the infrastructure that will make this possible.

Electromobility offers great opportunities for Germany. To ensure that Germany remains a world leader as a nation with cutting-edge, innovative technologies, all the players have to join forces today to set the course for the future. The cooperation in the NPE, which crosses the boundaries of sectors and social groups, is a unique example of the consolidation of resources. Therein lies the key to success.

3
Opportunities for Germany through electromobility

3 Opportunities for Germany through electromobility

Mobility means prosperity, freedom, quality of life, social and cultural inclusion. However, tomorrow's mobility has to be even more efficient. It has to reduce its climate change impact, become more environment-friendly, consume fewer resources and become quieter. Here, innovative technological solutions are called for. Electromobility will play a key role in this. Because electric vehicles will make a significant contribution towards reducing emissions at point of use, consume less primary energy and, by incorporating renewable energy and intermodal linkages, make a contribution to their expansion and thus help to tackle climate change. The NPE's vision for 2020 is clearly defined:

The NPE's vision: lead provider and lead market in 2020

Germany is a lead provider of and a lead market for electromobility, and is the world leader in the necessary key technologies. One million electric vehicles are an integral, widely accepted component of a comprehensive portfolio of innovative drivetrains. Via information and communications technologies, they are interlinked with intelligent transport systems and are an integral component of an intelligent energy system (smart grid). The interplay between intermodal transport systems, the generation of energy from renewable sources and the use of zero-emission electric vehicles creates additional opportunities for ecology and transport.

"Electromobility made in Germany" stands for systemic solutions that cross the boundaries of traditional branches of industry. New materials, products, services and business models exploit the value-added potential inherent in electromobility, and the production and manufacturing technology required for this comes from Germany. Better still: research and development by German academia and industry define the international benchmark for innovation in the field of electromobility. There is great international demand for German training and skills schemes, which cover all the key aspects of electromobility. Top-class scientists, engineers and specialists are the basis for ensuring that Germany retains a permanent edge in the field of electromobility.

Because of the technological and design edge that Germany enjoys in global competition, the export demand for electromobility goods and services produced in Germany is above average. In addition, recycling plays an important role in the raw materials cycle. Alongside an active raw materials policy, economical recycling solutions make a relevant contribution towards ensuring the long-term availability of important raw materials for Germany. Germany has also assumed a key role in international standardization issues.

Turning this vision into reality – that is the goal that industry, academia, government, trade unions and society, in close cooperation with customers and users, have set themselves. In doing so, the members of the NPE will focus on a systemic, market-focused and technologically neutral approach and on clearly defined tasks. The industry will develop innovative technologies, designs and solutions, and government will create the necessary framework, which will be based on the degree of maturity of the technologies and the market. Three development phases will characterize this process:

Market development phase over the period to 2014: The focus will be on research and development as well as training and skills. The spread of electric vehicles is to be stimulated by appropriate action programmes. Initial public charging infrastructure for a total of 100,000 vehicles will be installed. Showcase projects will be conducted to deliver innovations, customer uptake of electromobility will be enhanced in a targeted manner, and new ranges of intermodal services will be developed, all of which will support the international visibility of German technologies and services.

Market ramp-up phase over the period to 2017: Research and development will continue to be supported as demand requires. The basis for the intelligent incorporation of future electric vehicle fleets into the energy system will be created by establishing a smart grid. Targeted action will promote a speedy increase in the number of electric vehicles on the market. This will produce economies of scale in all sectors of industry and enhance Germany's international competitiveness.

Launch of mass marketing over the period to 2020: The next generation of vehicles and infrastructure will encounter increasingly self-sustaining demand. The number of electric vehicles on the market will permit more and more viable business models that also include the use of fluctuating electricity generated from renewable sources. The need for support measures to be taken by government will decline.

The Federal Government should play a leading role at European level in shaping a harmonized framework

Throughout all the phases, the Federal Government is called on to play a leading role at European level in shaping a consistent and internationally harmonized framework for electromobility. This includes, for instance, European energy and climate-change policy, transport policy and competition policy.

Germany's fundamental strengths include the cross-system cooperation between highly productive sectors of industry, the decentralized economic structure of SMEs and the crafts sector, a strong academic sector as well as the role played by the trade unions as a link between the workforce, businesses and government. German companies operate successfully as global players on the world markets. The fabric of their products benefits directly from research and development in Germany. In addition, their high degree of

competitiveness on international markets is a crucial basis for prosperity in our country. In many of the fields of technology relevant to electromobility, German businesses are among the most innovative suppliers. New patents are applied for every day. In the automotive industry and in many other key industries relevant to electromobility, Germany can build on existing excellence. Examples include expertise in sectors such as electronics and electrical engineering, heavy engineering and plant engineering, chemicals, metalworking, textiles, information and communications technologies and aviation.

German industry is fully aware of its responsibility for the transformation processes that are required for electromobility and is proactive. Thus, in the next three years, German industry will invest up to 17 billion euros across sectors in research and development in the field of technologies and solutions relating to electromobility. In addition, new manufacturing plants for the production of vehicles and components will be built at the centres of the German automotive industry. The energy supply industry is actively progressing the development of renewable energy, in particular, and has joined forces with the ICT sector to accelerate delivery of a smart grid. All these are key examples of the active and sustained commitment shown by German commercial enterprises in this emerging market.

The German industry will invest up to 17 billion euros

Industry and government have to join forces to shape research and development, the installation of infrastructure, commercialization and staff training. The speedy development of Germany into a lead market for electromobility will thus be supported by the creation of an appropriate framework. These measures will give the industry confidence and the ability to plan with certainty, and will encourage suppliers and consumers to invest in electromobility.

These concerted efforts will pay off – for the industry and for Germany's competitiveness in the global economy. Over the period to 2020, there will be a potential for the creation of around 30,000 additional jobs in the automotive and component supply industries. In addition, the proposed gradual decrease in the level of funding will result in a positive financial balance for the Federal budget as of 2018. The revenue that is likely to be generated from income tax, value added tax and social security contributions will, from this time on, exceed the investment made by the Federal Government in research and development and in the commercialization of electromobility.

Over the period to 2020, there will be a potential for the creation of around 30,000 additional jobs

4
Germany is to become a lead provider of electromobility

4 Germany is to become a lead provider of electromobility

4.1 Intelligent industrial policy

Intelligent industrial policy will create a reliable framework for investors

Intelligent industrial policy aims to redress the weaknesses of the market, also known as market failure, and to preserve its strength – the market as a process of discovery. It is based on the realization that the future is uncertain and government can only define the framework, without prescribing solutions.

The commercial success of electromobility will depend on a large number of variable factors. These include raw material and energy prices as well as user uptake and the willingness to pay for electromobility in various target groups. Intelligent industrial policy takes these uncertainties into account and, at the same time, creates a stable environment for investment. At the same time, it must not interfere with the ability of the market to correct itself by terminating unprofitable projects.

No regret: Care must be taken to ensure that high levels of investment are justifiable as knowledge advances, more user data are available and new business models assume concrete shape. Thus, the focus should be on investment that is considered necessary and appropriate in the various scenarios and that exploits and maximizes the comparative advantages of Germany as a competitive business site.

Portfolio approach: Against the background of the lessons learned in the market development phases, all instruments, measures and investment will be viewed as a portfolio of options for moving towards an optimum achievement of objectives, and will be managed dynamically and flexibly. This means, especially for R&D projects, that the list of projects will be continuously supplemented and revised, resources will be reallocated, new projects will be planned, evaluated and prioritized, existing projects will be accelerated, reprioritized or terminated if they do not achieve their objectives.

Basing action on the phased model described earlier and testing technologies, designs and assumptions in showcases are integral components of an intelligent industrial policy. If a country wants to be a lead provider, it must pursue global perspectives. An appropriate industrial policy must reflect these perspectives. Accordingly, the following criteria have been developed in the NPE.

Strengthen strengths: Policy must be guided by a determination of the comparative advantages of Germany as a competitive business site with regard to future electromobility.

Safeguard jobs: Measures must definitely be designed such that the industrial wealth creation that currently exists in Germany is safeguarded and new employment opportunities are created.

Consolidate the deployment of resources: Only an initiative that unites all the stakeholders can be taken as a benchmark for the effectiveness of measures in the global race for technological leadership.

Ensure sustainability: Measures – including those with high short-term political symbolism – must be designed for the long term and must not overlap, or even compete, with existing tools.

Promote competition: Industry policy measures must facilitate comprehensive and healthy competition in the Single European Market, on both the supply and demand sides. These premises must apply in the development of domestic programmes, and must be demanded of other Member States at EU level. The Federal Republic of Germany, as an export-driven nation, relies crucially on free competition in its partner countries. If it is to be able to demand this from countries where, in the face of competition to attract business in the electromobility sector, strategies are in place that distort competition, its own action must also be credible.

4.2 Research and development in Germany

The R&D projects of the NPE will be interlinked in lighthouses to unlock synergies

To encourage linkages in the field of electromobility, interdisciplinary lighthouses and thematic clusters have been defined on the basis of the technology roadmaps. The aim is to consolidate research projects arising from the NPE initiative, as well as ongoing projects that have already received funding, to gear distributed stand-alone projects to the overarching objective of becoming a "lead provider of and lead market for electromobility" and to help unlock synergies.

Lighthouses

- will consolidate stand-alone product and component development projects that are absolutely essential for the success of electromobility into a small number of thematic clusters;
- can include competitive and, possibly, cross-sectoral consortia to maximize the likelihood of success;
- will consist of a limited number of thematic clusters;
- will generate, by means of linkages, added value among one another and beyond thematic clusters and consortia and exploit synergies;
- will have a strategic character for positioning Germany as a lead provider of and lead market for electromobility.

The projects to be funded in lighthouses are characterized by the fact that their subject matter is of key importance for electromobility. They will be relevant to real-life applications, will very likely be implemented, and will make a significant contribution towards reducing the costs of electromobility and/or constitute a major technological advance. Optimum use will be made of existing outcomes and findings from electromobility initiatives at Federal state and Federal Government level that have already been concluded. When projects are being implemented, established centres of excellence for electromobility can be integrated or evolved as ideal points of contacts and consultants.

However, these projects are interesting not just because of the technological contribution they will make, but also because of their mandate to provide training and skills. Thus, at the same time as technological solutions are being developed, the skills that are likely to be needed by mechanical and electrical engineers, chemists and skilled workers in the future will be identified. In this way, it will be possible to send a signal at an early stage to the players who provide initial and continuing training, indicating the fields in which there will be a corresponding need for skills and the areas on which they should focus their training courses.

The lighthouses will include thematic clusters based on the technology roadmaps of the National Platform for Electromobility.

Thematic clusters

- will describe the key issues of the lighthouses;
- will form the tangible basis for invitations to apply for funding under specific financial assistance programmes.

All lighthouses and thematic clusters are to accelerate not only basic research projects at higher education institutions and in the industry but also, above all, the translation of R&D findings into practical applications, with the aim of roll-out by 2020 and sustained development beyond 2020.[1]

Thematic clusters will focus on the key issues of the lighthouses and will be advertised as a comprehensive financial assistance programme ranging from basic research to industrialization

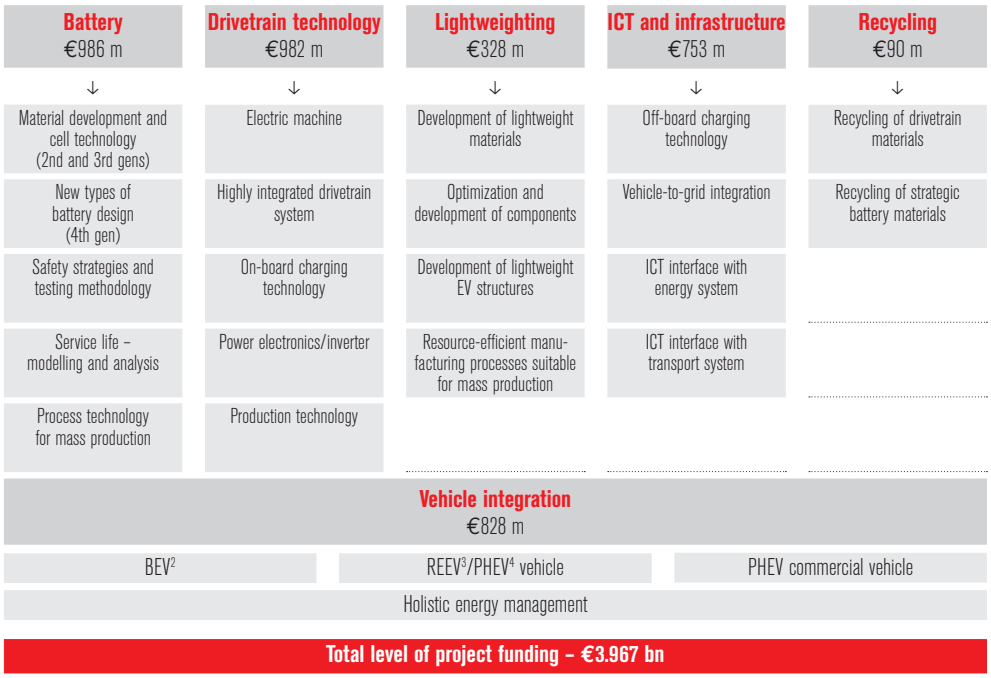
Recommendation for the funding structure of the R&D projects

An NPE catalogue of criteria has helped to identify and appraise potential R&D lighthouses and thematic clusters. On this basis, six lighthouses have been defined, comprising a total of 24 thematic clusters (Fig. 2). The “battery”, “drivetrain technology”, “lightweighting”, “ICT and infrastructure” and “recycling” lighthouses will progress the necessary key technological issues. The “vehicle integration” lighthouse will address the cross-sectoral and cross-technology aspects of integration. All those involved in the NPE have calculated the project budget requirements. The figures are now available in greater detail than in the interim report. To conclude, the ministries will decide which projects are actually eligible for funding, with the help of the established peer-review procedures.

[1] For further information, see also the “Second Report of the National Platform for Electromobility – Annex”

The subject matter of the lighthouses will be based on detailed project planning performed by the working groups of the National Platform for Electromobility on a cross-business and cross-sectoral basis. The thematic clusters will thus be an expression of specific development projects presented in the interim report of the NPE. The following diagram shows the structure and scope of the research projects in lighthouses:

Figure 02:
Overview of R&D lighthouses, thematic clusters and proposed budgets



The NPE is in favour of incorporating ongoing financial assistance programmes, such as “LIB 2015”, “STROM”, “ICT for Electromobility II”, “Series-Flexible Technologies for Electric Vehicle Drive Trains”, et al., at this stage, of taking into account roadmaps, such as that developed by the “eNOVA Electromobility Strategy Group”, and of including co-operative industrial research and relevant project management agencies.

The “battery” lighthouse

Technological leadership in the fields of battery cells and systems will require extensive R&D along the entire value-added chain

The “battery” lighthouse will address one of the key components in the electric vehicle. The battery’s share of the added value of the whole vehicle is around 30 to 40%. The interim report of the NPE stated: “Germany needs integrated cell and battery system production.”

To ensure that Germany can assume a leading position in the field of battery technologies for electric vehicles, there will have to be targeted interaction between the public sector, academia and industry. Because an analysis of the ongoing financial assistance programmes in Germany shows that major specific aspects of battery technology, such as process technologies for cell and battery manufacture, fundamentals of battery safety,

[2] BEV = battery electric vehicle | [3] REEV = range-extended electric vehicle | [4] PHEV = plug-in hybrid electric vehicle

trialling strategies and modelling and simulation for the batteries that are to be brought to commercial maturity over the next few years and the development of innovative materials are currently not covered or only inadequately covered.

The dual strategy for batteries: optimize current solutions while researching the next generations

For the analysis, the value chain of the battery has been divided into the following components: raw materials, active materials, cell components and cell, cell modules with cooling, electrics and electronics, battery modules and battery housing. The NPE experts have come to the conclusion that technological leadership in the field of cells and batteries and the creation of wealth along the battery value chain will be achievable in Germany or by German companies if targeted action is taken to strengthen the following thematic clusters, in particular:

- materials development and cell technology (battery packs, optimized materials);
- new battery designs for fourth-generation batteries (materials and cells for post-lithium-ion technologies);
- safety strategies and testing methodology (functional safety of battery systems, crashworthiness, transport safety);
- service life, modelling and analytical methods (service-life trialling, battery models, electrochemical reactions);
- process technology for mass production (manufacturing strategies, innovation in chemical engineering, quality assurance).

In the thematic clusters, the involvement of German companies has already assumed a more concrete shape, in both technological and financial terms. Accordingly, the steps towards rooting integrated cell and battery manufacture in Germany are described in relation to the entire battery value chain.

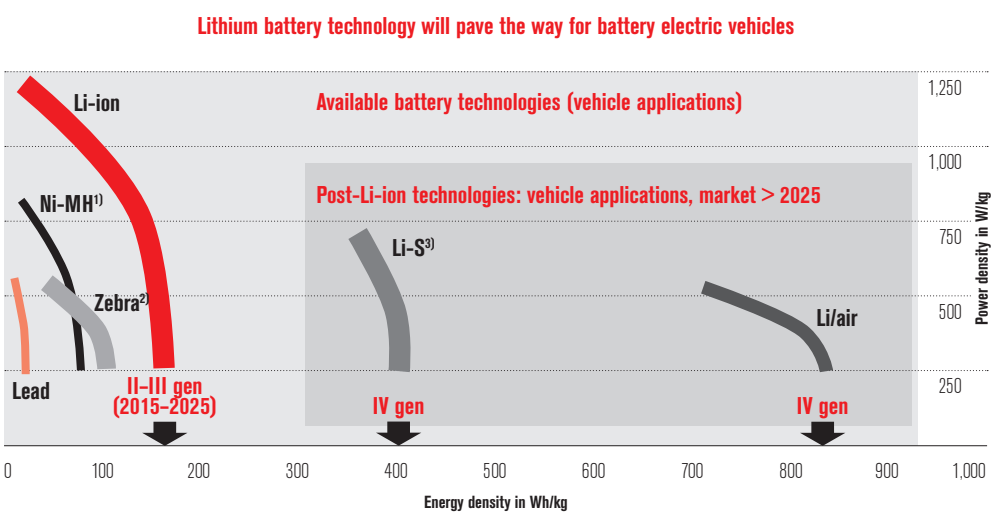


Figure 03:
The "battery" lighthouse

Lithium-ion technology currently offers the best battery option for achieving acceptable ranges for the EV, plug-in and range-extended vehicle applications. Extensive research into post-Li-ion technologies, such as Li-S and Li/air systems, will offer new options for 2025+.

[1] Ni-MH = nickel-metal hydride battery, [2] Zebra = sodium-nickel chloride cell, [3] Li-S = lithium sulphur battery

The “drivetrain technology” lighthouse

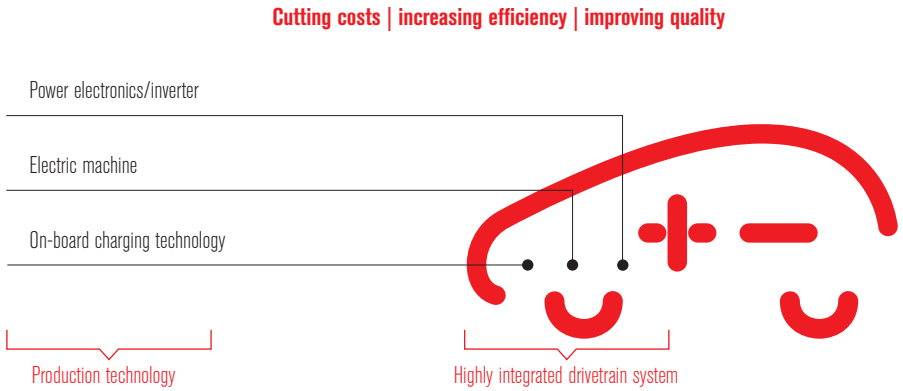
The “drivetrain technology for electric vehicles” lighthouse will address the resolution of technological issues that will help to reduce costs, increase the number of units produced and improve the power density, power-to-weight ratio, efficiency at the component and drivetrain levels, quality and reliability. This lighthouse will consist of the following thematic clusters: highly integrated drivetrain system, electric machine, power electronics/inverter, on-board charging technology and production technology.

The activities of this lighthouse will deliver a portfolio of solutions for a modular and scalable drivetrain system and a flexible basis for the use of the findings in various applications. Thus, the lighthouse projects will help to increase the likelihood of the development being successful and producing large numbers of units after a short time. In a mutual exchange of information, the findings will be made available to the vehicle integration projects and, in addition, will be used to identify the subject matter in the “production technology” thematic cluster.

The systems expertise of the German automotive industry will be key to achieving the cost, number of units, power and quality objectives

The key to success in the field of drivetrain technology lies in systems expertise. On this basis, costs can be reduced, the number of units produced can be increased and the power-to-weight ratio, efficiency, quality and reliability of electrified drivetrain systems can be improved.

Figure 04:
The “drivetrain technology” lighthouse



The “lightweighting” lighthouse

Functionally integrated lightweight systems will be key to offsetting the additional weight of the battery

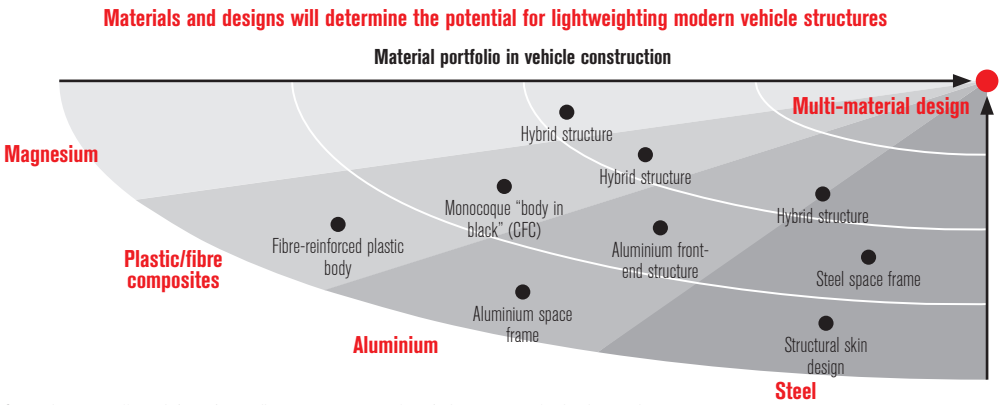
The “lightweighting (design and materials)” lighthouse will address the need to offset the significant increase in mass caused by the battery in terms of vehicle dynamics and costs. The overarching objective of this lighthouse will thus be to reduce vehicle weight in order to optimize the power and energy storage needs in interaction with the total vehicle costs.

Together with the advances to be made in battery technology and drivetrain efficiency, the expansion of lightweighting competence to electromobility applications will give

German automotive manufacturers a chance not only to catch up technologically with their international rivals, but also to achieve a competitive edge in electromobility.

The lightweighting objectives can normally be achieved by using metallic materials, fibre composite materials and non-reinforced plastics. However, the combination of various materials (multi-material design) will unlock great potential – only part of which has been exploited so far – for cost and resource-efficient lightweighting. However, this will require a move away from thinking in terms of isolated materials and towards a functionally inclusive approach to lightweight systems in multi-material design.

To reduce the weight of vehicles, it will be necessary to develop new lightweight materials for use in the mass production of electric vehicles as well as to optimize individual components of electric vehicles in terms of their weight and integrate them into lightweight structures designed specifically for electric cars. Manufacturing and disassembly processes that are suitable for mass production and which are resource-efficient are a major condition of holistic sustainable electromobility.



Cost and resource-efficient lightweighting will require a move away from thinking in terms of isolated materials and towards a functionally inclusive approach to lightweight systems in multi-material design.

Figure 05:
The "lightweighting" lighthouse

The "ICT (information and communications technology) and infrastructure" lighthouse

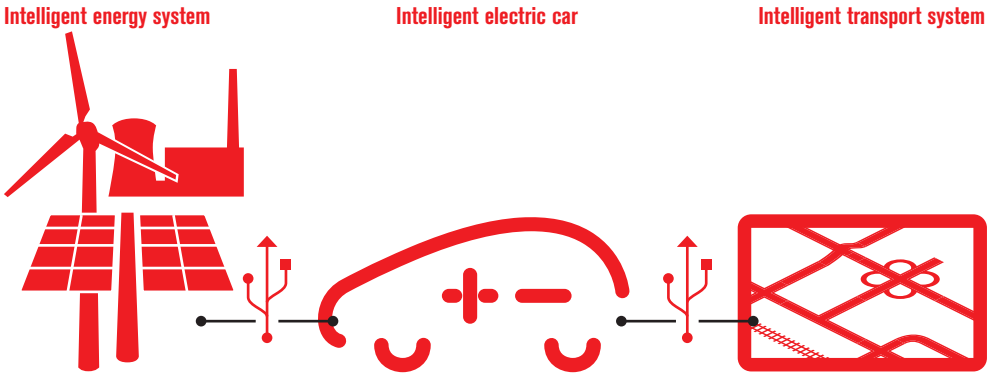
The "ICT and infrastructure" lighthouse will consolidate projects to optimize interaction between electric cars and the transport and energy systems that surround them.

The "vehicle-to-grid" thematic cluster will focus on the grid-related bases for an optimized integration of vehicles into the system. The key issues will be not only the handling, size, weight and costs of the components but also, above all, the reduction of complexity and energy losses.

ICT will provide solutions for the smart integration of vehicles into the transport and energy systems

The "off-board charging technology" thematic cluster will consolidate projects to progress the rapid evolution of charging points and to develop innovative types of charging until they are ready for the market, primarily in terms of charging speed, safety, convenience and reducing technology costs. In addition, in the two ICT clusters at the interfaces with energy and transport systems, the development of software solutions will be progressed that make it possible to intelligently integrate vehicles into the grid and the traffic control system and help to unlock new uses and business models. It is important that this lighthouse be closely linked to the existing "vehicle integration" and "battery" lighthouses, and this link must be created when designing the lighthouse.

Figure 06:
The "ICT and infrastructure" lighthouse



The "recycling" lighthouse

Recycling of key materials will ensure sustainable raw materials management

The "recycling" lighthouse will focus on the important issue of the availability of raw materials that are crucial to electromobility. The number of electrified vehicles that is likely to be produced throughout the world is growing. As a result, raw materials that are relevant to the electromobility industry will influence vehicle pricing, and this will become a crucial factor for the commercial uptake of the product as a whole. In this context, the recycling of drivetrain materials and batteries is a major strategic pillar of sustainable commodity management.

Figure 07:
The "recycling" lighthouse

To ensure the commercial competitiveness of electromobility, it will thus be necessary, at an early stage, to contain the dependence on raw material imports in strategically significant groups of materials, taking ecological and economic aspects into account.

The "vehicle integration" lighthouse

Finally, the "vehicle integration" lighthouse will stand for a holistic approach to development at the vehicle level, across the entire NPE. The projects funded here are to make it possible to establish a direct link to projects in the other lighthouses. An important connecting element will be the requirements resulting from the "vehicle integration" lighthouse, which will be indispensable for targeted activities in the other lighthouses. Vice versa, the innovative advances made in all lighthouses can influence the system topology in vehicle integration and thus necessitate an adaptation. For example, the lighthouse will create a new platform for testing stand-alone systems and components in the whole vehicle system. In this way, the transfer of the findings from the vehicle integration of stand-alone systems to the focus projects of the other lighthouses and vice versa will be guaranteed.

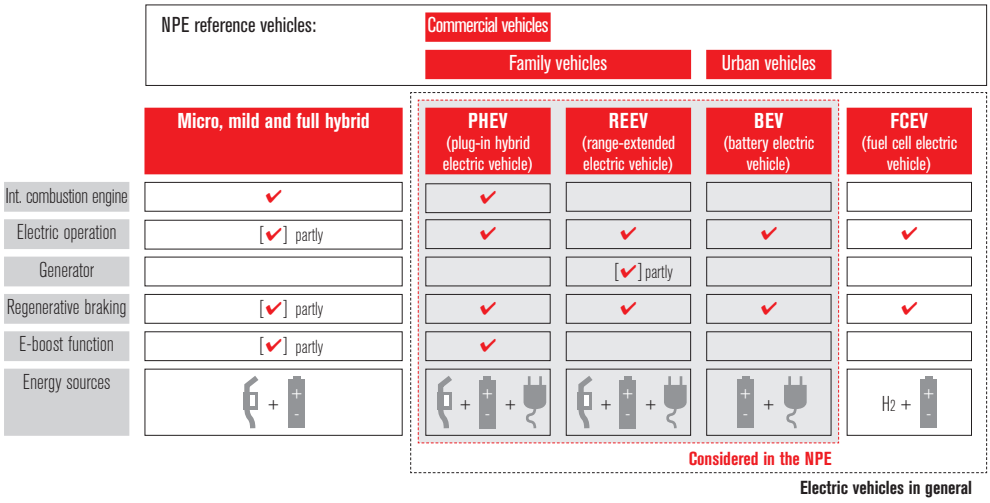


Figure 08:
The "vehicle integration" lighthouse

The electrified vehicles will thus be designed, built and tested in the "vehicle integration" lighthouse. This lighthouse will comprise four thematic clusters: three strategies for the use of electromobility (BEV urban vehicles, REEV and/or PHEV family vehicles, and PHEV commercial vehicles) and one thematic cluster that will address whole vehicle energy management. The need for research is extensive and includes aspects such as the integration of the drivetrain, battery systems and lightweighting into the whole vehicle, interlinking the vehicles with the new charging infrastructure that is to be installed, verifying stand-alone solutions in the whole system, basic studies on all aspects of functional safety and the development of heat management materials in the overall energy context of the vehicle.

The NPE experts are in favour of focusing on the drivetrain technology and key components for the BEV urban vehicle. Right from the outset, the aim should be to subsequently use the systemic solutions in the REEV/PHEV family vehicle and PHEV commercial vehicle, in keeping with the principle of a modular construction kit.

To sum up: holistic integration solutions will result in the emergence of attractive electrified vehicles that incorporate the advances made and lessons learned in the fields of battery and drivetrain technology, lightweighting, ICT and infrastructure and recycling. These solutions will preferably be of a modular design so that, as in a construction kit, as many synergies as possible between different vehicle designs can be used.

Attractive electric vehicles will result from holistic system solutions that incorporate the R&D findings from the lighthouse projects

Improving the funding award process

The NPE recommends the following measures, which are designed to simplify access to financial assistance programmes. The aim is both to reduce the administrative effort for the project members and to overcome the reluctance on the part of applicants, especially small and medium-sized enterprises and research institutions:

- In order to significantly simplify access by interested companies and institutions to funded projects, the NPE's R&D activities will be consolidated in a cross-ministerial financial assistance programme headed by a project management agency, with clearly defined responsibilities of the ministries involved. Invitations to apply for funding are to be communicated at an early stage before they are published in the Federal Gazette, for instance by means of annual plans/roadmaps, so that requests can be submitted within a very short time.
- An advice and information centre will be established as a central point of contact to provide all interested parties with advice and assistance on the road from the first contact via the request for funding to the project launch ("routing"). To ensure that the processes are as lean as possible, the NPE recommends that such an advice and information centre should be designed as a non-binding offer and not as a compulsory point of contact.

An optimized funding grant procedure under one umbrella is required if Germany is to achieve its objective of becoming a lead provider

The NPE believes that the following supplementary measures could help to significantly speed up the process of awarding funding.

- The funding award process is to be streamlined. A single-stage funding award process, for instance, could generate significant efficiency gains.
- The project management agency should reply promptly after it has received all the project application documents and the applicant should answer any queries.

The following measures will ensure that the findings are exploited within the NPE and that they are publicly accessible:

- The established publication process (status seminars, project meetings, etc.), with the involvement of the relevant NPE members, must be consistently implemented. This will make findings quickly visible, interlink participants and give interested members of the public and, in particular, experts an up-to-date picture of the status of the findings.
- In addition, the NPE suggests that regular reports be made from the lighthouses on the status of the findings. The lighthouses and their thematic clusters are to present their major findings, provide a critical appraisal of the progress made, explore the potential for linkages and share and evaluate the lessons learned from cross-sectoral cooperation. The direction in which the projects are heading is to be reviewed and, if necessary, readjusted. For this purpose, the NPE suggests that a mentor be appointed for each lighthouse, who will support these tasks.

4.3 Academic and vocational training

Initial measures to develop an electromobility skills roadmap in initial and continuing academic and vocational training are being developed. The aim of the project entitled "Skills Platform for Initial and Continuing Training in the Field of Electromobility" (with the Federal Ministry of Education and Research providing the funding and the University of Ulm as applicant) is to comprehensively prepare all the sectors and players of initial and continuing academic and vocational training to meet the challenges that will be posed by the transformation of technology towards electromobility.[5]

Training and skills development must be supported financially and by developing curricula

Here, there is an imminent necessity for the specific academic and vocational training of specialists, so that the need for engineers and skilled workers for this key technology can be met. Over the period to 2015, this will require investment totalling 360 million euros in initial and continuing training – 155 million euros in academic and 205 million euros in vocational training. The intensification of pre-competitive research at institutions of higher education – for instance by expanding cooperative industrial research, the high-tech strategy and the ICT 2020 programme – will make a contribution to the practical training of young scientists and to the establishment of academia-industry linkages. Existing training activities will shortly be coordinated with new skills measures relevant to electromobility, in order to avoid costly and time-consuming parallel developments and to optimize the overall system.

Particular attention is focused on intensive communications and linkages between the players involved in academic and vocational training. The "Skills Platform" project will thus pursue an integrated approach between initial and continuing academic and vocational training. On the basis of a masterplan for the development of electromobility skills and the related skills roadmap, experts will identify any shortcomings that exist and take structured and sustained action. The Federal states, Federal Government and EU are already funding various project activities that address issues relating to training

The skills road map and masterplan will be the basis for structured and sustained initial and continuing training measures in the field of electromobility

[5] For further information, see also the "Second Report of the National Platform for Electromobility – Annex"

and skills in the academic and vocational spheres. Identifying these issues, making them transparent and developing curricular structures and specific syllabuses for electromobility are major components of the project activities. By interlinking the players in industry, trade and crafts, associations, trade unions, chambers and educational institutions, a multifunctional use of the teaching and learning media and the technical equipment will be sought.

An important objective is to promote interdisciplinary and cross-sectoral cooperation within the framework of system-oriented training courses and skills schemes. This is the only way it will be possible to prepare, in a targeted and forward-looking manner, the skilled workers employed in the electromobility sector for the new challenges and opportunities. Another objective is to continuously improve the overall uptake of electromobility through the broad-based skills approach. To strengthen innovative capacity on a permanent basis, the members of the NPE stated that they were in favour of allowing expenditure on advanced and continuing training to be funded within the lighthouses and thematic clusters.

4.4 Standardization

Standards are of great strategic importance for electromobility and, when applied internationally, safeguard competitiveness on the global market. On this basis, market players can effectively consolidate development skills and deploy them in a targeted manner, while at the same time limiting the uncontrolled and non-transparent formation of variants in the customers' interest. In this way, it is also easier to achieve economies of scale.

The German standardization roadmap for electromobility represents cross-sectoral consensus and will form the keystone of standardization activities over the next few years

Standardization is an established and proven process. However, standardization in the field of electromobility is characterized by the fact that it differs from standardization carried out in other fields up to now in a few, but important, aspects: the special challenge is to coordinate and integrate the multiplicity of activities of different sectors and branches of industry to meet needs and in an expedient manner. In Germany, the first "Standardization Roadmap for Electromobility"[6] has been developed within the framework of the NPE with coordination of German industry, academia and government. This roadmap will form the core of standardization activities over the next few years and represents cross-sectoral consensus on how and when the key issues of electromobility are to be addressed at both national and international level.

The focus of current activities is now on internationally progressing and implementing the key issues identified in the standardization roadmap as needing action.

If Germany is to become a lead market for and a lead provider of electromobility, it must actively participate in the appropriate bodies, not only at national level, but above all at

[6] For further information, see also the "Second Report of the National Platform for Electromobility – Annex"

European and international level. The coordination work required to reach consensus will be especially time-consuming. The stakeholders from industry and academia will have to provide the resources for the necessary standardization activities.

The availability of international standards is a key basis for achieving the German objectives of becoming a lead provider and a lead market.

National regulations, for instance those governing charging infrastructure, are to be harmonized in favour of pan-European or international solutions

Internationally uniform standards can only be effective if there is correspondingly harmonized government regulation. Coordination processes in standardization will reach their limits if countries adopt regulations that counteract harmonization because of diverging industry policy interests. There is currently a need for action with regard to reaching agreement on a uniform charging infrastructure, which will have a significant impact on the customer uptake of electric vehicles. There is a pressing need for the harmonization of national regulations in favour of pan-European and international solutions.

A report on automotive engineering legislation and hazardous materials legislation has also been published. It provides an overview of the current state and the evolution of legislation in the fields of vehicle licensing and transport of dangerous goods in connection with electromobility.

The regulations governing the transport of dangerous goods are to be evolved as quickly as possible

The need for action in the field of dangerous goods transport has already been addressed but the work has not yet been completed. A revision of the weight limits for batteries transported by air is necessary. Moreover, in certain cases, transport is only possible with the authorization of the competent national authority. Recognition of the documents when goods are moved from one country to another is advisable and necessary. In addition, high priority is to be given to fleshing out and internationally harmonizing the legislation governing the transport of damaged batteries for analysis and recycling. Logistical processes that are as fast and uncomplicated as possible are an important prerequisite for the international commercial success of electromobility.

4.5 Other measures to enhance German competitiveness

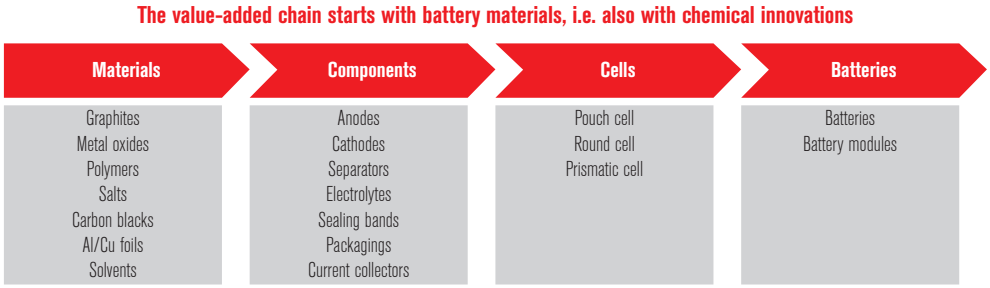
The NPE's objectives for Germany to be a lead provider and lead market by 2020 cannot be achieved unless the complete value-added chain for the production is covered in Germany. Electromobility innovations and products must be used in Germany and commercially mass-produced. This is the only way in which society, the state and industry will benefit from their introduction. The creation of additional jobs, the training of workers in companies, more tax revenue at all levels of government and the unlocking of new fields of application and business models will all be possible when commercial industrial production starts.

The time requirements for the emergence of a production basis in the period from 2012 to 2014 are indicated in the roadmaps prepared in the working groups, especially with regard to materials, battery and drivetrain. The only way to ensure that the technological skills and competitiveness of the companies operating in Germany, which exist in principle, become visible and usable as technological leadership in concrete projects is by building up production capacity as quickly as possible.

Production research and development by means of pilot plants are crucial elements of an R&D strategy for electromobility

Production research and development are thus crucial elements of an R&D strategy for electromobility. Here, the way in which the Special Electromobility Programme was fleshed out within the framework of the Federal Government's Second Economic Stimulus Programme proved to be the right approach. The Federal Government should thus continue to use these processes when awarding funding for production research and development. To design assembly lines and production linkages such that they can deliver the necessary findings for commercial mass production at another, later stage, the component supply industries have to be brought together with the user industries. The best way to do this is by means of pilot plants, which deliver a complete design for such assembly lines. Germany's advantage has to be exploited to research interlinked production solutions in pilot plants with the help of the strong components supply industry, especially the German heavy engineering sector. Production research will be concretized in machines and systems at pilot plants.

Figure 09:
Value-added chain of the battery



Preference should therefore be given to production research projects conducted by the industry. In the case of pilot plants operated by consortia with scientific equipment, at least one of the industrial enterprises should have lead responsibility. The best way to conduct a targeted review of suitability for mass production is by means of a joint financial basis comprising private and public sector funding.

When funding pilot plants for production research, the Federal Government should exploit all its legal scope for action and use it in concrete award procedures. This will give crucial support to the objective of rapidly translating technological knowledge into the build-up of mass production in Germany.

5
Germany is to become a lead market for electromobility

5 Germany is to become a lead market for electromobility

The innovative technologies of electromobility will be deployed on a lead market. Private motorized transport will become more environmentally friendly, and innovative business models and intermodal solutions will make a substantial contribution towards meeting the rising challenges in urban mobility. Commercialization will take place in three phases with the aim of achieving self-contained market functionality at as early a stage as possible with as much wealth creation as possible in Germany.

An analysis of the economic potential inherent in electromobility shows that the joint efforts by government and industry will pay off. The German industry is prepared to make great contributions of its own to support research and development in Germany. Moreover, if the commercialization objectives are successfully achieved by implementing the proposed programme of measures, there will be a potential for the creation of around 30,000 additional jobs in the automotive and component supply industries and in the infrastructure sector over the period to 2020. The proposed gradual decrease in the level of funding will result in a positive financial balance for the Federal budget as of 2018. The revenue that is likely to be generated from income tax, value added tax and social security contributions will, from this time on, exceed the investment made by the Federal Government in research and development and in the commercialization of electromobility.

In the following, the salient features of a lead market are described and proposals for a suitable framework are identified.

5.1 Assumptions on market trends

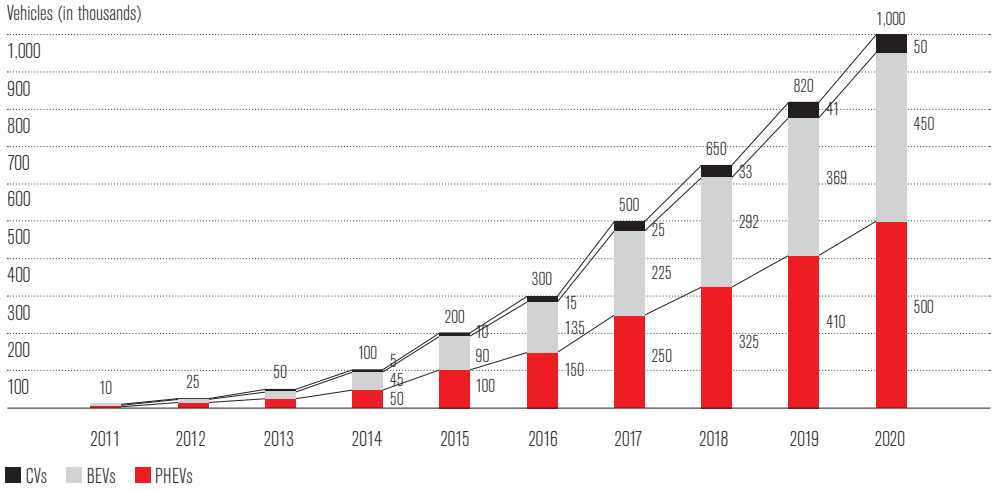
A possible market ramp-up curve for achieving the target of one million electric vehicles in the German population by 2020 is based on the following milestones:

- 2014: 100,000 electric vehicles in the population;
- 2017: 500,000 vehicles.

The market development will initially focus on metropolitan regions – 100,000 vehicles in 2014 as a milestone

For the period under consideration, the NPE's experts expect that there will be an average of 45% all-battery electric vehicles (BEVs), 50% plug-in hybrid vehicles (PHEVs) or electric vehicles with range-extender solutions (REEVs) and 5% PHEV commercial vehicles.

Figure 10:
Coordinated market ramp-up curve



This market ramp-up curve represents a plausible trend, which also, in particular, reflects the likely technological developments and the expectations of the strategy and sales departments of the vehicle manufacturers involved. There are still uncertainties because of the relatively small empirical basis, and these uncertainties increase for the post-2014 period, in particular.

In order to gear the framework as closely as possible to the actual demand, the working groups base their assumptions regarding the number of future new vehicle registrations on the present-day distribution of users. Experts predict that in 2014 there will be a customer mix of 40% private customers, 30% purely commercial customers and a further 30%of commercial customers with private use (company car users).

In the first few years, the prime markets for electric vehicles will be the metropolitan regions and their urban fringe. Growing demand for electric vehicles in the urban hinterland, medium-sized cities and, above all, rural areas is expected in 2020 and the following years.

The NPE's experts recommend that the assumptions be reviewed again at the end of the market preparation phase in 2014, especially with regard to:

- the distribution of private vehicles vs fleet vehicles;
- fundamental changes in user behaviour as a result of new approaches to mobility (car sharing, uptake of intermodal services, etc.);
- changes in user habits specific to electromobility (e.g. to make better use of the full battery capacity/routes);
- technological advances (e.g. significantly longer electric vehicle ranges).

5.2 Regulatory framework

Measures to support the market should be limited in number, gradually decrease in scale and be objectively verifiable

The way in which the electromobility market develops will depend on external factors, such as trends in the price of oil, charging current and batteries. It is only possible to a limited extent to predict customer uptake and willingness to purchase the new technologies. For this reason, the three-phase model described earlier (market preparation over the period to 2014, market ramp-up over the period to 2017, launch of mass marketing over the period to 2020) was used. Consequently, a description of specific measures can only be undertaken for the period to the end of the market preparation phase (up to and including 2014). There are three areas where action is needed for the establishment of a market-related framework:

- Limiting the number of instruments. A limited number will reduce the risk of undesired reciprocal, secondary and deadweight effects.
- Funding that is conditional, does not favour a specific measure and gradually decreases. Fleshing out the package of measures must be geared to the following basic parameters: development of the vehicle population, costs of drivetrain components and energy prices. The intensity of funding should be synchronized with the commercial uptake of electric vehicles in order to ensure planning certainty and, at the same time, avoid deadweight effects.
- Budget limitation and performance monitoring. Maximum funding sums should be determined. The success of the measures over the course of time must be monitored using clearly defined criteria. There are to be rules governing the discontinuation of funding if objectives are not reached.

The level of funding and the assessment criteria must be made transparent. The package as a whole must permit evaluation of the stand-alone measures over the course of time. Here, different packages of measures should be deployed in the showcases in a targeted manner so that their effectiveness can be appraised in detail.

5.3 Demand-responsive and environmentally acceptable infrastructure

The provision of charging current generated from renewable sources will be guaranteed, thereby delivering high environmental benefits

If electromobility is to enjoy wide uptake, it is absolutely essential that final customers be provided with infrastructure that is sufficiently dimensioned, to which there is non-discriminatory access and that meets certain minimum requirements. Electric vehicles will deliver maximum environmental benefit if they are closely linked to electricity generated from renewable sources and system services are provided as an element of safeguarding further expansion of renewable electricity generation.

Electromobility to stabilize grids and support renewable energy generation

The charging of electric cars will not result in overloads in the distribution networks before 2020 and for sometime after that. If there is an accumulation of charging points

with a high aggregate power output and a high level of simultaneity in one network section, it may be necessary to take grid reinforcement measures before 2020, and it may be necessary to manage the load locally to protect the grid from overload.

It appears very likely that there will be a further increase in the amount of electricity generated from wind and solar energy, in particular, and as this happens it will be necessary to upgrade the grids at all voltage levels. Some of this upgrading must head in the direction of establishing smart grids. This will also create the basis for a contribution to grid stabilization and the further integration of renewable energy through the electric car.

Charging current from renewable sources

The energy supply industry will provide additional electricity from renewable generation

The National Platform for Electromobility supports the objective of using electricity generated from renewable sources to charge electric vehicles. The energy supply industry will provide the additional electricity required for this purpose from renewable generation.

In addition, the total amount of traction current will be determined statistically (annually, as a lump sum) and included as an additional contribution in the upgrading objective for electricity generated from renewable sources by 2020. There will be no need to selectively capture the data via in-vehicle meters. In any case, the capping of CO_2 emissions from the energy supply industry via the European emissions trading scheme means that the additional electricity required by electric vehicles will not result in any additional CO_2 emissions.

The energy suppliers already offer green tariffs. Customers should remain free to choose whether they wish to switch to these tariffs.

Environmental benefits through the contribution made by electric cars to the integration of electricity generated from renewable sources

In addition to the fact that electric vehicles produce zero noise and emissions at point of use, they support the expansion of electricity generated from renewable sources, thereby making a further contribution to environmental protection and emissions reduction. In addition, electric cars and their storage systems, as a time-shifting load, help to better integrate fluctuating electricity generators, in particular.

Electromobility can make a major contribution to the storage of electricity generated from renewable sources

In this context, the batteries of electric vehicles, taken together, offer a useful storage potential. Assuming that one half of the targeted one million electric vehicles in 2020 are connected to the grid and 30% of their battery capacity is available (average battery size 15 kWh) as storage potential, there would be a theoretical storage volume of 2.5 GWh. Accordingly, the six million vehicles targeted in 2030 would have a storage volume of around 15 GWh. The useful standby power (input power) could be assumed to be 1.5 GW in 2020 and, accordingly, 9 GW in 2030. In the long term – after 2020 –

it may be possible to make positive and negative standby power available to meet the technological and commercial challenges of bidirectional charging. Given that the total capacity of German pumped storage hydroelectric stations is currently around 40 GWh with an installed capacity of 7 GW, it is clear that electromobility can make a major contribution to the storage of electricity generated from renewable sources.

There is commercial potential for vehicle users inherent in the provision of this storage capacity. The contribution to local grid stabilization at the distribution network level can create further opportunities for generating revenue. An effect is likely to be felt here starting sometime between 2018 and 2020. The NPE believes that the intelligent integration of electric cars into the energy system will not happen without the explicit approval of vehicle users.

Establishing smart grids and adapting the regulatory framework

Upgrading to a smart grid and installing smart charging infrastructure is recommended

A major prerequisite for the optimization of the energy and environmental potential inherent in electric vehicles is smart charging. Given the long lead times of grid upgrades and changes to the regulatory framework, the NPE advocates implementation of the following steps:

- The distribution networks should be upgraded to smart grids. Grid regulation should be evolved with a view to an innovative grid upgrade.
- The charging infrastructure should be able to facilitate the exchange of data with the grid and the vehicle that is necessary for smart charging, at least in the case of forms of charging where the vehicle is parked for a lengthy period of time (at home, at work, at the depot and at public charging points at the user's place of residence). The vehicle should support this exchange of data.
- The NPE recommends that the installation of smart charging infrastructure be incentivized at locations where the vehicles being charged are likely to be parked for a lengthy period of time in order to improve the contribution of electric vehicles to vehicle-to-grid integration. Here, public fleets, such as those operated by car-sharing schemes, can play an important role.
- Amendments to/adaptations of the regulatory framework for the energy sector will be necessary in order to make business models possible in all areas relating to the provision of products in the field of energy logistics and services, including in the distribution network. Especially important will be the creation of a regulatory basis for possible simplified marketing.

To encourage vehicle users to plug their electric vehicle into the grid whenever it is parked, technological requirements for smart vehicle-to-grid integration have to be met. One approach to motivating motorists could be the provision of incentives. Members of the NPE have developed a proposal[7] for implementing this. The NPE unanimously recommends that this approach be trialled as part of the showcases in order to assess its impact and system compatibility.

[7] For further information, see also the "Second Report of the National Platform for Electromobility – Annex"

Showcase projects will play a major role in the integration of electric vehicles and the energy system

The showcase projects will play a major role in fleshing out the approaches to optimizing the interaction between electric vehicles and the energy system. The large-scale use of smart charging and the trialling of grid-related business models and consumer incentive schemes should by systematically pursued.

Installation of demand-responsive charging infrastructure

User behaviour and vehicle distribution are the basis for determining the need for charging infrastructure over the period to 2020. Corresponding to the market phases, the years 2014, 2017 and 2020 will serve as milestones.

When ascertaining the needs, it will be necessary to define the number and type of charging points that would appear to be required in order to realize the planned level of vehicle sales. In addition, it will be necessary to determine the conditions for the installation of charging infrastructure that corresponds to user behaviour.

Over the period to 2020, the needs will be met primarily by the following types of charging point:

Figure 11:
Types of charging point

Type	Description
Simple socket	Earthed power socket
Wall box, mode 3[8]	Charging point for higher currents (simple) or intelligent vehicle-to-grid integration (smart) in private or communal garages
Company premises, mode 3[8]	Car parks at a company's premises for company fleets or employees' vehicles
Semi-public, mode 3[8]	Charging points at publicly accessible privately owned sites, e.g. supermarket car parks or multi-storey car parks
Public, mode 3[8]	Charging points in public places, e.g. for on-street parkers or at central sites
DC[9] rapid charging	DC rapid charging points up to 60 kW (or possibly up to 100 kW)

Calculation of the total needs will be based on the number of electric vehicles sold and the following basic assumptions:

- Customers will recharge their vehicles every other day on average, because the distance they drive each day is likely to be significantly less than one half of the range possible with a fully charged battery.
- PHEVs and, in particular, REEVs will be seen by their users as electric vehicles and will thus be operated mainly in the electric mode. For this reason, infrastructure needs for these vehicles are to be estimated in the same way as for all-electric vehicles.
- To allay potential customers' range anxiety, one additional public or semi-public charging point for every ten electric vehicles is planned on top of the arithmetical needs.

[8] Mode 3 describes a charging process with infrastructure-to-vehicle communications | [9] Direct current

- One important option in the field of public charging is “rapid top-up charging” to a maximum of 80% SoC[10]. According to information provided by the manufacturers, motorists will be able to recharge their vehicles at 50 kW DC in 2014; the aim is to increase the maximum charging capacity to up to 100 kW by 2020.

On the basis of these assumptions, the members of the NPE have calculated the total need for charging points in 2014, 2017 and 2020:

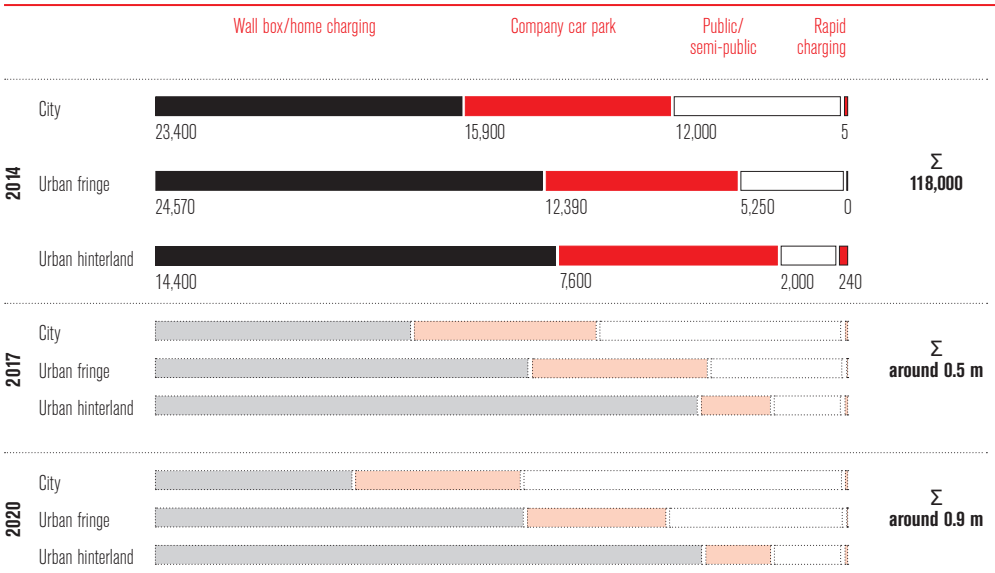


Figure 12: Development of the need for charging points by different types of charging to 2014 and forecast to 2020

On the basis of the current state of knowledge, it is possible to make reliable predictions of the need for charging infrastructure according to the defined customer structure for the period 2014. There is also a long-term need for the public infrastructure installed in this period.

The figures for the period after 2014 and until 2020 are forecasts that will be reviewed and fleshed out by the NPE by 2014. Subsequently, on the empirical basis that has evolved by then, needs will be determined, initially to 2017, with regard to the issues of user behaviour, buyer structure and recharging behaviour, among others.

Charging points at people’s homes and at businesses will account for the largest share of charging infrastructure over the period to 2020. The members of the NPE expect that this infrastructure will be installed and operated on the market and that an adequate supply will be guaranteed.

Most of the charging infrastructure required will be provided in the private and commercial sectors

However, if electric cars are to make a breakthrough, especially in large cities, the experts of the NPE believe that the creation of purely public charging infrastructure for users without a garage of their own or without domestic off-street parking with a charging point will be critical to success.

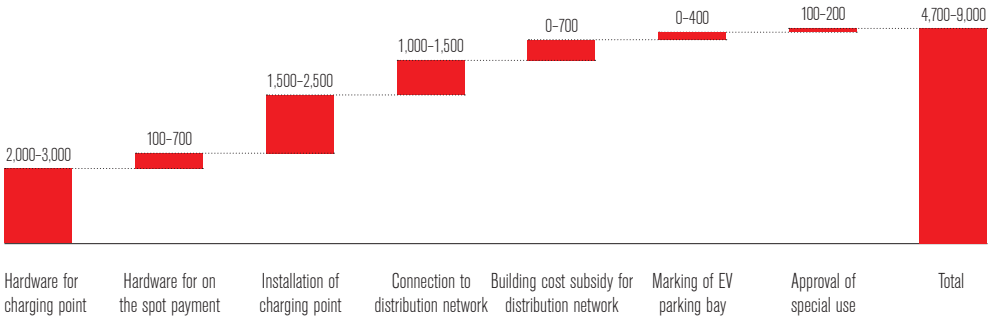
[10] State of charge

Challenges faced by the installation of public charging infrastructure

The provision and operation of charging points in public places pose considerable challenges in terms of costs.

Fig. 13 shows the components of the investment costs per charging point. It will not be possible, in the foreseeable future, to fully recover these costs via an electricity price that is the same as the rate charged for domestic electricity. However, the electricity prices that are actually necessary to recoup costs would make the economical operation of electric vehicles impossible for customer groups without access to a parking space of their own or to workplace charging points.

Figure 13:
Investment costs of public charging infrastructure (one-off expenditure in euros/ charging point) to 2020



Some cost components can vary depending on municipal requirements or local circumstances. The ranges shown in the graph take this into account. Conversely, some cost components can be significantly reduced by community initiatives, for instance with local authorities.

On the basis of the market ramp-up scenarios for vehicles and the need for public infrastructure derived from them, the following costs will be incurred for the installation of public infrastructure over the period to 2014:

Figure 14:
Total investment in public charging infrastructure to 2014

Year	2011	2012	2013	2014	Total
Total number of public charging points	2,200	3,600	5,000	7,000	
Annual investment in millions of euros (rounded)	7	8.5	8.5	12	35.5

Especially in the market preparation phase (to 2014), it is unlikely that all the needs will be met without financial incentives. To ensure that the infrastructure is installed, the NPE recommends a joint approach by industry and government. Funding options do not rule out direct government involvement. There are also funding approaches for charging points, similar to the incentives for the purchase of vehicles, such as special depreciation allowances on expenditure or low-interest loans to reduce annuities.

It is true that expenditure over the period to 2014 will be limited. However, the longer-term perspective calls for thorough market observation as well as the continuation of technological developments and the development of innovative business models that go beyond the demand-responsive distribution of infrastructure (cf. also the SIMONE model, p. 41).

Because of the uncertainties mentioned above, there is no point attempting to forecast the investment costs beyond 2014. The infrastructure needs will have to be reviewed again before 2014. Only then will it be possible to formulate a concrete forecast of needs to 2020.

Given the looming cost problems, the NPE argues for the following approaches for the period after 2014 and until 2020.

Future business models for operation of the public charging infrastructure

Nor will it be possible to totally fund the operation of the public charging infrastructure via the sale of electricity alone. The NPE experts thus suggest that a pro rata funding of the specific operating costs be considered. Thus, for instance, cost components of electricity that are related to taxes or surcharges could be reduced or dispensed with altogether (starting points include value added tax, the renewables[11] and CHP[12] surcharges, electricity tax, concession levy). Arrangements such as lowered user charges for deferrable loads are also possible.

The development of new business models will be the focus of future activities

The members of the NPE assume that, as technological development advances and a larger number of electric vehicles enter the market, new business models will emerge that differ from, or expand, the operator models trialled in today's pilot regions. Schemes such as park and charge as well as value-added services or advertisements on the charging posts present realistic opportunities for additional sources of income.

The development of new business models to ensure that the need for public infrastructure is met will be a key issue in the showcases and in the future activities of the NPE. One approach to promoting the integration of electric vehicles into the energy system could be to incentivize vehicle users to plug their vehicle into the grid whenever it is parked and to create the necessary technological conditions for smart integration into the grid. This approach is designed to promote the roll-out of grid-friendly and smart electromobility. The level of funding will be based on the time during which the vehicle is plugged into the grid, the rated power that is provided and the degree of flexibility of the integration (on/off vs smart charging).

On top of the contribution it makes to the integration of renewable energy, this "Innovation Funding in Germany for Renewable Electromobility" (I.D.E.E.) will also help to reduce electric vehicles' TCO gap.

[11] Under the Renewable Energy Sources Act | [12] Under the Combined Heat and Power Act

A specific proposal for implementation made by some members of the NPE under the name I.D.E.E. is described in the annex. The NPE unanimously recommends that this approach be trialled as part of the showcases in order to assess its impact and system compatibility.

Stepping up technological development

In addition to new business models, innovative technological solutions are another possibility for addressing the looming cost problems surrounding public infrastructure. Stepping up the development of DC charging technology is emerging as the main option towards rapid top-up charging as a substitute for slower AC[13] charging. The technological conditions must be quickly created in the battery, vehicle and charging technology fields, and in such a way that the vehicle-to-grid objective is also taken into account. The lighthouses will address this need.

New technologies, such as direct current rapid charging, promise to solve the problems associated with the costs of public charging infrastructure

Initial calculations show that DC charging points for rapid charging can, in filling-station-like business models, be operated such that they break even. Such a solution would make a major contribution towards ensuring that the need for public infrastructure is met. The advantage of DC rapid charging points is that better use is made of their capacity, because the charging times are much shorter and thus enable higher throughput. The NPE experts assume that users will be willing to pay a slightly higher price for rapid charging. Users' willingness to pay and uptake of the DC points are to be trialled in the showcases in the near future.

Currently available designs for AC charging points in public places are based either on a stand-alone post with typically two charging points or on a larger charging post with a central control panel and several satellites in the immediate vicinity. New innovative approaches to charging are required to enable residents without off-street parking, in particular, to recharge their vehicles economically.

Approach to ensure demand-responsive distribution of the charging infrastructure (SIMONE)

There are two main questions regarding the installation of public infrastructure. Alongside ensuring that the total need is met, how can an appropriate regional distribution be shaped? And how will it be possible to bridge the cost recovery gap that is likely to exist?

[13] Alternating current

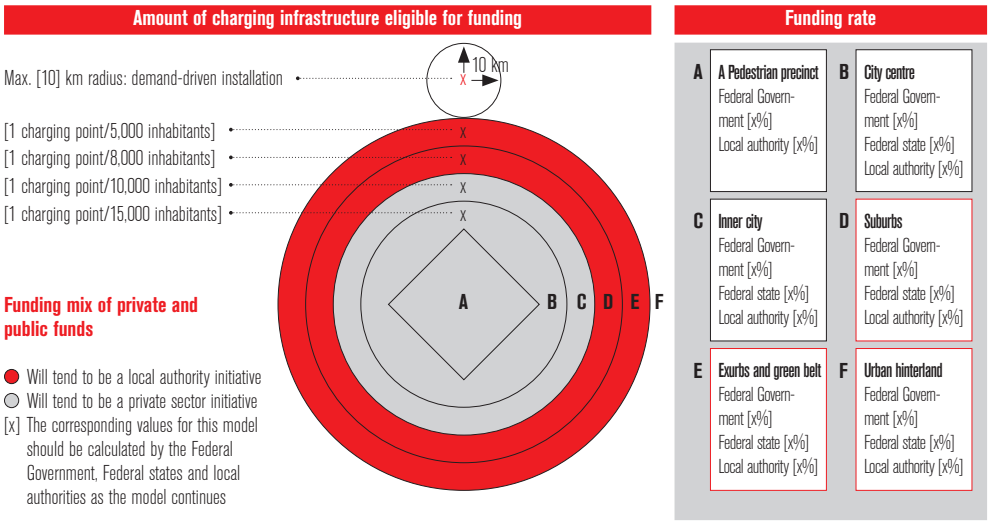


Figure 15: Systematics of the SIMONE model

As an approach for ensuring that the charging infrastructure needs are met, the National Platform for Electromobility has presented to the Federal Government a **Settlement-Based Model for the Sustainable Installation and Promotion of eCharging Infrastructure (SIMONE)**[14] and recommends that it be evolved and implemented. Local authorities are to assume organizational responsibility for ramping up the charging infrastructure on the ground in order to take individual urban and transport planning objectives into account.

Local authorities are to decide where public infrastructure is installed and how much is to be installed

The authorities will decide themselves how proactive they wish to be in installing the charging infrastructure. A decision not to install public charging infrastructure will be just as possible as a decision to install and fund infrastructure that goes beyond immediate requirements.

The model also includes an approach that addresses the funding of infrastructure with the involvement of possible funders (Federal Government, Federal states and local authorities) and private sector investors (charging post operators, commercial initiatives or private initiatives). The logic of this funding will ensure that the total number funded is limited and deadweight effects are ruled out as far as possible. Local authority tenders can be used in all zones for the award of contracts for installation and operation. Here, too, decisions will be taken by the local authorities.

Minimum requirements for charging points

Safe and convenient charging and confidence that the charging process will be efficient and transparent are important criteria for the uptake of electromobility. The charging infrastructure to be installed should therefore meet a range of minimum requirements that

[14] For further information, see also the "Second Report of the National Platform for Electromobility – Annex"

Uniform requirements to be met by public charging points as a basis for customer uptake and planning certainty

will enable uniform operation based on these criteria outside the emerging standards. The basic premises are:

- The physical safety of vehicle users must be guaranteed each time they recharge their vehicle.
- There must be non-discriminatory use, especially of the public charging infrastructure by final customers.
- Minimum requirements must not be phrased such that they favour the market exclusion of individual business models.
- As little regulation as necessary and as much market as possible.

Because charging infrastructure will become a basic commodity, it will have to be continuously checked. Uptake of the charging points will also depend to a great extent on efficient repair management.

Specific recommendations[15] have been developed on the following aspects in order to support the design of a charging infrastructure that meets demand and provides blanket coverage. Where necessary, they should be taken up and become the subject of the regulatory framework for the installation and operation of charging infrastructure.

- Guaranteed access to public charging sockets
- Safety-related activation of the charging process
- Authentification and authorization
- Receipt and bill
- Payment options
- Collection, transport and processing of electronic data
- Energy management metering
- Access for third-party suppliers to charging posts in public places

The technology roadmap of charging points, which was created in the interim report, has since been fleshed out by experts, stating when it will be possible for vehicles to use the charging options and whether vehicles will be fitted with these options as standard.

The wireless, inductive charging of a stationary vehicle has been functionally demonstrated for the 3 kW power range. It is conceivable that initial systems suitable for mass production will, if certain conditions are met, be in showrooms within around five years. Other developments are to be considered.

For the rapid top-up charging of vehicle batteries, the NPE believes that a charging capacity of over 50 kW will be available by the middle of the decade. The aim should be to increase the maximum charging capacity to up to 100 kW by 2020.[16]

[15/16] For further information, see also the "Second Report of the National Platform for Electromobility – Annex"

5.4 The automotive package of measures

An analysis of the total cost of ownership (TCO) shows that, in the short to medium term, there will be a significant cost gap between electric vehicles and functionally comparable conventional vehicles. For this model calculation, reference vehicles and assumptions on how their power and maintenance costs are likely to develop have been coordinated within the National Platform for Electromobility.[17] The data used for this calculation corresponds to the current status of expert opinions and has been coordinated among the NPE working groups. The model will be monitored annually and, if necessary, adapted, taking the actual development of the input data into account.

Electric vehicles will be considerably more expensive than conventional vehicles over the medium term

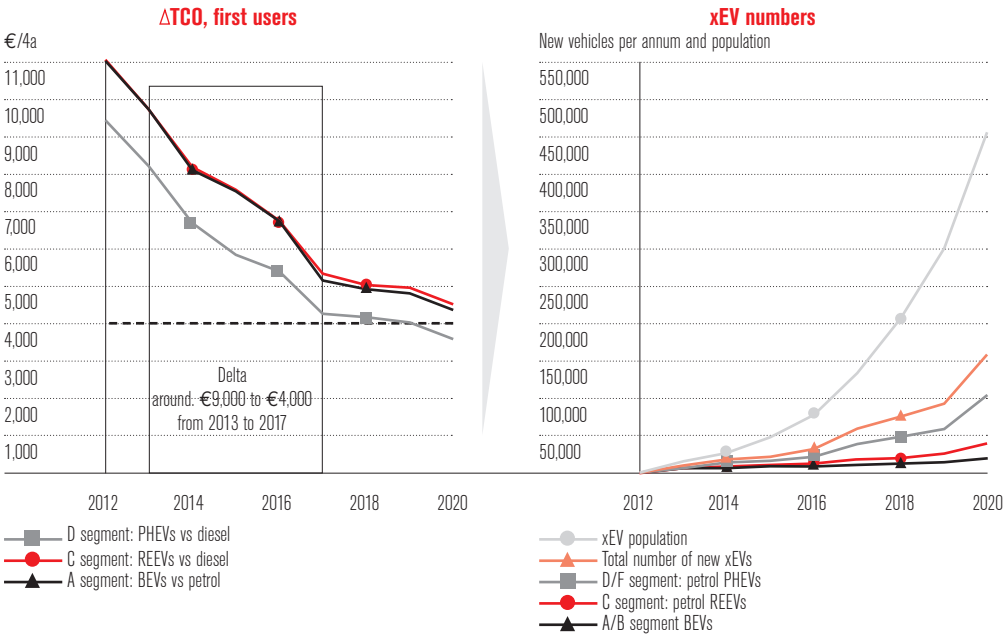


Figure 16:
TCO model

On the basis of this model, a population of only around 450,000 electric vehicles is likely by 2020 without additional incentives. This would fall way short of the objective of having an electric vehicle population of one million by 2020.

To achieve the objective of one million electric vehicles by 2020, the NPE recommends non-monetary and monetary incentives. The following describes in more detail the package of measures for the first phase (market preparation from 2012 to 2014) to achieve the milestone of 100,000 xEVs in the population in 2014. Without financial assistance, the population would be around 25,000 over the same period.

With appropriate market incentives, it will be possible to achieve the targeted number of electric vehicles

[17] For further information, see also the "Second Report of the National Platform for Electromobility – Annex"

Non-monetary incentives

Wherever possible and practicable, preference should be given to non-monetary measures, in other words granting privileges to electric vehicles, for instance by allowing them to use bus lanes and providing them with priority parking. Local authorities will have to consider the pros and cons of granting these priorities on a case-by-case basis.

Non-monetary measures can make certain customers with specific mobility patterns significantly more willing to purchase electric vehicles that are promoted accordingly.[18] However, these measures will not incentivize customer groups with other use patterns. It is therefore recommended that, in the first market development phase, the instruments described below be included in the tendering criteria for showcase projects, so that they can be trialled in various configurations within this framework. The NPE supports a systematic exchange of good practice at local authority level. The costs of these measures are to be borne by the local authorities. The provision of financial assistance from Federal funds for their deployment within the framework of the showcase regions is to be considered.[19]

Use of bus lanes/introduction of dedicated lanes

The option of allowing electric vehicles to use bus/taxi lanes is an incentive that would provide great benefits to users in densely populated areas. On the basis of international experience (for instance high occupancy vehicle lanes (HOV) in the USA), it can be assumed that these measures would encourage some user groups to purchase electric vehicles. Before these measures are introduced, however, undesired side effects have to be assessed. Primarily, it must be ensured that the use of bus lanes is compatible with the interests of local public transport. In addition, the increased likelihood of accidents around bus stops and/or as a result of the specific traffic signal control is to be assessed.

Priority parking for electric vehicles

In the discussion on priority parking for electric vehicles, various situations have to be distinguished, each of which exhibits a specific need for regulation. In order to make the on-street recharging of electric vehicles possible, it is necessary to include electric vehicles as a further priority group in road traffic law. The necessary amendment to Section 45 of the German Road Traffic Regulations is already the subject of political discussion.

[18] The Innovation Centre's 2008 study entitled "DB Mobility" puts the advantage of a free parking space in conventional fleet usage at 600 to 1,200 euros per year. For the limited use within the market preparation over the period to 2014, it would appear advisable to take the lower value with a 50% deduction.
[19] For the entire package of measures, a monetary incentive effect of 300 euros on average per year and vehicle is assumed for these non-monetary measures. The costs are likewise put at 300 euros per year and vehicle, but are not taken into account in the following compilation.

It is recommended that, when the regulatory framework is adapted, the requirements for the implementation of business models associated with electromobility also be taken into account. These include, for instance, car sharing, because it can help to reduce congestion in city centres caused by private transport. Other cases include the provision of dedicated parking spaces for electric vehicles in city centres without recharging facilities and electromobility in combination with more extensive business models. These are local governance measures that primarily have the character of additional incentives. When they are implemented, existing legislation must be complied with and discrimination against other road users avoided.

Recommended non-monetary incentives

- Grant electric vehicles parking privileges and introduce dedicated lanes in showcase projects as of 2012.
- Decide whether to continue the schemes after 2014 on the basis of an evaluation in the autumn of 2013.

Parking privileges and the use of dedicated lanes can incentivize the purchase of electric vehicles

Monetary incentives

With the following monetary incentives, the National Platform for Electromobility proposes a package of measures to compensate for the calculated cost disadvantage of electric vehicles. The calculated cost gap will be reduced only to such an extent as is necessary to reach the electric vehicle population targets for 2014, 2017 and 2020.

Compensating for disadvantages in company car taxation

The private use of company vehicles by employers or employees constitutes a taxable (income or wages tax) pecuniary advantage. As a rule, the basis of assessment is 1% of the gross list price per month. In addition, there may be a surcharge amounting to 0.03% per kilometre for journeys between home and workplace.

Because electric cars will have a higher gross list price than comparable conventional vehicles in the years ahead, application of the 1% rule would result in the user of an electric company car having to pay tax on a significantly higher pecuniary advantage, while the utility value would be at best similar. This would make it difficult to fully unlock the market potential among commercial customers, because a large number of potential company car users would decide not to purchase electric vehicles given the financial drawback. A lump sum deduction from the gross list price assessment basis will compensate appropriately for disadvantages within the existing system. The level of the deduction should be based on how drivetrain costs develop.

Incentives will boost the demand for electric vehicles

Given these obvious drawbacks in the taxation of the private use of electric company vehicles, high priority will be given to use of a compensatory arrangement for the taxation of company cars. It is recommended that gradually decreasing compensation (€/kWh) be introduced starting in 2012, based on the likely additional prices due to high drivetrain costs. It will start at €500/kWh in 2012 and decrease by around €50/kWh each year (being capped at 20 kWh). The instrument will be reviewed when the evaluation is carried out in 2013.

The harmonization of the basis of assessment for company car taxation will result in users deciding to purchase electric company cars that they would otherwise not have chosen. This measure will thus not lead to a shortfall in tax revenue.

Special arrangements regarding the depreciation of electric vehicles

Technological developments in the field of electric vehicles will result in a significantly higher pace of innovation and greater economies of scale in consecutive periods compared with conventionally powered vehicles. The associated impact on the development of value in the market ramp-up phase justifies a faster depreciation of commercially acquired electric vehicles compared with a regular depreciation over six years. A special depreciation allowance amounting to 50% of the costs of acquisition in the first year of use is recommended. Through the special depreciation allowance, commercial purchasers will enjoy a tax deferral advantage over the entire service life of their electric vehicles. In the year they purchase an electric vehicle, they will also benefit from a noticeable, positive liquidity effect. The associated incentives to innovate will compensate for any risks in the depreciation of the vehicle due to the higher pace of innovation in electric drivetrain and vehicle technology. The liquidity advantage in the year of acquisition will be cancelled out by the lower depreciation allowances in the following years. Because of the time value of money, the result will be a net present value benefit.

Compensating for the disadvantage in company car taxation and special depreciation allowances will stimulate the commercial demand for electric vehicles

Because commercial customers will play an important role for the market penetration of electric vehicles in the early market development phase, it is recommended that the special depreciation allowance be introduced in 2012 and reviewed at the end of 2013. The 50% special depreciation allowance for commercially acquired electric vehicles will not result in any final shortfall in tax revenue. The budgetary expenditure will be limited to the tax deferral effect. The use of the special depreciation allowance in combination with the proposed compensation for disadvantages in company car taxation is recommended as a financial assistance package to stimulate demand among commercial purchasers for electric vehicles.

Low-interest loans from the Kreditanstalt für Wiederaufbau (KfW)

Financing electric vehicles by means of low-interest loans will help to tap into wider groups of customers for electromobility. The NPE recommends that the Kreditanstalt für Wiederaufbau launch a programme of loans for the purchase of electric vehicles. A scheme should be developed involving a loan with a fixed rate of interest for four years, for instance for private customers, for up to 30,000 euros with a maximum effective annual rate of interest of 2.5%. On the basis of empirical data available, it is assumed that around one-third of all private customers will opt for loan financing of their vehicle.

It is recommended that the programme be introduced in 2012. The KfW's refinancing options will ensure that the low interest rate can be offered without subsidies. In addition, it is an established instrument for implementing the Meseberg decisions (e.g. in the building refurbishment programme).

Low-interest loans for private customers will make it easier for large groups of purchasers to switch over to electromobility

Fiscal incentives

A very effective instrument to encourage the purchase of electric vehicles is the direct payment of incentives. An annual fiscal incentive is suggested, drawing on existing administrative processes in the licensing procedure and vehicle taxation. The support provided will be based on the electrical storage capacity of the electric vehicle's traction battery as a reference value. The resultant amount in €/kWh will take into account the key cost driver and the functional potential of the vehicle, since vehicles with a greater storage capacity generate significantly higher manufacturing costs for the drivetrain, while at the same time enabling longer electric ranges. To avoid excessive support, it is recommended that assistance be limited to a maximum battery capacity of 20 kWh. In keeping with the scope for cost reduction identified by the NPE, the level of support provided should gradually decrease. It is suggested that the fiscal incentive be introduced starting in 2013 with support amounting to €100–150/kWh and that the impact on the market ramp-up be reviewed at the agreed evaluation time in the autumn of 2013. This evaluation will then also be able to include recent data from international experience and the showcases on the actual TCO gap and user preferences, before the fiscal incentive is included in the catalogue of possible measures for phase 2 of market ramp-up.

An annual fiscal incentive over four years from first use, based on the size of the vehicle's battery, will offset the high costs of purchasing electric vehicles

In the market preparation phase (2012 to 2014), there is likely to be a relatively high TCO disadvantage and a limited range of electric vehicles on the market. In the period between now and 2020, the highest need for support per vehicle will be in this market development phase. The grand total of all measures, however, will be comparatively low because of the low level of market penetration.

To sum up, the following financial assistance packages are recommended for the individual customer groups:

- As of 2012, the private acquisition of electric vehicles should be supported by means of low-interest loans (2.5% p.a. on a loan of up to 30,000 euros). As of 2013, it should be supported by means of a fiscal incentive that provides €150/kWh.
- For the private use of electric company vehicles, it is suggested that, as of 2012, compensation be provided for the disadvantage suffered when paying tax on the pecuniary advantage.
- As of 2012, the commercial acquisition of electric vehicles will be supported by means of a special depreciation allowance of 50% of the purchase price in the first year of use. As of 2013, it will be supported by a fiscal incentive that provides €100/kWh.

Model calculations for a plug-in hybrid vehicle with a 9 kWh battery identify considerable TCO gaps

The actual impact of the incentives on purchasers of electric vehicles has been studied on the basis of model calculations.[20] The example chosen was the purchase of a PHEV in the D segment with a net purchase price of around 40,000 euros in 2014 and a battery capacity of 9 kWh, and the calculation was performed for all three user groups. The non-monetary incentives amount to 300 euros per year and are contrasted with the remaining TCO gap. The calculation assumes that the first use of the vehicle is for four years from the stated year of purchase.

For private acquisition, the following support would be provided in the year of purchase, paid out proportionally over the first four years (Fig. 17):

Figure 17:
Funding the private acquisition of an electric vehicle

D seg. private PHEV	2012*	2013*	2014*
TCO gap	9,419	8,161	6,658
KfW loan (low interest)	3,569	3,569	3,569
Incentive		1,350	1,350
TCO gap after funding	5,850	3,242	1,739
Inclusion of non-monetary incentives	1,200	1,200	1,200
TCO gap incl. non-monetary incentives	4,650	2,042	539

* Year of purchase, funding pledge for four years (first use)

[20] For further information, see also the "Second Report of the National Platform for Electromobility – Annex"

In the case of the commercial acquisition of electric vehicles, there is a smaller TCO gap to be compensated for if there is no support compared with private purchase, because commercial purchasers can offset the additional costs of electric vehicles – like all other operating expenses – against tax (deduction from taxable income and deduction of input value added tax), Thus, the financial assistance situation for the commercial acquisition of the assumed PHEV in the D segment is as follows (Fig. 18):

D seg. commercial PHEV	2012*	2013*	2014*
TCO gap	4,963	4,286	3,449
Special depreciation allowance	843	789	775
Incentive		900	900
TCO gap after funding	4,120	2,913	2,090
Inclusion of non-monetary incentives	1,200	1,200	1,200
TCO gap incl. non-monetary incentives	2,920	1,713	890

* Year of purchase, funding pledge for four years (first use)

Figure 18:
Funding the commercial purchase of an electric vehicle

The financial assistance package for private company car users is based on the aforementioned package of incentives for commercial purchase. To simplify matters, in the table below the tax disadvantage of the company car has been added to the TCO gap for commercial purchasers of the PHEV in the D segment. The combination of incentives for commercial purchasers and private users of company vehicles results in the following support being provided (Fig. 19):

D seg. company car PHEV	2012*	2013*	2014*
TCO gap	7,491	6,501	5,352
Special depreciation allowance	843	789	775
Compensation for company car disadvantage	1,414	1,272	1,131
Incentive		900	900
TCO gap after funding	5,234	3,855	2,861
Inclusion of non-monetary incentives	1,200	1,200	1,200
TCO gap incl. non-monetary incentives	4,034	2,655	1,661

* Year of purchase, funding pledge for four years (first use)

Figure 19:
Funding the commercial purchase of an electric vehicle as a company car

Assessment and outlook

A phased package of measures with reviews at regular intervals will ensure that the defined objectives are achieved

Establishing a market at as early a stage as possible will, by generating economies of scale for drivetrain components, support a rapid decrease in costs. This will result in the short-term reduction of the TCO gap for the subsequent market development phases.

The present programme proposal takes into account the requirements of the various customer groups and market development phases. The definition of the required amount of support is based on the identified need for incentives to achieve the desired market development. An annual cross-check between the financial assistance programme and the development of the actual framework will ensure that the defined objectives are implemented and avoid excessive support. In this way, the present proposal explicitly sets itself apart from an international subsidy race and represents an intelligent approach to promoting the commercialization of electromobility.

Figure 20 shows how the market is likely to develop if the proposed financial assistance packages are implemented and the total level of funding on which this is based:

Figure 20:
Market development if the funding packages are implemented and levels of funding

	2012	2013	2014	Total
Newly registered BEVs/REEVs/PHEVs	6,500	14,000	79,000	
BEV/REEV/PHEV population	8,000	22,000	101,000	
Funding pledge (four years)*	€6 m	€33 m	€180 m	€219 m

* Excluding compensation in company car taxation and non-monetary incentives

On the basis of current evidence, it can be assumed that in phase 2 of the market development a significantly reduced TCO disadvantage and rising segment penetration through an increasing range of products will result in the market becoming very sensitive to monetary incentives. The deployment of an appropriate package of measures in this market ramp-up phase will be of crucial importance to achieving the objective of an electric vehicle population of one million in 2020. In phase 3 from 2018 to 2020, the electromobility market is likely to function in an increasingly autonomous manner. The TCO disadvantage will continue at a relatively low level. A large number of products and services in an established marketplace will make electric vehicles an increasingly attractive alternative to people deciding which vehicle to purchase.

The recommended mix of measures will make it possible to achieve the following objectives:

- The TCO gap will be reduced to a comparable level for all user groups and all segments. The individual measures will be dovetailed and will build on existing legal structures. Excessive funding will be avoided, as will inappropriate bureaucracy.
- Taking into account the increasing segment penetration in the range of vehicles in subsequent years, it will be possible to achieve the objective of having a vehicle population of one million by 2020 even if the measures provide a gradually decreasing level of support.
- The expected need for support amounting to around 220 million euros[21] in the period from 2012 to 2014 reflects the budgetary framework and the ambitious goal of making Germany a lead market for electromobility in equal measure.

In the autumn of 2013, a decision is to be taken on fleshing out the measures, especially on the funding lever in €/kWh for shaping the basis of assessment for company car tax and the incentive. As part of the review, a maximum budget for the deployment of the measures could be established.

Recommended monetary measures

- Adapt the basis of assessment for company car taxation; introduce a special depreciation allowance and a KfW programme of loans as of 2012.
- Deploy the fiscal incentive as of 2013.
- Define the deployment of measures for the market ramp-up phase on the basis of an analysis of market development and the general framework (energy prices, component prices) by the end of 2013.

Other incentives

Other funding measures are to be assessed

Going beyond the non-monetary and monetary measures, the NPE suggests that further instruments be considered in the next monitoring report. The instruments presented below are not part of the proposed package of measures to compensate for the TCO gap.

The introduction of a common **transferable number plate** for first and second vehicles to save tax and insurance costs has been a subject of political discussion for months. Making use of this tool would also have a positive impact on electromobility. It would, for instance, incentivize the combined use of electric vehicles for short trips and conventional family vehicles for longer distances.

[21] Because it is assumed that people who are potentially interested will decide not to purchase electric vehicles in view of the existing disadvantage they would suffer in taxation of the private use of electric company cars and thus no additional tax revenue will be generated, the costs of company car compensation are not shown here. Costs will also be incurred for non-monetary incentives, for instance in local authority budgets, and are likewise not shown here.

The resultant annual savings in maintenance costs is relevant to the TCO and could be an additional incentive for the purchase of electric vehicles. The attractiveness of this incentive will essentially depend on what shape the measure takes, and in this case it will be reduced by the fact that the measure will exclusively support users of second vehicles. This may also result in disadvantages regarding acceptance by civil society. Moreover, electric vehicles are currently exempt from motor vehicle tax for the first five years.

Taking into account the fact that, once the vehicles no longer qualify for this exemption, the taxation of battery electric vehicles will be based on weight, and the fact that plug-in hybrid vehicles produce very few CO_2 emissions, the annual motor vehicle tax to be paid would be comparatively low even without exemption from the tax. Defining appropriate insurance policies to cover the use of transferable number plates is the exclusive responsibility of the insurance industry. The NPE recommends that this incentive be deployed without restricting it to one type of drivetrain or category of vehicle on the basis of a simple administrative application and approval procedure.

A procurement programme for electric vehicles in the fleets of the Federal Government, Federal states and local authorities is recommended

In addition, within the scope of the NPE's 2012 annual progress report, the Federal Government, Federal states and local authorities should take a joint initiative to develop a recommendation on fleshing out a **public procurement programme**. By guaranteeing that it will purchase a large number of vehicles (based on the market ramp-up), the public sector can make a major contribution towards the commercialization of electromobility, especially in the initial phase. Investment risks for manufacturers and component suppliers will be reduced and economies of scale will be reached more quickly, with a positive impact on the cost structure. When the proposal is being developed, account must be taken of the fact that it will be fleshed out within the framework of national and European requirements. The vehicles brought to market through this instrument are to be taken into account when defining the volume targets in the market development phases.

Also as part of the 2012 monitoring report, proposals should be made on **incentives for electric commercial vehicles**, paying due regard to the programme of measures defined above. Starting from niche markets such as distribution operations, alternative drivetrains for commercial vehicles will also be able to spread in today's mass markets if users can be offered an economic incentive to purchase such a vehicle, including all costs from purchase through operation to decommissioning.

In addition, the contribution that a **compensation for vehicle-to-grid integration** could make towards enhancing the attractiveness of electromobility for customers is to be explored. In this way, users would be incentivized to plug their vehicle into the grid as frequently as possible. This measure would also support the use of the potential inherent in electromobility for balancing load fluctuations in the grid.

Initiatives to encourage the integration of electric vehicles into the grid in order to unlock the energy potential of electromobility at an early stage should be considered

6 Electromobility showcases

6 Electromobility showcases

6.1 Pooling resources and creating visibility

The establishment of a lead market for electromobility must be tackled in a speedy and concerted manner. The visibility of innovative technologies and solutions is a basis for enhancing uptake in Germany and for successful exports. In the early phase of market ramp-up, this visibility will be achieved primarily when resources are pooled and commercially mature innovations are brought to market in a concentrated manner.

Showcases will bring together technologies and partial solutions to form visionary masterplans

This should be done in a small number of large-scale showcases. The NPE defines showcase projects as self-contained electromobility regions in which, over the period from 2012 to 2015, technologies and solutions integrated into an overall system from all electromobility sub-systems (energy, vehicle, transport) are applied.

The showcases will actively draw on the development findings in the technological lighthouses and speed up their roll-out. At the same time, by drawing conclusions from the application, it will be possible to establish bases for further technological development. Each individual showcase will make a contribution to training and skills development and will address issues from applied and basic research in the field of electromobility provided that they have reached a sufficient degree of technical maturity.

Showcases will be used to review assumptions and measures

In addition, showcases will be an important basis for checking the plausibility of the assumptions on which the NPE's recommendations for a framework for commercialization and the installation of infrastructure were based. Measures can be applied in showcases on an experimental basis by means of trial clauses.

The explicit objective in designing and deploying the showcases will be to apply technologies and solutions before they are able to take hold on the mass market through self-sustaining demand, although their innovative character means that they can make a major contribution towards achieving the objective of Germany becoming a lead provider. In doing so, they will support two aspirations:

Becoming a lead provider: showcases will provide a framework for rapidly and comprehensively displaying the innovative capacity of "electromobility made in Germany" by means of applications and thus making it marketable in real-world conditions.

Becoming a lead market: they will be an ideal platform for familiarizing potential customers and users with electromobility, enhancing uptake and stimulating demand.

It must be ensured that showcases deploy technologies and solutions from the entire system chain, from the energy system through the vehicle to the transport system.

6.2 Invitation to tender and award

The NPE recommends the following approach be adopted when shaping the tendering and award process:

Showcase projects will be awarded using a transparent procedure

The showcases will replace parts of the pilot regions and projects established with funding from the Second Economic Stimulus Package. Existing pilot regions are strongly encouraged to apply. An amalgamation of several regions to form one showcase region is possible provided that it can be justified by a coherent strategy.

The NPE does not recommend removing the infrastructure installed as part of the pilot regions and projects. Continuing the provision of financial assistance to the pilot projects by the Federal Government on a limited scale should be based on the findings of the overall evaluation. The guiding principle here is "pooling resources", and the focusing of existing resources on the showcases remains the overarching objective.

The NPE recommends that the showcase projects be awarded by an independent jury of experts in the second half of 2011, following a transparent competitive tendering procedure. The award process should be organized and coordinated by the Federal Government.

Only applications that cover all aspects of electromobility (along the entire energy-vehicle-transport system chain) for one region or showcase strategy from a single source and in accordance with the criteria[22] described in the conditions of application should be accepted. It would be desirable for the projects to focus on different themes.

Synergies with existing programmes funded by the Federal Government in the transport and energy infrastructure sector are to be demonstrated and exploited in keeping with the recommendations of the National Platform for Electromobility.

Establishment of the showcases should start in the second half of 2012. Their performance will be monitored by means of reviews in the NPE steering committee.

[22] For further information, see also the "Second Report of the National Platform for Electromobility – Annex"

Figure 21:
Showcases will pool resources and create visibility for ground-breaking comprehensive solutions

7
Active communications, function and future role of the NPE

7 Active communications, function and future role of the NPE

7.1 Communications roadmap

Current situation: communications for the success of electromobility

Germany wants to become a lead provider of and a lead market for electromobility. For this to happen, it is essential that the general public and potential customers understand, take up and accept the "electromobility system". The objective of communications is to raise people's awareness that electromobility is not just a drivetrain system but also a mobility strategy requiring a high level of development and investment. To achieve this, it is necessary to highlight more clearly the advantages of this new mobility strategy and the contribution it will make towards tackling climate change, safeguarding jobs, boosting economic growth and enabling sustainable individual mobility, and to convince the public of these advantages.

Technology uptake and willingness to buy have to be encouraged by clearly highlighting the advantages

Communications target groups

Electromobility target groups are to be addressed on the basis of clustering focused on needs and interests and on strategic prioritization and cascading. This approach will make it possible to target segments of the public and to implement the communications measures in a cost-effective and focused manner, in keeping with the respective phase of overall planning.

Key messages of communications

Crucial to the success of the communications is the consistency of the messages conveyed by the various players. Only by ensuring that this consistency is placed on a permanent basis will it be possible to create a coherent, sustainable image of electromobility in and from Germany. The key messages developed and defined by the NPE will create the basis on which all stakeholders can place their specific information:

The uniformity of the messages conveyed will be crucial to overall success

- "Electromobility with the use of renewable energy is a major component for the individual mobility of the future."
- "Germany is to become a lead provider of and a lead market for electromobility."
- "Electromobility will open up new opportunities for enhancing German competitiveness in the global economy and will create jobs."
- "Electromobility, in combination with renewable energy and integrated transport systems, will make a valuable contribution towards tackling climate change and conserving natural resources."
- "The cooperation in the NPE, which crosses the boundaries of sectors and social groups, is a unique example of the consolidation of resources."
- "The first steps have already been taken. The next stage is implementation."

Components of the communications roadmap

The components of the communications roadmap will enable a flexible approach and the integration of all players

The catalogue of communications measures on electromobility in and from Germany comprises components that can be used in combination with one another or on their own:

- The NPE will coordinate the communications activities. It will be responsible for, among other things, a coherent public image of the future NPE and will push ahead with the measures defined in the communications roadmap.
- The companies/organizations involved and the NPE will step up their media activities on the issue of electromobility. The media activities will complement one another and generate a continuous presence in the media landscape which, over time, will produce an image of electromobility that is both objective and professional.
- For electromobility in/from Germany, a label that is capable of being registered as a trademark, including a brand essence and values, will be developed. The label will act on the one hand as a transmitter for communications on the issue of electromobility in/from Germany and on the other hand as a seal of quality. The NPE will ideally ensure that the label is used correctly.
- The state of play of research and development in the field of electromobility will be demonstrated at an annual event for policymakers, the media and interested members of the public. By including all interests and their high-level representatives (from industry, academia, government, trade unions and society), the special approach will be renewed and updated annually. In addition, the event will provide a regular framework for the establishment of further linkages between the members and companies of the NPE successor organization and will thus carry the basic idea of the NPE into the future. It will also be a presentation forum for the showcases.

An image campaign (print media, online, billboards, TV) for electromobility in/from Germany is to be mounted to draw the public's attention to the issue and generate sympathy. The campaign will highlight the importance, objectives and process of development of electromobility. The proposal to mount a concerted image campaign should now be fleshed out within the NPE and further action should be coordinated accordingly.

7.2 Regular monitoring and continuation of the NPE

Structure of the NPE

To implement the objectives of the NPE, the members recommend that the steering committee be retained as the management body, meeting at infrequent intervals and comprising the appointed members. It is recommended that the steering committee be enlarged in a targeted manner, or this should be considered. Likewise, the existing

working groups are to be continued and, if necessary, sub-groups are to be established, with the working groups themselves being responsible for their method of operation (frequency of meetings, terms of reference, issues to be addressed). It has been decided that the existing editorial team for strategic preparation be evolved into an NPE task force. The members of the steering committee have agreed to continue to support the task force by providing personnel. The NPE also recommends that the Federal Government Joint Unit for Electromobility be continued. Within the NPE, it performs a coordinating function for the administrative preparation. At the same time, it can contribute coordinated government positions to the joint work with the NPE task force.

The tried-and-tested organization of the NPE will be continued and systematically developed further

Functions and responsibilities of the NPE

The NPE, as a catalyst, adviser and think tank for electromobility in Germany, is to continue its work beyond the delivery of the Second Report. It is also to help to interlink industry, society and government on the issue of electromobility and coordinate their joint approach. To this end, the NPE is to manage communications on electromobility with a view to encouraging uptake of the technologies, Germany's role as a lead provider of (international marketing) and a lead market for (uptake of applications) electromobility and acceptance and prioritization in government, including internal communications between members of the NPE.

The NPE intends to assume responsibility for monitoring the following developments:

- implementation of the NPE's recommendations;
- international benchmarking with regard to the state of the art, capacities, market development and funding environment;
- market development;
- customer uptake;
- implementation of the roadmaps, lighthouses and showcases.

In addition, the NPE advocates a regular revision and adaptation of the medium-term objectives, milestones, recommendations, measures and roadmaps. This also includes a review of its own assumptions and the success or legitimation of the recommended measures. In addition, further issues are to be considered, such as widening the focus of the NPE to a technological change through electromobility. On this basis, the NPE should be conceptually evolved. There should be a comprehensive review by the end of the market preparation phase in 2014 at the latest.

Issues, roadmaps and objectives will be regularly reviewed and adapted

Glossary

AC
Alternating current

BEV
Battery electric vehicle

DC
Direct current

FCEV
Fuel cell electric vehicle

ICT
Information and communications technology

Communications roadmap
→ Roadmap

Li-ion technology
Lithium-ion technology, also lithium-ion rechargeable battery or lithium-ion secondary battery

Meseberg decisions
The Federal Government's Integrated Energy and Climate Programme, adopted in Meseberg in 2007

Mode 3
Charging process with infrastructure-to-vehicle communications

PHEV
Plug-in hybrid electric vehicle

Roadmap
Preparatory project plan that defines the steps necessary to achieve the objectives

REEV
Range-extended electric vehicle

Smart grid
Intelligent power distribution network

SoC
State of charge, the capacity remaining in a battery

TCO
Total cost of ownership, computational model that includes all the costs (operation, maintenance, etc.) of capital goods

Technology roadmap
→ Roadmap

Wallbox
Wall-mounted charging point

xEV
Generic term for electric vehicles, including → BEV, → FCEV, → PHEV, → REEV

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