

Annual Report **2017**

NOW

 National Organisation
 Hydrogen and Fuel Cell Technology



NOW – Annual Report **2017**

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FOREWORD BY FEDERAL MINISTER ANDREAS SCHEUER MDB



Air quality means quality of life. At the same time, quality of life also incorporates freedom of movement and mobility. These are the fuels of a dynamic economy. This is what has made Germany strong.

It is my task to combine the two: greater mobility and better air quality. While we take legitimate concerns of the people in our country and their health seriously, we should not forget the following two aspects: Our businesses' goal is to create value thereby bringing us jobs and prosperity. And many people depend on cars – be it commuters or those who work in logistics or trades. A conflict between our economy and society is unacceptable. The Federal Government will therefore do everything within its power to reduce transport emissions while boosting our economy and meeting our citizens' need for mobility.

We are well-positioned. We are currently witnessing the greatest mobility revolution since the invention of the car. Automated driving is just around the corner. Transport is being interlinked. We are seeing an unstoppable rise of alternative drivetrains. All this means that, in the next five to ten years, mobility will change more than in many of the previous decades. Tremendous potential lies in this development. Mobility 4.0 will make transport cleaner, safer and more efficient.

Alternative drivetrains are at the core of this development. Electricity, used in battery electric, hydrogen or fuel cell powered vehicles, is the fuel of the future. It must be our ambition to deploy electric mobility quickly and throughout the country. We have already achieved a lot. Since 2009, the Federal Government has invested nearly five billion euros to promote electric mobility in the form of battery and fuel cell powered vehicles including support for vehicle purchase as well as investment in research and development and infrastructure. The National Organization for Hydrogen and Fuel Cell Technology (NOW) was established by the Federal Government as a vital institution for the coordination of our technology neutral measures. You will find an overview of our joint achievements in this annual report.

What we now have to do is further boost the ramp-up of alternative drivetrains. We have set ourselves clear goals in the coalition agreement. We will step up the deployment of a charging and refuelling infrastructure for electricity and hydrogen providing universal coverage. If we want to gain acceptance for new drivetrain technologies, we need to build up confidence among drivers that they may recharge and refuel their cars anytime and anywhere. It is therefore our goal to set up an additional 100,000 new charging points for electric vehicles by 2020. At least one third of them are supposed to be rapid charging posts (DC). We will also promote private sector deployment of charging posts. Another goal is to permanently switch bus fleets to alternative drivetrains. For this transformation, we need new vehicles but also a suitable charging infrastructure and operations management systems. We will also create a legal framework that makes it easier to install electric vehicle charging points at residential buildings.

The success story of the first National Hydrogen and Fuel Cell Technology Innovation Programme (NIP) will go on with the transformation of the existing National Platform for Electric Mobility into a platform for the future of mobility, which will deal with the future development of the automotive industry. The establishment of battery cell production is also a matter of high priority. We want to support industry in setting up the whole value-added chain of electric mobility in Germany.

I have no doubt that the future belongs to alternative drivetrains. Standing at the forefront, Germany has the unique opportunity to make products and strategies for clean air and low emissions a worldwide export hit. NOW is an indispensable partner on this path and will continue to be instrumental in making Mobility 4.0 a success.

I hope you enjoy reading this report.

Yours,

Andreas Scheuer, Member of the German Bundestag
Federal Minister for Transport and Digital Infrastructure

FOREWORD BY DR. KLAUS BONHOFF



THE TRANSITION TAKING PLACE IN THE ENERGY AND TRANSPORT SECTORS IS COMPLEX

The integration of renewable energy into our energy system – including the transport sector – is a necessity but it is also a highly complex task. It encompasses new technologies and types of infrastructure that bring together the generation and demand of renewable electricity, hydrogen or power-to-x in a technically, economically and above all temporally and regionally flexible manner. At the same time, the electricity, transport and heating sectors must be intelligently coupled in order to achieve the optimum system on the path towards the decarbonisation of our energy system.

THE TRANSPORT SECTOR IS TURNING ELECTRIC

In the transport sector, the electrification of drives and fuels is essential. We will only achieve our emission reduction targets by integrating green electricity using hydrogen/fuel cell and battery technology. The developments are promising. A look at other countries and markets confirms that the tipping point – from which a development experiences significant acceleration – seems to have been reached in battery-electric mobility. In Germany, we note that fleet operators and municipalities are prepared to

invest in emission-free mobility, not least due to the backdrop of limits for pollutants in city centres being exceeded. This is demonstrated by the approx. 160 procurement and 130 concept applications received as part of the local electric mobility (Elektromobilität vor Ort) programme of the Federal Ministry of Transport and Digital Infrastructure (BMVI). Electric mobility is becoming increasingly attractive: in 2017, 1.6 per cent of newly registered vehicles in Germany were (partially) electric, i.e. around 55,000 vehicles. A total of around 61,800 pure battery vehicles and 53,200 plug-in hybrids are currently registered. With a growing charging infrastructure, the number of registrations will certainly continue to rise. Since 2016, the number of cars could be doubled to around 500, in part thanks to support from the German government's National Innovation Programme Hydrogen and Fuel Cell Technology (NIP). In Hamburg and Munich, the first fleets are operating emission-free with hydrogen in carsharing or shared taxi operations. The number of buses is also increasing: a total of more than 60 fuel cell buses were ordered by several public transport companies in Germany last year. Another decisive factor for the market ramp-up of battery-powered vehicles is that manufacturers continue to work on the availability of affordable vehicles.

ALTERNATIVE FUEL INFRASTRUCTURES ARE EMERGING

The German government's National Policy Framework (NPF) for the development of infrastructure for alternative fuels provides that 7,000 fast-charging points and 36,000 normal charging points are to be available by 2020. The BMVI "Charging infrastructure for electric vehicles" programme has already led to a great deal of progress in this area: while there were 10,000 normal charging points in 2016, the number, including the currently approved applications for funding, is now 27,000; for fast charging, the number has risen from 500 charging points to over 3,000. Although not all approved charging points have yet been constructed, financing and location are already fixed and implementation is underway. Now the main priority is to work on coordinated network expansion in order to build up a comprehensive network. Important user-relevant criteria such as unrestricted accessibility to the charging facility, a straightforward billing system or the retrieval of real-time information on the current availability of a charging bay are to be taken into account. In particular, the nationwide fast-charging network must be planned in such a way that the charging processes are efficient and take place without losing any avoidable time.

The start for a comprehensive network of hydrogen refuelling stations for fuel cell vehicles has been made. According to the National Policy Framework, a network of 100

stations will be established by 2020. In 2017, 25 new locations were added. There are currently around 50 refuelling stations in the metropolitan regions and along motorway corridors throughout Germany. This is increasingly invalidating a major consumer argument against switching to hydrogen drives. With H₂ Mobility Deutschland, we have established industrial structures that professionally promote this expansion.

RETAINING VALUE CREATION WITH HYDROGEN IN GERMANY

Hydrogen and fuel cell technology is not only worthwhile for the sake of the environment and the avoidance of pollutant emissions. It is also lucrative from an economic point of view: while the added-value of battery cell production lies in Asian countries, in fuel cell stack production we still have every chance of creating and safeguarding added-value and jobs in Germany. Japan, Korea and China will have established this from 2020. The prerequisites for competing internationally from the very beginning are fulfilled. A consortium of German automobile manufacturers and suppliers is currently developing mass production technologies for fuel cells in passenger cars. The supply of the transport sector with hydrogen from renewable electricity requires the industrialisation of electrolysis. It is a key component of the energy transition. A decisive driver will be the creation of an early volume market for hydrogen or the rapid development of the first 1–2 GW electrolysis capacities.

REDUCING EMISSIONS WITH ELECTRICITY-BASED FUELS IN SHIPPING

As part of the BMVI's Mobility and Fuels Strategy, with the promotion of LNG as marine fuel, a pathway was established in 2017 which also contributes to reducing greenhouse gas and air pollutant emissions. In contrast to conventional, crude oil-based marine fuels, LNG does not cause any sulphur oxide emissions. Compared to conventional fuels, nitrogen oxide emissions are reduced by up to 90 per cent and particle emissions by around 98 per cent. The aim of the funding support is to increase the demand for LNG as a marine fuel in Germany in order to provide incentives for the development of the corresponding LNG supply infrastructure in ports.

IMPLEMENTATION OF NATIONAL STRATEGIES AND PROGRAMMES FROM A SINGLE BODY

The task of federally-owned NOW is the implementation and coordination of national strategies and public-private programmes in the field of sustainable drive technology. These include, in particular, electric mobility with fuel cells and batteries, but also electricity-based fuels and the introduction and market ramp-up of fuel cell technology in the stationary sector.

We see ourselves as a designer and moderator at the interface of politics, business and science, promoting the complex task of change, especially in the transport sector, in a technical and strategic sense as well as with a view to customer requirements and social acceptance – and in international alliances with partners. For this reason, we carefully evaluate the project ideas of private and scientific organisations as a basis for coherent, well-reasoned funding by the federal government.

With this NOW Annual Report of 2017, we trust that you will receive an informative and interesting overview of the last financial year. If you have any questions that remain unanswered, my team and I will be delighted to address them.

Yours,

Dr. Klaus Bonhoff
Managing Director (Chair) NOW GmbH
National Organisation Hydrogen and
Fuel Cell Technology



NOW

NATIONAL ORGANISATION HYDROGEN AND FUEL CELL TECHNOLOGY

NOW GmbH National Organisation Hydrogen and Fuel Cell Technology is responsible for the coordination and management of the federal government's National Innovation Programme Hydrogen and Fuel Cell Technology (NIP) as well as the Federal Ministry of Transport and Digital Infrastructure (BMVI – Bundesministerium für Verkehr und digitale Infrastruktur) funding guidelines for electric mobility and recharging infrastructure (LIS).

On behalf of the BMVI, NOW also supports the further development of the Mobility and Fuels Strategy (MFS, German: MKS – Mobilitäts- und Kraftstoffstrategie), the implementation of EU Directive 2014/94/EU on the development of an alternative fuel infrastructure (CPT – Clean Power for Transport). Specifically, NOW is involved in the development of an overall strategy taking individual fuel options into account, analysing the positions of the relevant players and coordinating projects that have German participation including those in the framework of trans-European transport networks (TEN-T).



On behalf of the Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety (BMU – Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit), NOW GmbH supports the “Environmental Technologies” export initiative (German: Exportinitiative Umwelttechnologien) in the field of hydrogen and fuel cell technology, as well as the German-Japanese cooperation in the area of power-to-gas technology.

NOW GmbH initiates projects, evaluates proposals and bundles issues in such a way that synergy effects can be exploited. Furthermore, NOW also undertakes interdisciplinary tasks. These include topics such as the advancement of international collaborations, education and training, communication at the interface of politics, industry and science as well as public relations in order to increase overall awareness of the technologies and their perspectives.



INTERNATIONAL COOPERATION 2017

Global developments in sustainable mobility and integrated energy systems are becoming increasingly dynamic. In the past, international cooperation has mainly focused on the technical challenges of implementing innovative technologies and developing corresponding funding structures for R&D and market activation. Due to the increasing market maturity of innovative technologies, the regulatory framework is moving into closer focus for their establishment in the market. With the “Clean Energy for all Europeans” package, the European Commission has laid the foundations for the further advancement of the energy and transport sector in Europe. The political developments in the USA have notably weakened the Department of Energy (DoE) in its efforts for climate and environmental protection in the transport sector. In contrast, China continues to strengthen its electric mobility ambitions at an impressive pace, thereby setting very dynamic private-sector processes in motion. The key challenges here are the integration of renewable energy and the establishment of appropriate framework conditions for cooperative international collaborations.



With the commissioning of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU – Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit) to implement international projects for the climate-friendly use of hydrogen and fuel cell technology, NOW's international field of activity has expanded to include emerging and developing countries. Besides the technical implementation of hydrogen and fuel cell technology, it is also necessary to support the development of the corresponding framework conditions here, too.

In addition to existing activities concerning technical issues and market preparation, these developments will lead to greater cooperation in the area of the regulatory framework for sustainable mobility and to new cooperation partners, such as for work conducted in emerging and developing countries.

EUROPE

European Commission

At a European level, negotiations commenced in 2017 on the “Clean Energy for all Europeans” package, which was presented by the European Commission at the end of 2016. The regulations and directives contained in this legislative package set out the energy policy framework for the years 2021 to 2030 and will have a decisive impact on the energy transition in the transport sector. NOW supported the BMVI within the scope of the intergovernmental negotiations at the Council of the European Union, which with the vote on so-called general orientations on most legislative texts, reached its preliminary highpoint in December 2017. NOW primarily accompanied the dossiers on the revision of the Renewable Energy Directive, the Energy Efficiency Directive and the Governance Regulation. To a lesser extent, NOW also advised the BMVI in the negotiations on the directive and ordinance on the design of Europe’s electricity market. The aim is to enable effective sectoral coupling and encourage the use of alternative fuels, in particular electricity and electricity-based fuels. After final positions have been formulated, NOW will support the BMVI in triologue negotiations with the European Parliament.

In November 2017, the Commission also presented the second mobility package of the year. It included the evaluation of the National Policy Framework (NPF) formulated by the member states as part of the implementation of the Alternative Fuels Infrastructure Directive (AFID). The German NPF, in which NOW played a major role in its drafting, was one of the few to be assessed as being good.

The Commission also made proposals to revise the directive on the procurement of clean vehicles and the regulation on CO₂ standards for passenger cars and light commercial vehicles. Both legislative proposals are expected to have a direct impact on the widespread use of alternative drive systems in the transport sector. Similar to the proposals negotiated as part of the “Clean Energy for all Europeans” package, NOW will intensively pursue the legislative process and advise the BMVI in this regard.

Government Support Group (GSG)

Part of the NPF evaluation concerned the intergovernmental cooperation of the member states, which in the case of Germany takes place via the Government Support Group (GSG), whose secretariat is managed by NOW in cooperation with the Dutch Rijkswaterstaat. In 2017, there were two meetings at which the GSG members intensively exchanged views on their efforts to expand alternative fuel infrastructure. The number of members of this informal forum is growing steadily.



ASIA

China

Based on the joint declaration for cooperation in the fields of electric mobility as well as hydrogen and fuel cell technology between the BMVI and China's Ministry of Science and Technology (MOST), as well as the cooperation declaration between China Automotive Technology & Research Center (CATARC) and NOW, the establishment of the virtual Sino German Electro-Mobility Innovation and Support Center (SGEC) was advanced during 2017. A corresponding implementation agreement was signed by CATARC and NOW on 5 December 2017. The SGEC will focus on battery-electric mobility, strengthening scientific exchange and establishing a partnership in the field of hydrogen and fuel cell technology with a focus on the transport sector. German-Chinese projects will also be conducted. These are open to all national partners and are initially divided into four thematic areas: battery-electric mobility, electric mobility with hydrogen fuel cells, safety (battery and hydrogen) and integration of renewable energy. NOW prepared and implemented the tender that called for submissions to be made for the supervision of each separate subject area.

As part of a trip to China that was made in December, together with CATARC, NOW organised an exchange between Chinese and German experts from the international standardisation bodies for hydrogen and fuel cell applications on "Regulations, Codes and Standards" (RCS), upon the backdrop of the growing importance and dynamic development of hydrogen and fuel cell technology in China. The first exchange held on 9 December aimed to initiate a close dialogue to support the establishment of uniform international standards and thus help to prevent potential trade barriers.

With the GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit) German development agency, NOW has also had a German partner in China since 2017, which can act as the first local point of contact and support the activities locally.

Japan

Japan continues to be one of Germany's most important partners in promoting the subject of hydrogen and fuel cell technology in an international context. At COP 23 in Bonn in November, Norbert Barthle, the then current Parliamentary State Secretary to the Federal Minister of Transport and Digital Infrastructure, and NOW met with Masaki Ogushi, Japan's Parliamentary Vice-Minister of Economy, Trade and Industry. Both participated in a high-level meeting of the Hydrogen Council, an association of international corporations from Japan (Honda, Toyota, Iwatani, Kawasaki) and Germany (Audi, BMW, Daimler, Linde), among others, which aims to facilitate the breakthrough of hydrogen technology.

NOW welcomed numerous Japanese delegations whose focus of interest – in line with the Japanese government's milestone planning – is shifting towards a hydrogen society focusing on hydrogen production from renewable energy and power-to-gas technologies. Besides further meetings with stakeholders from Japan at the Fuel Cell Expo, a trip to Japan was undertaken in November on behalf of the German Federal Ministry for the Environment to identify possible projects for greater cooperation. During this trip, projects were visited in Fukushima Prefecture which, after the 2011 disaster, is promoting the expansion of renewable energy. The trip also included several model projects in Tokyo, where the use of hydrogen and fuel cell technology is being prepared as part of the 2020 Olympics. In addition to the government representatives, various companies such as Toyota, Sunfire and Apollo Gas were also represented. Japan's government is stepping up efforts to enable the production of hydrogen with renewable energy (power-to-gas). The cooperation aims to promote the involvement of German and Japanese companies and the exchange of experiences.

During the 8th German-Japanese Environment and Energy Dialogue Forum in Tokyo, the German federal environment ministry and the Japanese New Energy and Industrial Technology Development Organization (NEDO) decided to establish a bilateral working group on the climate-friendly use of power-to-gas technology, as a first step.



EMERGING AND DEVELOPING COUNTRIES

Export initiative for environmental technologies

The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU – Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit) promotes innovations in environmental and climate protection in emerging and developing countries for sustainable economic development.

The “Export Initiative for Environmental Technologies”, which was established in 2016 by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), aims to share and promote environmental technologies, environmental awareness and knowledge in order to make a tangible contribution to the sustainable development of other countries. At the same time, new markets for the export of German environmental technologies are to be identified. The export initiative’s transfer of knowledge and technologies extends across the BMU’s various areas of competence. One focus is on the area of environmentally friendly mobility.

NOW GmbH supports the BMU in setting up a network in developing and emerging countries to prepare, coordinate and implement activities for the use of climate-friendly hydrogen and fuel cell technologies, in cooperation with the Gesellschaft für Internationale Zusammenarbeit (GIZ). Through its strategic network with local industry partners, NOW will provide the current state of hydrogen and fuel cell technology as well as contemporary perspectives into the energy system considerations of the respective countries. And building upon this, the aim is to identify potential cooperation partners in emerging and developing countries for specific demonstration projects. In this way, the conditions for generating demand for German products in the field of environmental technologies and to establish the associated infrastructures, can be shaped.



MULTILATERAL COOPERATION

International Workshop on Hydrogen Infrastructure and Transportation

In May 2017, the 5th International Workshop on Hydrogen Infrastructure and Transportation took place in Berlin. The workshop was organised by NOW together with the US Department of Energy (DoE), the Japanese New Energy and Industrial Technology Development Organization (NEDO) and the Joint Research Center (JRC) of the European Union. Around 50 technical experts from the USA, Japan and Europe, including Scandinavia and Germany, took part to discuss the current challenges in implementing international standards for hydrogen refuelling stations.

China participated for the second time as an observer and presented its latest national developments. Questions regarding hydrogen logistics were discussed for the first time during the workshop in Berlin. These have arisen due to the growing number of refuelling stations, fuel cell vehicles and also due to the larger demand in volume, e.g. from fuel cell trains. Furthermore, developments concerning the measurement of hydrogen quality, the harmonized certification of hydrogen refuelling stations and the measurement dispensed fuel were presented. In addition to purely technical subjects, questions of commercialisation are also gaining in importance.

IPHE

The International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE) is a consortium of 18 member states and the European Commission with the goal of accompanying and promoting the commercialisation of hydrogen and fuel cell technology. German representation in the IPHE is provided by the BMVI, with NOW as the coordinating body. The Permanent Secretarial Office (PSO), which was established in 2015, is now fully operational and is proving its value.

Besides half-yearly Steering Committee meetings, further formats are organised and regularly take place for the active exchange with various target groups. Among these is an Industry Forum in which current policy developments are discussed with partners from business. Within the scope of an educational event, the subject of hydrogen and fuel cell technology is discussed together with students from various disciplines.

More information can be found at ➤ www.iphe.net

IEA Hydrogen Implementing Agreement

NOW is a member of the Executive Committee of the International Energy Agency Hydrogen Implementing Agreement (IEA HIA) and co-designs the content orientation of the IEA HIA. The IEA HIA brings scientists together from all over the world who discuss joint research projects on current hydrogen and fuel cell topics. The platform offers a good basis for acquiring an overview of current global research activities as well as establishing and maintaining valuable connections to the IEA and other countries.

An overview of the current task package ("Tasks") can be found under the following link:

➤ <http://ieahia.org>



SAUBERE LÖSUNG: EMISSIONSFREI FAHREN MIT WASSERSTOFF.



Drei Minuten tanken, bis zu 600 Kilometer fahren und null CO₂ ausstoßen – das ist möglich mit Wasserstoff, hergestellt aus erneuerbaren Energien. In der Brennstoffzelle wird der Wasserstoff in Strom umgewandelt, der den Elektromotor antreibt. Diese innovative Technologie unterstützt den Ausbau einer nachhaltigen Energieversorgung in Deutschland und macht unser Land fit für die Zukunft. Mehr Informationen unter energie-für-immer.de



**WASSERSTOFF +
BRENNSTOFFZELLE**
Energie für immer

ENERGY FOREVER: THE HYDROGEN FUEL CELL GERMANY INITIATIVE RETURNS WITH ONLINE CAMPAIGN

The “Hydrogen Fuel Cell Germany” initiative (Initiative Wasserstoff Brennstoffzelle Deutschland) went into the next round in 2017 with an online media campaign. The goal remains to promote the nationwide introduction of environmentally friendly hydrogen and fuel cell technologies – from hydrogen-powered cars and the expansion of hydrogen refuelling stations to the establishment of fuel cell devices for the supply of power and heat to buildings.



A total of more than 22.4 million user views and around 180,000 clicks on the ads could be generated by the campaign.

Besides a precisely targeted placement in the media and extensive partner communication with new imagery, the revamped central website ➔ **www.energie-für-immer.de** is an essential part of the online campaign, now containing new content. The breadth of information has been significantly expanded, especially in order to highlight the prospects for intelligent networking in the areas of power, heat and transportation.

THE KEY MESSAGE: SYNERGY EFFECTS MAKE HYDROGEN A VALUABLE SOURCE OF ENERGY FOR AN ENERGY-EFFICIENT OVERALL SYSTEM. DIFFERENT APPLICATIONS OF HYDROGEN TECHNOLOGY IN THE FIELDS OF MOBILITY AND TRANSPORT, IN INDUSTRY AND BUSINESS AS WELL AS IN PRIVATE HOMES ARE HIGHLIGHTED THROUGH THE PROVISION OF GENERAL INFORMATION AND KEY FACTS.

In addition to numerous other updates and additions on the website, a selection of best-practice applications is now also included, underscoring the everyday suitability of hydrogen and fuel cell technology.

Partners from politics, business and science joined forces in 2015 to form the "Hydrogen Fuel Cell Germany" initiative. Their common goal: to help hydrogen and fuel cell technology achieve its breakthrough in Germany, thus paving the way for sustainable mobility and environmentally friendly energy storage without fossil-based sources of energy.



WORLD CLIMATE CONFERENCE: “MULTITALENT HYDROGEN” CAMPAIGN PUTS HYDROGEN IN THE SPOTLIGHT

Under the MULTITALENT HYDROGEN umbrella brand, NOW GmbH, EnergieAgentur.NRW, the European industry association Hydrogen Europe and the European private-public partnership Fuel Cells and Hydrogen Joint Undertaking (FCH JU) launched an information campaign on hydrogen and fuel cell technology in October 2017. The campaign accompanied the 23rd UN Climate Change Conference (COP 23), which took place in Bonn, 6–17 November 2017.

In cooperation with the Association of German Transport Companies (VDV – Verband Deutscher Verkehrsunternehmen), NOW GmbH organised a shuttle service with fuel cell and battery buses during the climate conference. The conference delegates were able to use the so-called “CleanShuttle” buses for transfers between the various venues.

Three emission-free shuttle connections were provided, two inner-city lines connecting the conference venues as well as one line providing the connection to Cologne-Bonn Airport.

In addition, a fourth shuttle line featuring hydrogen buses between “Deutsches Museum” and “Bad Godesberg” was also in operation. In total, more than 25 battery and fuel cell buses were in service. Besides public utilities company Stadtwerke Bonn, the local transport companies from Bochum, Cologne, Munich, Düsseldorf and Stuttgart participated in the “CleanShuttle” project with vehicles and drivers. Moreover, companies from Bremen, Lübeck and Luxembourg provided additional vehicles. During the two-week duration of the World Climate Conference, the shuttle buses covered a total distance of 20,000 kilometres. The 14 drivers that were rostered to work each day put in a total of around 3,000 hours at the wheel. Fuel cell cars from Honda, Hyundai and Toyota as well as battery-electric cars from BMW were also used for VIP services. The automobile manufacturers are members of the European hydrogen and fuel cell association Hydrogen Europe. Via its member partners, the public-private Clean Energy Partnership provided the hydrogen supply and refuelling infrastructure for the shuttle services.



Nina Eichinger hands over the special NOW "Jugend forscht" (youth research) "Hydrogen, Fuel Cell and Battery-electric Drive" Award to Sebastian Durchholz, Tom Hinzmann and Tony Oehm for their project "Ecocaps: Development of ecologically sustainable supercapacitors from biological waste products, used in recuperation systems to increase efficiency" (Ökocaps: Entwicklung ökologisch-nachhaltiger Superkondensatoren aus biologischen Abfallprodukten, effizienzsteigernd angewandt in Rekuperationssystemen).

Providing a fitting setting for this was the opening of the "Hydrogen – the unlimited source of energy" exhibition at Deutsches Museum, Bonn.

In addition, the association HyCologne e. V., together with the participation of NOW GmbH, presented the special "Hydrogen – the unlimited source of energy" exhibition at the Deutsches Museum in Bonn from 7 November to 3 December. It was aimed both at the participants of the climate conference as well as at the general public. On behalf of the state of North Rhine-Westphalia, EnergieAgentur.NRW presented an excursion programme to international media representatives throughout the entire conference and also hosted the NRW Climate Lounge, which besides the various hydrogen and fuel cell activities also presented numerous climate protection and sustainability projects being undertaken throughout the state.

As the central element of the campaign, the www.multitalent-h2.com website pools information and also provides details on events and activities dealing with the climate-friendly possibilities of hydrogen and fuel cell technologies in the various application areas of energy supply.

OVERVIEW OF EVENTS NOW



DATE	TITLE/TOPIC	PLACE
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January 2017

18 January 2017	Opening of the H ₂ refuelling station in Kamen	Kamen
23 – 24 January 2017	<i>Fuels of the Future</i> – 14 th international conference on renewable energy	Berlin
26 January 2017	Opening of the H ₂ refuelling station in Limburg	Limburg

February 2017

21 – 22 February 2017	4th “Elektromobilität vor Ort” conference of the Federal Ministry of Transport and Digital Infrastructure on local electric mobility	Munich
21 – 22 February 2017	6 th Workshop “Accreditation – Certification – Standards” with the focus on “Components, Fuel Cells and Hydrogen Infrastructure – Experiences and Demands”	Oldenburg

March 2017

01 – 03 March 2017	13 th International Hydrogen and Fuel Cell Expo (FC Expo 2017)	Tokyo
09 March 2017	Parliamentary evening on the subject of electric mobility	Berlin
15 March 2017	CPN general assembly and user workshop	Berlin
16 – 17 March 2017	Roadshow (New Energy Fair)	Husum
22 March 2017	Parliamentary breakfast on the subject of the HyTrustPlus project in Steinfurt	Berlin
22 March 2017	Workshop “Evaluation municipal electric mobility concepts” for the <i>Networked Mobility</i> subject area	Stuttgart
30 March 2017	Parliamentary evening on the subject of hydrogen and fuel cell technologies	Berlin
30 March 2017	Workshop “Electric mobility in urban logistics – perspectives and challenges” in the <i>Framework Conditions and Market</i> subject area	Cologne



Birgitta Worringen, Head of Subdivision G 2 Sustainable Mobility, Energy, Logistics at BMVI, at the 4th “Elektromobilität vor Ort” conference in Munich

DATE	TITLE/TOPIC	PLACE
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April 2017		
01 – 02 April 2017	Roadshow (element-e Energy Fair)	Hirschaid
06 April 2017	22 nd Strategy Group Electric Mobility	Berlin



DATE	TITLE/TOPIC	PLACE
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May 2017		
04 May 2017	Subject area network meeting for accompanying research in the subject area of <i>Networked Mobility</i> with a focus on sectoral coupling	Berlin
04 May 2017	New mobility – strategies for municipalities and public fleets	Leipzig
06 – 07 May 2017	Roadshow (Herforder Automeile)	Herford
09 – 10 May 2017	7 th eMobility Summit of the Tagesspiegel	Berlin
12 May 2017	GreenTec Awards	Berlin
16 May 2017	Taking the energy transition to the streets	Berlin
17 May 2017	Parliamentary breakfast on the subject of integrated energy concepts	Berlin
17 – 19 May 2017	5 th International Workshop on Hydrogen Infrastructure and Transportation	Berlin
19 May 2017	Opening of the multi-energy refuelling station in Rostock	Rostock
23 May 2017	Opening of the H ₂ refuelling station in Mülheim an der Ruhr	Mülheim an der Ruhr
29 May 2017	MFS Annual Conference	Berlin

June 2017		
01 June 2017	Steering Committee meeting of the Sino-German Innovation and Cooperation Forum	Berlin
07 June 2017	Efficient and emission-free – development of hydrogen and fuel cell applications in Lower Saxony	Salzgitter
14 June 2017	Electric Delivery Transportation User Day 2017	Essen
14 June 2017	Opening of H ₂ refuelling stations in Frankfurt and Wiesbaden	Frankfurt
17 June 2017	Roadshow (Birkenfest)	Birkenwerder
20 June 2017	Subject area network meeting for the accompanying research subjects <i>Networked Mobility</i> and <i>Framework Conditions and Market</i>	Berlin
22 June 2017	Concluding event of the NoLimits project	Bremen
22 June 2017	Workshop “Electric mobility in urban logistics – perspectives and challenges” in the <i>Framework Conditions and Market subject area</i>	Berlin
23 June 2017	Concluding event of the Wirtschaft am Strom and ePowered Fleets projects	Hamburg



Efficient and emission-free – the event for the development of hydrogen and fuel cell applications in Lower Saxony is accompanied by Enak Ferlemann (centre), Parliamentary State Secretary at the BMVI

DATE	TITLE/TOPIC	PLACE
23 June 2017	Network event and press talk "Electric mobility – practice meets politics"	Hamburg
24 June 2017	Roadshow (e/motion Expo)	Oranienburg
24 June 2017	Long night of the science – Ride and Drive with H ₂ vehicles	Berlin
29 June 2017	Ceremonial handover of a non-binding offer to the AutoStack-Industrie project	Berlin



DATE	TITLE/TOPIC	PLACE
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July 2017

04 July 2017	State meeting on the subject of recharging infrastructure	Berlin
06 July 2017	23 rd Strategy Group Electric Mobility	Berlin
08 July 2017	Roadshow (Lichtenfelser Sonnentage)	Lichtenfels
12 July 2017	Alternative drive in local public transport	Hürth
18 July 2017	Hydrogen technology in Mecklenburg-Western Pomerania	Rostock
31 July 2017	Opening of H ₂ refuelling stations in Sindelfingen and Pforzheim	Sindelfingen

August 2017

10 August 2017	Roadshow (E-Mobility Day)	Hodenhagen
23 August 2017	Parliamentary evening on the subject of hydrogen and fuel cell technology	Erfurt
26 – 27 August 2017	Open Day of the federal government	Berlin



Handover of the Electric Mobility Starter Set at the Roadshow in Hodenhagen

DATE	TITLE/TOPIC	PLACE
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September 2017		
02 September 2017	Roadshow (Rhineland-Palatinate action week „A state full of energy“)	Montabaur
04 September 2017	Roadshow (19 th Brandenburg Energy Day)	Cottbus
04 September 2017	1. HYPOS-Dialog on funding opportunities in hydrogen research	Leipzig
05 September 2017	Roadshow (kick-off conference on the subject of electric mobility)	Rheine
06 September 2017	Opening of the H ₂ refuelling station in Karlsruhe	Karlsruhe
06 September 2017	Mobility and transport – sharing, autonomous driving and fuels (young+restless at Base.camp Berlin)	Berlin
07 September 2017	Rhine-Ruhr Hydrogen Workshop 2.0: Battery + Fuel Cell. Game over, petrol and diesel?	Duisburg
08 September 2017	Press event for the kick-off of CleverShuttle – handover of 20 funded Toyota Mirai cars	Hamburg
08 September 2017	Subect area network meeting for the accompanying research subjects <i>Networked Mobility and Framework Conditions</i> and <i>Market</i> Subect area network meeting for the accompanying research subjects <i>Networked Mobility and Framework Conditions and Market</i>	Berlin
10 September 2017	Roadshow (Climate day of action and eMobility parcour)	Rostock
11 – 13 September 2017	ICHS 2017 (International Conference on Hydrogen Safety)	Hamburg
14 September 2017	Meeting of the NOW Advisory Board	Berlin
15 September 2017	Roadshow (Ludwigshafen Climate Weeks 2017)	Ludwigshafen
17 September 2017	Roadshow (Kiel makes the switch)	Kiel
19 September 2017	How with people and goods move in the future? Innovation at Deutsche Bahn in the areas of logistics, mobility and energy	Essen
19 September 2017	Seminar with Osaka Pref. government, METI (Ministry of Economy, Trade and Industry) Kansai and NOW	Osaka, Japan
20 September 2017	4 th Hydrogen and Fuel Cell Technology Supplier MarketplaceRoadshow	Berlin
23 September 2017	Roadshow (city event as part of the eRUDA stop)	Garmisch-Patenkirchen
27 September 2017	User Workshop Deployment of hydrogen and fuel cells in intralogistics – status quo and perspectives	Stuttgart
29 September – 01 October 2017	Roadshow (Ingobertus Fair)	St. Ingbert



Norbert Barthle, Parliamentary State Secretary at the BMVI, hands over the funding approval: German industry is preparing series production of fuel cells.





DATE	TITLE/TOPIC	PLACE
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October 2017		
01–03 October 2017	STS Forum 2017	Kyoto
08 October 2017	Roadshow (Electric mobility market)	Rasdorf/Rhön
08 October 2017	Roadshow (AtEM – Electric mobility day of action)	Stuttgart
09–11 October 2017	30th International Electric Vehicle Symposium (EVS)	Stuttgart
14 October 2017	Roadshow (DrivingDay)	Bottrop
16 October 2017	Opening of the H ₂ refuelling station in Bad Rappenau	Bad Rappenau
16 October 2017	Opening of the H ₂ refuelling station in Bremen	Bremen
17 October 2017	Opening of the H ₂ refuelling station at Cologne/Bonn Airport	Flughafen Köln/Bonn
18 October 2017	NOW Workshop Urban Commercial Transport	Berlin
18 October 2017	Opening of the H ₂ refuelling station at Kreillerstrasse in Munich	Munich
24 October 2017	16 th Fuel Cell Forum Hesse – Power and Heat from Residential Dwellings to Industrial Operations	Frankfurt am Main
26 October 2017	Roadshow (Open Day – Display Home)	Emden

November 2017		
06 November 2017	Opening of the “Hydrogen – the unlimited source of energy” exhibition at the Deutsches Museum Bonn & award ceremony for the national NOW winner of the Jugend forscht Awards	Bonn
09 November 2017	Contract signing for the purchase of 14 Coradia iLint from Alstom by the state of Lower Saxony	Wolfsburg
06–17 November 2017	World Climate Conference (COP 23) – Zero emission shuttle with battery and fuel cell buses	Bonn
08 November 2017	Parliamentary lunch at the State Parliament of Baden Württemberg on the subject of hydrogen and fuel cell technologies	Stuttgart
09 November 2017	Meeting of the AG Hydrogen, Fuel Cell and Electric Mobility working group at airports	Cologne
08–09 November 2017	REIF Fukushima Seminar 2017	Fukushima, Japan



Norbert Barthle, Parliamentary State Secretary at the BMVI, opens the closing event of the eMERGE2 project.



Official opening of the H₂ refuelling station in Frankfurt am Main, with Norbert Barthle, Parliamentary State Secretary at the BMVI

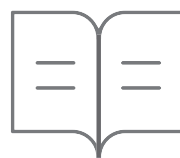
DATE	TITLE/TOPIC	PLACE
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10 November 2017	Concluding event of the eMERGE2 project	Berlin
11 November 2017	Roadshow (Day of climate action in front of the Pomeranian State Museum)	Greifswald
14 November 2017	Roadshow (Chemnitz Chambers of Trade and Commerce day of electric mobility)	Chemnitz
20 – 22 November 2017	Hypermotion 2017	Frankfurt am Main
21 November 2017	Opening of the H ₂ refuelling station in Koblenz	Koblenz
23 November 2017	Workshop “Electric mobility from the perspective of distribution network operators” from the Networked Mobility subject area	Wuppertal
27 November 2017	Fireside chat on the subject of hydrogen	Berlin
28 November 2017	7 th Dialogue of the Associations – Hydrogen, Fuel Cell and Battery Technology	Berlin
29 – 30 November 2017	Roadshow (Netzwerk21 Kongress and Climate Protection Days in Göttingen)	Göttingen

December 2017

06 December 2017	24 th Strategy Group Electric Mobility	Berlin
08 December 2017	Workshop “Electrification of fleets” of the accompanying research Networked Mobility	Erfurt
09 December 2017	Meeting of the AG Bus working group	Berlin
13 December 2017	7 th European Fuel Cell Technology & Applications (EFC17)	Naples, Italy

NOW PUBLICATIONS OF 2017



In 2017, the National Organisation Hydrogen and Fuel Cell Technology, published numerous new publications and updated existing ones, either alone or in cooperation with partners.

These include annual and results reports, studies, funding programme-specific information brochures, guidelines and manuals for the four programme areas National Innovation Programme Hydrogen and Fuel Cell Technology (NIP), Charging Infrastructure (LIS), Local Electric Mobility (Elektromobilität vor Ort) and Mobility and Fuels Strategy. (MKS).

The publications are available in German and often also in English, and can be downloaded from the website at:

➤ www.now-gmbh.de/en/service/publications

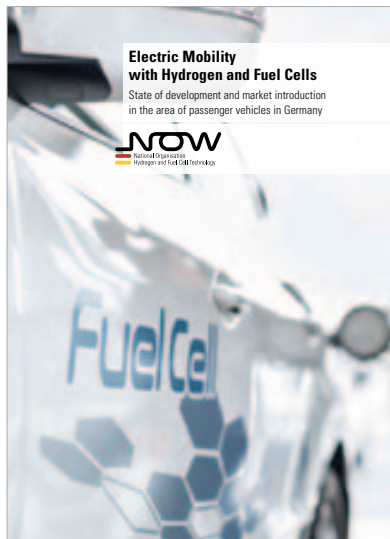


Elektromobilität – Mobil mit
Batterie und Brennstoffzelle /
Mini brochure

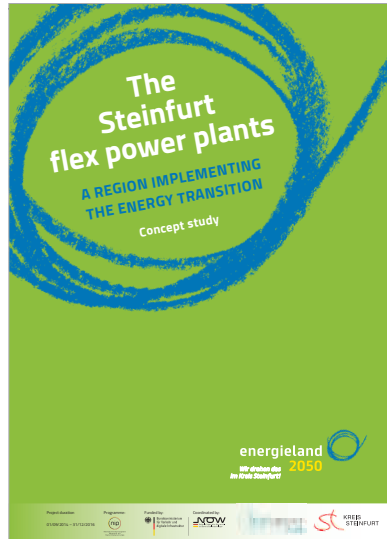
Begleitforschung Rahmen-
bedingungen und Markt /
Flyer

Begleitforschung Vernetzte
Mobilität / Flyer

E-Mail-Service zu Förder-
aufrufen/NOW-Anzeiger /
Flyer



Electric Mobility with Hydrogen and Fuel Cells – State of development and market introduction in the area of passenger vehicles in Germany / Brochure



The Steinfurt flex power plants / Brochure



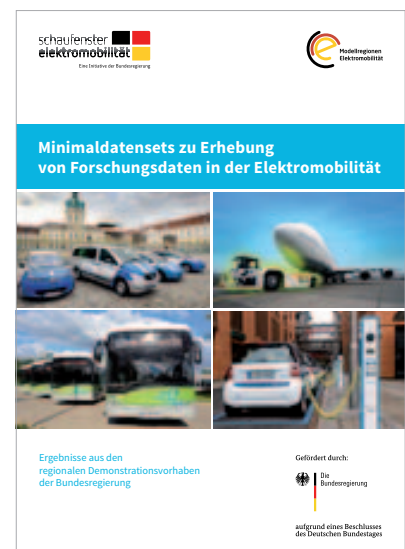
Prozessleitfaden zur rechtssicheren Errichtung und Organisation von AC-/DC-Infrastruktur / Guideline



Annual Report 2016 / Annual Report

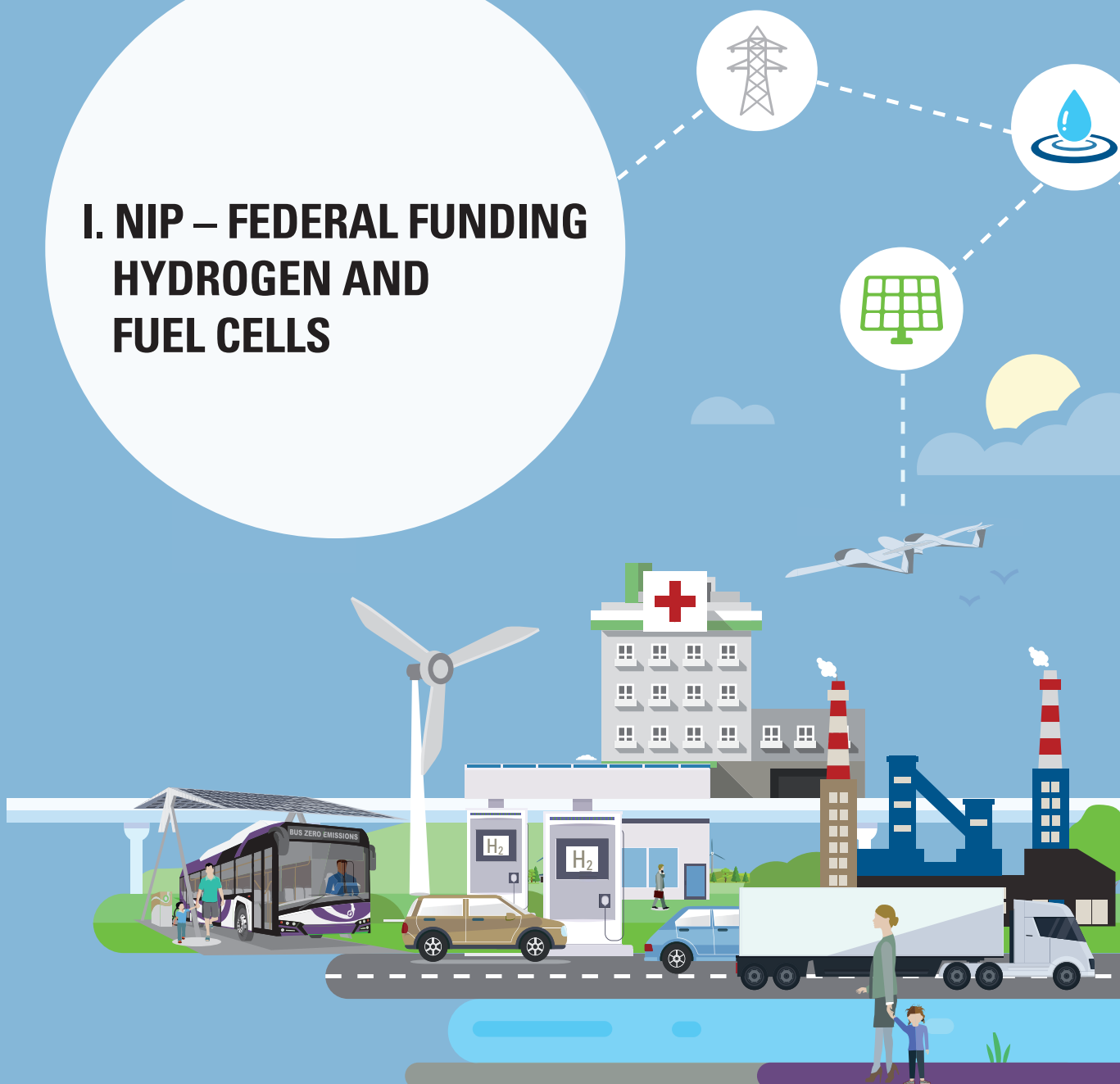


NOW „10 years NIP“ / Magazine



Minimaldatensets zur Erhebung von Forschungsdaten in der Elektromobilität / Brochure

I. NIP – FEDERAL FUNDING HYDROGEN AND FUEL CELLS



THE PROJECTS ON THE FOLLOWING PAGES ARE LABELLED WITH I/01 – I/21.



NEWLY APPROVED PROJECTS



COMPLETED PROJECTS



INTERDISCIPLINARY THEMES



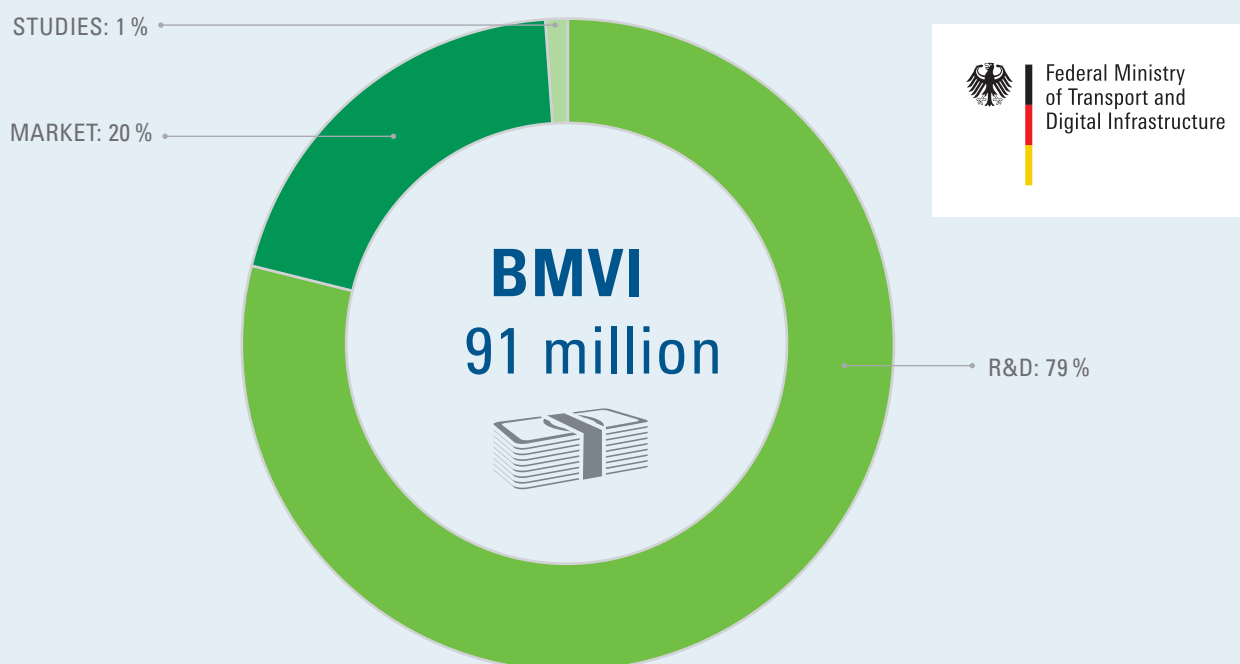
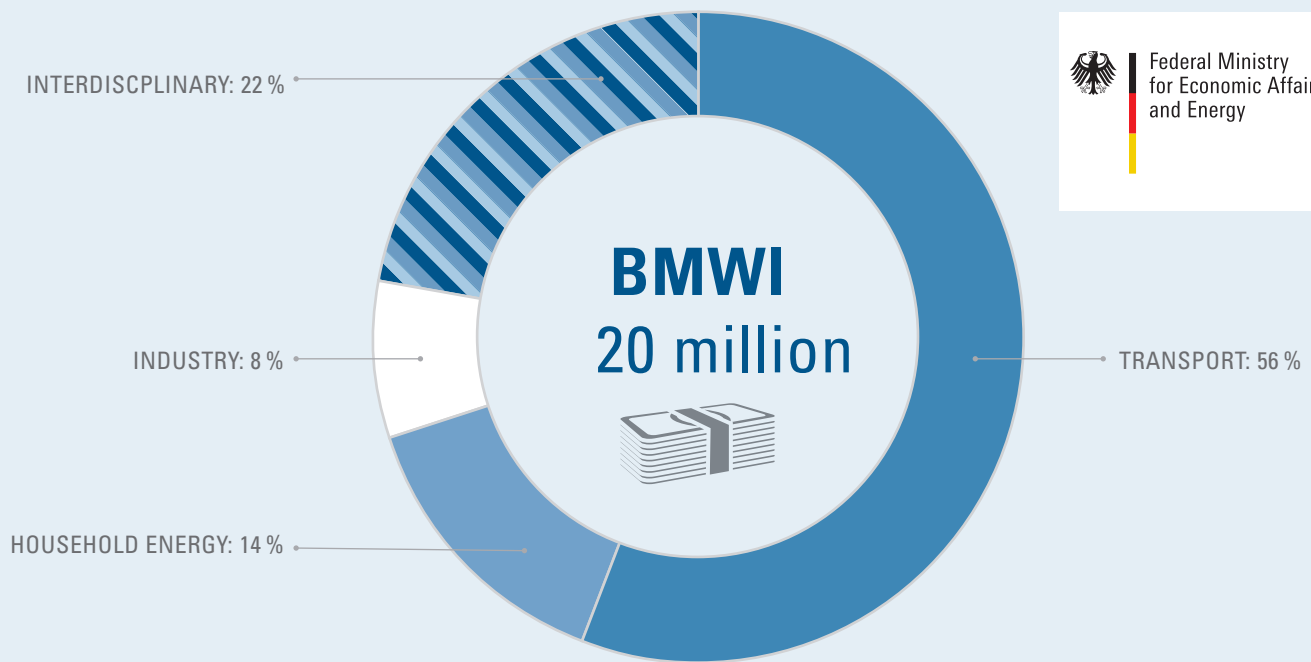
NIP



To accelerate the market maturity of hydrogen and fuel cell technologies in different application areas, in 2006 the federal government, states, industry and science initiated the ten-year National Innovation Programme Hydrogen and Fuel Cell Technology (NIP), with a funding budget of 1.4 billion euros. In September 2016 the federal cabinet adopted the hydrogen and fuel cell technology governmental programme for the period of 2016 to 2026, thus signalling the start of the second phase (NIP II) of the successful NIP. The continuation of the interdepartmental programme ensures continuity for research and development and supports market activation through corresponding product developments.

The Federal Ministry of Transport and Digital Infrastructure (BMVI) is initially spending 250 million euros for the implementation of the programme in the second phase to support hydrogen and fuel cell technology up to 2019. The Federal Ministry for Economic Affairs and Energy (BMWi) is continuing its funding for hydrogen and fuel cell technology in the area of applied research and development within the framework of the 6th Energy Research Programme with around 25 million euros annually. In addition, in August 2016 the BMWi rolled out a funding programme for private customers for the purchase of fuel cell heating appliances under the National Action Plan on Energy Efficiency (NAPE). The federal ministries for the Environment, Nature Conservation and Nuclear Safety (BMU) as well as Education and Research (BMBF) are actively involved in the strategic design of NIP through the structures of NOW GmbH, as was already the case in the first NIP phase.

NIP 2 FUNDING* OVERVIEW



* approved

Source: PtJ 2017 year-end lists



Federal Ministry
for Economic Affairs
and Energy

THE FOLLOWING PROJECTS IN THE BMWI NIP FUNDING PRIORITY WERE APPROVED IN 2017

PROJECT NAME	COMMENCEMENT	CONCLUSION	FUNDING AMOUNT [€]	PARTNER
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SOFC5-60	01.04.2017	31.03.2020	235,997	AVL Schrick GmbH
HIKAB	01.04.2017	31.03.2020	542,672	Centrum for Applied Nanotechnology (CAN) GmbH
HIS	01.05.2017	30.04.2020	1,072,349	ElringKlinger AG
HIKAB	01.04.2017	31.03.2020	411,103	Forschungszentrum Jülich GmbH
HIS	01.05.2017	30.04.2020	750,385	Forschungszentrum Jülich GmbH
HIFI-PEFC	01.11.2017	31.10.2020	831,595	Forschungszentrum Jülich GmbH
SOFC5-60	01.04.2017	31.03.2020	2,408,128	Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e. V.
HIKS	01.08.2017	31.07.2020	606,452	Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e. V.
HIKS	01.08.2017	31.07.2020	436,659	FUMATECH BWT GmbH
innoKA	01.04.2017	31.03.2020	230,638	Greenerity GmbH
HIS	01.05.2017	30.04.2020	258,297	ISATEC GmbH
HIKS	01.08.2017	31.07.2020	1,698,186	MAHLE Filtersysteme GmbH
HIS	01.05.2017	30.04.2020	179,331	new enerday GmbH
H ₂ Hybridtank	01.07.2017	30.06.2021	1,226,110	Helmholtz-Zentrum Geesthacht Centre for Materials and Coastal Research GmbH
HIKAB	01.04.2017	31.03.2020	82,427	SFC Energy AG
H ₂ Hybridtank	01.07.2017	30.06.2021	547,280	Stühff GmbH
VALIDATE	01.09.2017	31.08.2020	453,287	SGS INSTITUT FRESENIUS GmbH
HIFI-PEFC	01.11.2017	30.10.2020	590,223	Sondervermögen Großforschung beim Karlsruher Institut für Technologie (KIT)
innoKA	01.04.2017	31.03.2020	169,640	Technical University of Berlin
innoKA	01.04.2017	31.03.2020	1,404,065	Technical University of Munich
HIKAB	01.04.2017	31.03.2020	151,094	University of Hamburg
HIKS	01.08.2017	31.07.2020	311,146	University of Regensburg
HIKS	01.08.2017	31.07.2020	224,550	University of Stuttgart
SOFC5-60	01.04.2017	31.03.2020	191,661	Viessmann Werke GmbH & Co KG
VALIDATE	01.09.2017	31.08.2020	339,874	VOLKSWAGEN AKTIENGESELLSCHAFT
VALIDATE	01.09.2017	31.08.2020	763,029	The Hydrogen and Fuel Cell Center ZBT GmbH

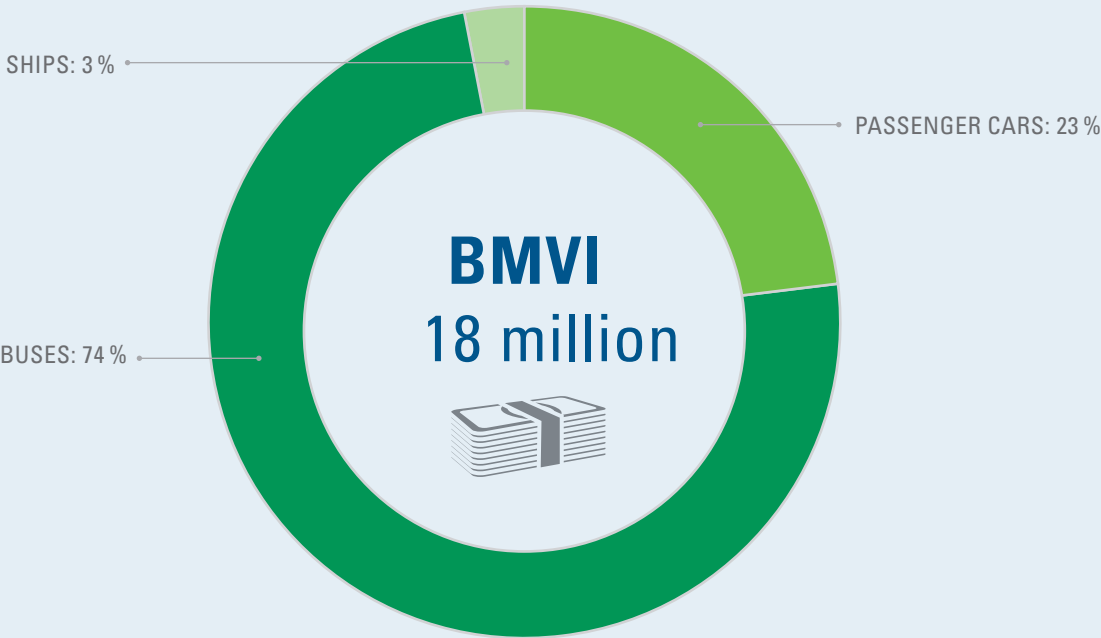


With NIP funding, the H₂ refueling station network in Germany grew by an additional 25 locations in 2017.

DISTRIBUTION OF BMVI FUNDS* MARKET ACTIVATION



Federal Ministry
of Transport and
Digital Infrastructure



16 applications

- 8 applications passenger cars
- 6 applications buses
- 1 application ships

15 different partners

FUNDING AMOUNT/€:	
Passenger cars:	4,043,459
Buses:	13,142,414
Ships:	511,679
Total	17,697,552

* approved

Source: PtJ 2017 year-end lists

IN 2017, THE FOLLOWING PROCUREMENT PROJECTS WERE APPROVED IN THE BMVI NIP FUNDING PRIORITY

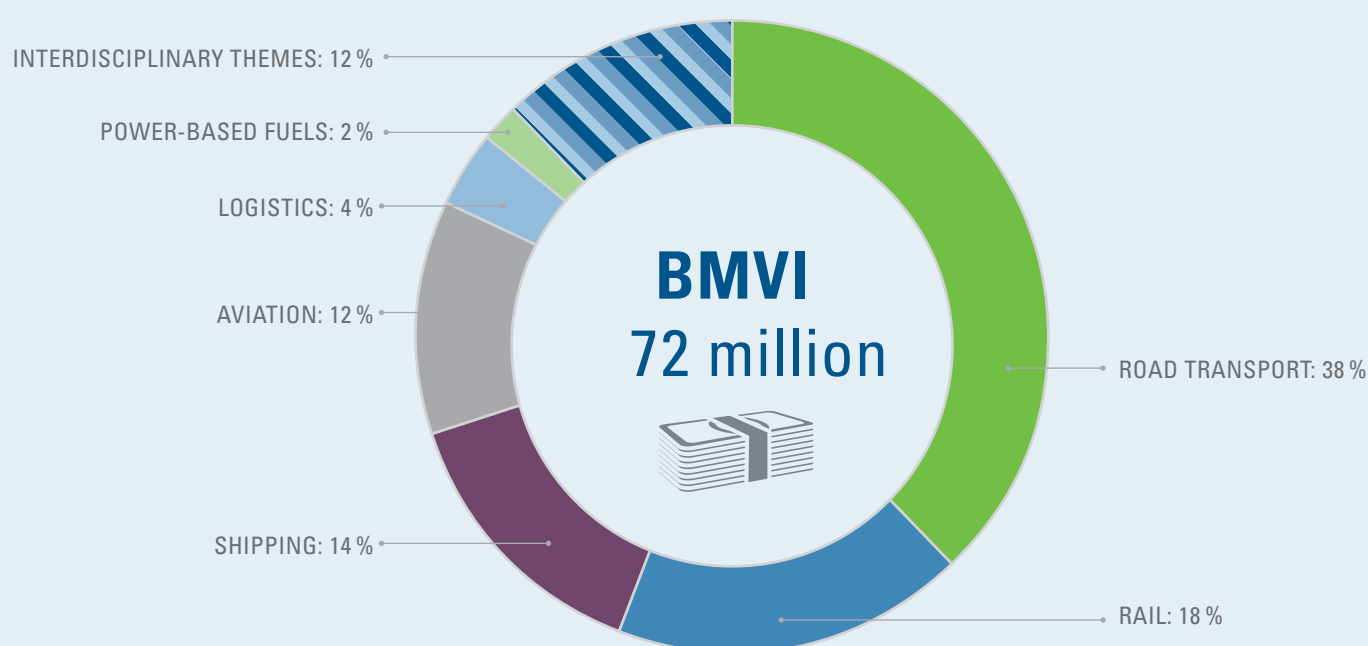


PROJECT NAME	COMMENCEMENT	CONCLUSION	FUNDING AMOUNT [€]	PARTNER
ZeroE	01.05.2017	31.12.2018	780,807	Toyota Leasing GmbH
hyFES_FCEV	01.01.2018	30.09.2019	47,781	FES GmbH Fahrzeug-Entwicklung Sachsen
ZeroE 2	01.09.2017	31.12.2018	1,735,126	Toyota Leasing GmbH
ZeroE 2	01.01.2019	30.09.2019	694,050	Toyota Leasing GmbH
H ₂ Fahrzeug	01.09.2017	31.12.2018	49,046	GFW –Gesellschaft für Windenergieanlagen Jürgen Fuhrländer GmbH & Co. KG
Flotten- tauglichkeit	01.10.2017	31.12.2018	433,781	Alphabet Fuhrparkmanagement GmbH
Flotten- tauglichkeit	01.01.2019	30.09.2019	86,756	Alphabet Fuhrparkmanagement GmbH
AMKFCEV	01.11.2017	31.12.2018	34,702	AMK Holding GmbH & Co. KG
AMKFCEV	01.01.2019	31.08.2019	17,352	AMK Holding GmbH & Co. KG
NMKFS	01.10.2017	31.12.2018	97,764	Kazenmaier Fleetservice GmbH
ux35FuelCell	01.11.2017	31.12.2018	39,237	Hyundai Capital Bank Europe GmbH
H ₂ -W_mobil	01.06.2017	31.12.2018	420,584	WSW mobil GmbH
H ₂ -W_mobil	01.01.2019	30.09.2019	1,410,336	WSW mobil GmbH
H ₂ -W_AWG	01.09.2017	31.12.2018	895,985	AWG Abfallwirtschaftsgesellschaft mbH Wuppertal
H ₂ -W_AWG	01.01.2019	30.09.2019	482,329	AWG Abfallwirtschaftsgesellschaft mbH Wuppertal
BIC_H2	01.09.2017	31.12.2018	4,536,988	Regionalverkehr Köln Gesellschaft mit beschränkter Haftung (RVK)
BIC_H3	01.01.2019	30.09.2019	2,893,312	Regionalverkehr Köln Gesellschaft mit beschränkter Haftung (RVK)
H ₂ BusESWE	01.09.2017	31.12.2018	22,800	ESWE Verkehrsgesellschaft mbH
H ₂ BusESWE	01.01.2019	30.09.2019	912,652	ESWE Verkehrsgesellschaft mbH
H ₂ BusMVG	01.09.2017	31.12.2018	508,776	In-der-City-Bus GmbH
H ₂ BusMVG	01.01.2019	30.09.2019	50,000	In-der-City-Bus GmbH
H ₂ BusMVG	01.09.2017	31.12.2018	96,000	Mainzer Verkehrsgesellschaft mbH
H ₂ BusMVG	01.01.2019	30.09.2019	912,652	Mainzer Verkehrsgesellschaft mbH
WBD_H ₂ _NFZ	01.09.2017	31.12.2018	27,057	Wirtschaftsbetriebe Duisburg – Anstalt des öffentlichen Rechts
MARIE	01.12.2017	31.12.2018	480,000	ATG Alster-Touristik GmbH
MARIE	01.01.2019	30.09.2019	31,679	ATG Alster-Touristik GmbH



Fuel cell cars are filled up at the fuel pump within just a few minutes.

DISTRIBUTION OF BMVI FUNDS* RESEARCH & DEVELOPMENT



76 applications

- 7 individual projects
- 14 joint projects (69 applications)

59 different partners

APPLICATION SECTOR/FUNDING AMOUNT/€:

Road transport	27,522,816
Rail	12,822,592
Shipping	10,252,720
Aviation	8,467,544
Logistics	2,563,320
Power-based fuels	1,668,700
Interdisciplinary themes	8,283,037
Studies	160,402
Total	71,741,131

EVALUATION OF THE NATIONAL INNOVATION PROGRAMME HYDROGEN AND FUEL CELL TECHNOLOGY PHASE I (2006 TO 2016)



In February to November 2017, the first NIP phase of 2006-2016 was evaluated on behalf of the BMVI and the BMWi. The areas focused on by the project were: the evaluation of the funding plan (what was funded and thus achieved?); the programme's implementation (how were projects funded?); and the context (where does Germany stand in hydrogen and fuel cell technology?). For the purposes of the evaluation, funding data as well as technical and financial target monitoring from project administrator Projektträger Jülich (PtJ) were consulted, a specially developed online survey of funding recipients was carried out, and detailed interviews with project leaders from selected projects along with programme managers, international partners of the NIP as well as from industry and research were conducted. In addition, publicly available data on industry and market development in 12 countries were evaluated, too.

The evaluation of the funding projects showed that the NIP made a significant and measurable contribution to achieving the goals set in 2006. After ten years of NIP funding, the German hydrogen and fuel cell industry is on the threshold of moving from the laboratory to market entry.

PARTNER:
McKinsey & Company, Inc.

COMMENCEMENT:
1 February 2017

CONCLUSION:
30 September 2017

Germany is one of the five global technology leaders for both stationary and mobile applications. In particular, the efficiency of fuel cell types and applications are now reaching levels that experts and funding recipients believe are sufficient for commercialisation. However, despite the significant progress made, the service life and cost of many fuel cell types are still seen as an obstacle to market activation.

Hydrogen and fuel cell technology has not yet established itself on the market. The first marketable products were developed in the area of stationary home energy applications. Despite extensive R&D funding, the development of mobile applications in Germany is still subdued. The success of the NIP, however, is the development of hydrogen refuelling station infrastructure, which is being driven forward by the H₂ Mobility joint venture promoted by NIP I.

While value chains have developed over the past ten years, they are still relatively small. Nevertheless, Germany, together with Japan and the USA, is one of the three countries with the largest supplier and manufacturing landscapes. Prognoses have shown that around 1,500 jobs were secured through NIP projects and almost 800 more were created.

The results of the evaluation were used to develop recommendations for the second phase of the NIP with regard to orientation and implementation. In addition to the continuation of R&D funding, market activation and the cross-application approach, NIP II should set specific strategic priorities with clear objectives. SMEs and suppliers should be tied in more closely in NIP II and research institutions should also be involved more in pre-normative research projects, technology benchmarks and market activation studies in addition to programme research. Moreover, an extension of the range of funding instruments and activities should be taken into consideration within the framework of the possibilities available under funding law. In addition to investment subsidies and the promotion of infrastructure, this could also include the assumption of guarantees, the provision of loans and the activation of public procurement. In order to improve the regulatory framework, a stronger coordination of the stakeholders should also be made possible with NIP II.

In the implementation of the programme, the use of funds should be managed more strongly on the basis of clearly defined programme objectives and measurable indicators. Approval, reporting and evaluation processes should be carried out and accelerated in a more structured manner. In addition, NIP II should communicate the successes of the programme and the exchange of knowledge more aggressively in order to further promote public acceptance of the technology.

The results of the evaluation were discussed with BMWi, BMVI, PtJ and NOW and presented to the NOW Advisory Board. The summary and the approaches for further development were accepted.



Fuel cell hybrid bus in
scheduled operations
by RVK in Cologne



NIP – TRANSPORT AND INFRASTRUCTURE

Measures in the area of transport and infrastructure of NIP aim to establish hydrogen and fuel cell mobility as competitive in the market over the next ten year period. This includes on-board technologies and systems as well as the necessary fuel infrastructure.

The measures concerned are application-oriented for road, rail, water and air. For each area, research and development projects as well as market activation projects will be carried out. In implementing these individual measures it is crucial to ensure cross-linking of stakeholders beyond the industry sectors, e.g. within the framework of innovation clusters, so that overarching themes can still be jointly worked on as well, flanked by independent scientific accompanying research.

In accordance with the industrial policy character of NIP, the value-added chain in Germany and Europe in the technology field of hydrogen and fuel cells must be built up and strengthened for each individual measure. This requires an internationally competitive supply industry, particularly for key components such as fuel cell stacks or electrolysis.



COLOGNE PROCURES LARGEST FUEL CELL HYBRID BUS FLEET IN GERMANY

Regionalverkehr Köln GmbH (RVK) is receiving 7.4 million euros in funding within the National Innovation Programme Hydrogen and Fuel Cell Technology (NIP) for the procurement of 30 fuel cell hybrid buses and two hydrogen refuelling stations (350 bar) through the Federal Ministry of Transport and Digital Infrastructure (BMVI). With the BIC¹ H₂ project, the innovative and environmentally-friendly technology is to be deployed in a large section of the company's operating area. BIC H₂ is part of the company's "Zero Emissions" project through which RVK is pursuing sustainable and emission-free local public transport. With the commissioning of the buses, the company has one of the largest emission-free bus fleets in Europe.

The procurement of 30 fuel cell hybrid buses shows that transport companies want to use the technology and view it as an everyday alternative to the diesel bus. The reasons for this are long ranges, short refuelling times and the flexibility of fuel cell hybrid buses. These features come very close to the advantages of conventional diesel technology, allowing local transport operators to offer their services at the usual standard and without productivity loss.



PARTNERS:

- a) Regionalverkehr Köln GmbH (RVK)*
- b) Linde Aktiengesellschaft
- c) AREVA GmbH
- d) Enrichment Technology Company Limited, Zweigniederlassung Deutschland
- e) Forschungszentrum Jülich GmbH

PROJECT BUDGET/€ / FUNDING BUDGET/€:

- a) 189,510/47,377
- b) 1,133,741/453,496
- c) 286,808/86,042
- d) 2,140,646/856,258
- e) 168,545/151,690

COMMENCEMENT:

1 May 2017

CONCLUSION:

30 September 2019

* Additional funds from the NIP Market Activation funding guideline

PROJECT BUDGET/€ / FUNDING BUDGET/€ OF THE PROCUREMENT:
18,575,750/7,430,300

¹ Buses, Infrastructure, Cologne Region

RVK's 30 fuel cell hybrid buses will be stationed at Hürth, Meckenheim and Wermelskirchen. There is a funding option for another 10 vehicles which should be launched in 2020 at the latest.

A hydrogen refuelling station at both the RVK site in Meckenheim (Rhine-Sieg district) and in Wermelskirchen (Rhine-Bergischer district) will be built to supply the buses in a research and development project. Together with a consortium comprising Linde, New NP, ETC and Forschungszentrum Jülich, the required H₂ refuelling stations will be constructed and evaluated at RVK premises in Meckenheim and Wermelskirchen. The deployment will demonstrate that the technology has reached a development stage that allows reliable operation of large fleets.

The RVK project is incorporated in the EU funding project: JIVE² (Joint Initiative for hydrogen Vehicles across Europe), in which 139 fuel cell hybrid buses were procured across Europe and a number of H₂ refuelling stations were commissioned. The use of the technology in local public transport generates a high level of visibility in broad sections of the population.

Aside from funding RVK fuel cell bus projects, there are currently over 50 other procurements of fuel cell buses in NIP being funded, including in Wuppertal, at Rheinbahn AG and in Mainz.

² See:

➤ www.fch.europa.eu/project/joint-initiative-hydrogen-vehicles-across-europe

I/01 ROBALD: STUDIES ON ROBUSTNESS OF AN ALTERNATIVE PRODUCTION PROCESS FOR HYDROGEN PRESSURE TANKS



The overarching goal of the ROBALD project is to enable the manufacture of effective and efficient pressure storage for hydrogen. In this way the project can make a major contribution to helping hydrogen technology achieve breakthrough in mobile applications.

The task of the project is to examine braiding technology in detail for the manufacture of pressure tanks with the objective of identifying the relationship between cause and disturbance variables on the one hand, and with the main qualitative characteristics on the other, and on this basis, define the process limits. In this way, a conclusion can be drawn about the robustness of the process.

Fundamental insights on process steps and the overall process will be obtained in experimental investigations. In terms of different methods, like for example statistical such as statistical experimental design, functional relationships can be deduced between the manufacturing parameters, process variables and product or semi-product characteristics. This systematic modelling of the alternative production process enables the prediction of component properties in terms of parameters from the production as well as the variables resulting from the process itself. On this basis a robust manufacturing process can be established, so that additional savings potential, e.g. the reduction of fibre quantities, can be exploited for future vehicles with fuel cell technology.

PARTNER:
REHAU AG + Co

PROJECT BUDGET/€:
3,188,498

FUNDING BUDGET/€:
1,431,636

COMMENCEMENT:
1 April 2017

CONCLUSION:
31 March 2019

» The task of the project is to examine braiding technology in detail for the manufacture of pressure tanks with the objective of identifying the relationship between cause and disturbance variables on the one hand, and with with the main qualitative characteristics on the other, and on this basis, define the process limits. «

» The transport sector is currently up to 90% reliant on fossil energy sources and thus a principle emission polluter. All the greater the potential then, when alternative technologies such as fuel cells are used in energy conversion. «

I/02 GEN5-FC: DEVELOPMENT OF 5TH GENERATION OF AUTOMOTIVE FUEL CELLS



In the context of increasing global mobility demands and climate change, sustainable mobility represents a critical field of activity. The transport sector is currently up to 90 % reliant on fossil energy sources and thus a principle emission polluter. All the greater the potential then, when alternative technologies such as fuel cells are used in energy conversion.

The project aims to realise this potential and pursues series production development of fuel cell technology in hybrid vehicles across all car and utility vehicle classes. This includes the creation of preconditions for standardised and sustainable function and system components. By integrating fuel cell technology in the hybrid drive train, different performance parameters and efficiencies can be tested and evaluated. Here different operating conditions are to be taken into consideration, including for example dynamics, performance, and fatigue strength of the entire vehicle. By surveying and analysing the relevant measurement data, important findings can be deduced and utilised for the design for future drive trains. Furthermore, the sixth generation of fuel cell technology will emerge on this basis.

PARTNER:
AUDI AG

PROJECT BUDGET/€:
15,013,515

FUNDING BUDGET/€
4,841,858

COMMENCEMENT:
1 March 2017

CONCLUSION:
31 August 2019

I/03 “AUTO-STACK INDUSTRY” – DEVELOPMENT AND PRODUCTION PREPARATION OF AN AUTOMOTIVE HIGH PERFORMANCE STACK



A joint initiative of the German automotive and supply industry, the project seeks to create the technical and technological conditions for the commercial launch of FC vehicles in Germany and Europe by around 2020. The goal of the project is to develop and share stack technology for automotive application based on manufacturing processes and techniques which are conducive to fulfilling the functional, quality and cost goals of the automotive industry for the industrial mass production of stacks and their components.

Common construction and quality guidelines for component and stacks form the basis for this, with the objective of optimising economies of scale in development and manufacturing as well as sharing main components. An important aspect is scaling stack power for different vehicles and vehicle platforms and other applications. The project takes a holistic approach, covering all relevant aspects of component and stack design as well as the process development necessary for mass production.

An accompanying research programme serves to enhance scientific understanding of fuel cell operation at high current density. Experimental and modelling work will be carried out for this purpose.

» The project takes a holistic approach, covering all relevant aspects of component and stack design as well as the process development necessary for mass production. «

PARTNERS:

- a) Zentrum für Sonnenenergie- und Wasserstoff-Forschung , Baden-Württemberg (ZSW)
- b) Bayerische Motoren Werke Aktiengesellschaft
- c) Daimler AG
- d) REINZ-Dichtungs-GmbH
- e) Ford-Werke GmbH
- f) Freudenberg Performance Materials SE & Co. KG
- g) Greenerity GmbH
- h) NuCellSys GmbH
- i) Powercell Sweden AB
- j) Umicore AG & Co. KG
- k) VW AG

PROJECT BUDGET/€/ FUNDING BUDGET/€:

- a) 5,465,309/5,465,309
- b) 3,769,837/1,507,935
- c) 443,901/177,560
- d) 3,530,273/1,588,623
- e) 978,021/ 391,208
- f) 2,296,218/1,148,109
- g) 2,556,123/1,278,061
- h) 4,273,561/1,709,424
- i) 5,235,931/3,141,559
- j) 2,603,622/1,301,811
- k) 2,096,226/838,490

COMMENCEMENT:

1 May 2017

CONCLUSION:

30 September 2019



A fuel cell bus runs on the company's internal bus line in the Höchst Industrial Park.

I/04 INVESTIGATION OF NON-TECHNICAL INFLUENCING FACTORS ON THE AVAILABILITY OF FUEL CELL BUSES – INCLUDING VALIDATION IN LINE OPERATION

In the framework of this project numerous non-technical influencing factors on the availability of FC buses are to be evaluated. There will be particular focus on optimisation possibilities of personnel deployment, interface management, spare parts logistics and infrastructure and their effect on the availability of FC buses. Overall the following will be shown in the project:

- Availability of buses can increase by over 85% via non-technical measures;
- Appropriate, targeted deployment of personnel leads to improved communication and coordination and thus to improved availability of vehicles;
- By means of intelligent spare parts and maintenance logistics, downtimes can be minimised;
- A corresponding adaptation of infrastructure (hydrogen hall, refuelling station, spare parts warehouse etc.) enables efficient operation;
- The suitability of fuel cell technology for equipping transport companies with FC buses beyond 2018.

When the desired increase in availability is achieved, FC buses will be able to fully replace diesel buses. Insights acquired can also be used in future for other locations and fleets. The project objectives will be evaluated and verified through documentation and evaluation of the data and insights obtained.



PARTNERS:

Omnibusbetrieb Winzenhöler GmbH & Co. KG

PROJECT BUDGET/€:

1,204,870

FUNDING BUDGET/€:

602,435

COMMENCEMENT:

1 October 2017

CONCLUSION:

31 March 2019

I/05 LINDE HYDROGEN MOBILITY CONCEPT – ANALYSIS, EVALUATION AND MODELING OF AN INNOVATIVE MOBILITY CONCEPT BASED ON FC VEHICLES



Linde AG put a fleet of 50 fuel cell vehicles (FCEVs) onto the road at its own cost in the greater Munich area (the costs incurred are not a part of this project). These FCEVs are used by private end users within the “BeeZero” Linde project in a car-sharing concept. In this way the technology can be experienced by the end users themselves and the acceptance of the technology can be tested within the population. Aside from pure car-sharing – which is not part of the project – knowledge about developing FCEV/H₂ mobility concepts should be acquired in the scope of the investigative and research work. Individual user impressions in relation to the vehicle, refuelling infrastructure, refuelling and the technology in general as well as the use of the vehicles will be regularly documented and evaluated through on-the-spot and intermittent surveys.

The Chair of Automotive Technology at the Technical University of Munich is carrying out the analysis of the FCEV deployment in real conditions in this cooperation project. The priorities here are on the analysis of vehicles, infrastructure and end user behaviour. The objective is the investigation of the suitability of hydrogen vehicles currently available on the market for the everyday mobility needs of large cities such as Munich. Furthermore it will be examined how hydrogen infrastructure can be developed in order to make using FCEVs more attractive.

PARTNERS:

- a) Linde AG
- b) Technische Universität München, Lehrstuhl für Fahrzeugtechnik

PROJECT BUDGET/€:

- a) 598,504
- b) 301,042

FUNDING BUDGET/€:

- a) 202,893
- b) 301,042

COMMENCEMENT:

1 January 2017

CONCLUSION:

2 January 2019

» The objective is the investigation of the suitability of hydrogen vehicles currently available on the market for the everyday mobility needs of large cities such as Munich. «

» A preliminary investigation into the technological, economic and ecological suitability of LOHC technology for use in heavy goods vehicle transport will be carried out in the project. «

I/06 LOHC-LKW



The federal government has acknowledged that the goals of the energy transition in relation to CO₂ emissions cannot be achieved on time. One of the reasons for this is the uninterrupted increase in CO₂ emissions in mobility, where kilometres travelled has risen more sharply than the increase in vehicle efficiency. That is why the University of Erlangen has been tasked with a “Hydrogen and storage in heavy goods vehicle transport” project, in order to highlight CO₂ reduction potential. The project consciously selects heavy goods vehicle transport, because in contrast to passenger cars, a battery-operated approach is not feasible at present, and this is unlikely to change soon. In 2012, 44 million tonnes of CO₂ was emitted in Germany in goods transport, the lion’s share through road freight transport. Only by using hydrogen can these CO₂ amounts be eliminated under the current stage of technology, where hydrogen is packed densely and safely as a liquid organic hydrogen carrier (LOHC). This transport platform has a range of advantages compared to compressed hydrogen, including a substantially greater amount of energy in the tank and the already established infrastructure from mineral fuels. Furthermore, LOHC can be brought by standard ship (oil tanker) or pipeline to Europe from a longer distance. The hydrogen for LOHC is to be manufactured by electrolysis with renewable electricity. Countries and regions such as the Arab Emirates, North Africa, Iceland and Canada would be suitable for the task.

Project objective: A preliminary investigation into the technological, economic and ecological suitability of LOHC technology for use in heavy goods vehicle transport will be carried out in the project. The focus here is on recording the actual state of the drive concepts in heavy goods transport, identification of requirements for LOHC technology for mobile applications as well as a first concept study about possible LOHC infrastructure. In terms of the drive, two concepts are to be juxtaposed: combustion engine with enhanced nitrogen oxide and fuel cell. As the pollutant nitrogen oxide occurs in a combustion engine with hydrogen, it must be tested at the same time whether, using hydrogen, it can be transformed into nitrogen and water. For this task the TU Bergakademie Freiberg (Prof. Kureti) was involved as a subcontractor.

PARTNER:

Friedrich-Alexander-Universität Erlangen-Nürnberg

PROJECT BUDGET/€:

160,402

FUNDING BUDGET/€:

160,402

COMMENCEMENT:

1 February 2017

CONCLUSION:

31 March 2018



Fuel cell bus in scheduled
works transport operations
the Höchst industry park.



I/07 BETHY2

The project examines for the first time in Europe the operational capability of hydrogen fuel cell technology (H₂FC technology) in real railway operation. Two rail vehicle prototypes with H₂FC energy supply will be validated, licensed for regular operational deployment and tested with passengers in scheduled demonstration operation for this purpose. The project continues the NIP-funded predecessor project, BetHy, which ended with the construction of two prototype vehicles. Evidence of technical feasibility as well as operational suitability of H₂FC technology for the railway environment will be provided. Specifically the processes (incl. documentation and training measures) as well as the infrastructure for the operation (in the narrow sense of the word) and for the maintenance required will be designed and implemented, then examined and evaluated for their effectiveness. The project-based measures will be accompanied by an extensive survey and analysis of field data. The objective is to build a comprehensive understanding of the operating behaviour of the following subcomponents: fuel cells, hydrogen storage media and batteries, both intrinsically and in terms of their complex interactions within the integrated rail network.

The conditions will be created in the project so that H₂FC multiple unit trains reach a comparably high level of availability to diesel trains at an equally high level of economic efficiency and operational flexibility. This project constitutes the laying of an important foundation, including for subsequent further demonstration operation of vehicle fleets in the federal states of Lower Saxony, North-Rhine Westphalia, Hesse and Baden-Württemberg.

» The objective is to build a comprehensive understanding of the operating behaviour of the following subcomponents: fuel cells, hydrogen storage media and batteries, both intrinsically and in terms of their complex interactions within the integrated rail network. «

**PARTNER:**

ALSTOM Transport
Deutschland GmbH

PROJECT BUDGET/€:

3,010,080

FUNDING BUDGET/€:

1,137,208

COMMENCEMENT:

1 February 2017

CONCLUSION:

30 September 2019

I/08 X-EMU: DEVELOPMENT AND VALIDATION OF A HIGH-PERFORMANCE FUEL CELL DRIVE FOR HYBRID EMU TRAINS IN A TRACTION MODULAR SYSTEM



The proposed project focuses on developing the integration of a fuel cell in a traction modular system for rail vehicles. In order to achieve this, a profound understanding of components and their interaction throughout the overall system will be acquired. RWTH Aachen will develop a universally applicable hardware-in-the-loop (HIL) test environment for this purpose, in which real components as well as their models can be integrated, further developed and evaluated. The general insights obtained from the research are to be applied to the development of a modular, scalable traction modular system using fuel cells, which will be integrated in the Siemens train platform: Mireo®.

The development work to be carried out in this project is different to that of previous projects. Alternative drive systems will not be installed in existing diesel or electric multiple units, but rather the train will be defined and scaled on the basis of drive requirements in traction modular system operation. The goal is to safeguard technological application in terms of dynamics, performance and finally modularisation of the individual components and thus design a flexible traction modular system. Bearing customer-specific framework conditions in mind (route-specific, infrastructural, operational), this flexibility enables the provision of different technology solutions (fuel cells and/or batteries).

PARTNERS:

- a) Siemens AG
- b) RWTH Aachen

PROJECT BUDGET/€:

- a) 16,802,200
- b) 3,536,317

FUNDING BUDGET/€:

- a) 8,149,067
- b) 3,536,317

COMMENCEMENT:

1 October 2017

CONCLUSION:

30 September 2019



The findings of the research are to be integrated into the Siemens Mireo® train platform.

As they drive emission-free, fuel cell vehicles help to improve air quality in cities.





» In particular, the optimal fuel cell architecture necessary for a highly efficient and redundant drive unit is to be researched. «

I/09 GO4H₂: COMPLETELY POLLUTANT-FREE 4-PERSON AIRPLANE WITH H₂ FC DRIVE



The research project will investigate and further develop a future-oriented zero-emission modular drive concept based on fuel cells for a passenger airplane for a minimum of four persons in terms of efficiency, everyday feasibility and safety. The research and development work builds on existing technology and will ascertain operating fundamentals for the reliability as well as long distance and altitude capabilities of the systems and improve them in such a way as to fulfil the conditions for regional air transport deployment. In particular, the optimal fuel cell architecture necessary for a highly efficient and redundant drive unit is to be researched.

Initial investigations in previous projects have shown that the complexity of the system will have to be vastly simplified. The additional main components of the entire drive train comprising a hydrogen tank, a Li-ion hybrid unit, an electric engine and propellers will be re-engineered and adapted to the optimised fuel cell system. For this there is the option within the cooperation of partly or fully reverting to airworthy components. The planned integration of the fuel cell hybrid drive, which is to be developed, into the already existing air platform HY4, provides a significant time and cost benefit in the research. The potential for emission, noise and cost reduction and the associated higher acceptance of flights facilitate new intermodal mobility concepts and business models and incorporate regional airports with new services.

PARTNERS:

- a) Siemens AG
- b) Universität Ulm
- c) Deutsches Zentrum f. Luft- u. Raumfahrt e. V.
- d) Diehl Aerospace GmbH
- e) H₂Fly GmbH

PROJECT BUDGET/€:

- a) 1,298,510
- b) 1,977,064
- c) 2,224,523
- d) 482,894
- e) 179,758

FUNDING BUDGET/€:

- a) 649,255
- b) 1,977,064
- c) 2,002,071
- d) 241,447
- e) 107,855

COMMENCEMENT:

1 July 2017

CONCLUSION:

30 September 2019

I/10 BILBO: FUEL CELL INTEGRATION IN THE LABORATORY AND OPERATIONAL OPTIMISATION



The research project on fuel cell integration in the laboratory and operational optimisation (BILBO – Brennstoffzellen-Integration im Labor und Betriebs-Optimierung) focuses on creating the foundations for and acceptance of using hydrogen as well as on the operation of fuel cells on-board an airplane and at the airport. To achieve this, the fuel cells and their associated subsystems are to be further developed for commercial application within a consortium of experienced partners, such as an environmentally-friendly fire-extinguishing system. But innovative ideas are also to be developed on functional models, which could provide new impetus to air travel.

Different tasks allocated to laboratory prototypes, e.g. behaviour in the system network or component operation under extreme conditions, will be examined more closely and the scientific and technical correlations examined. Based on the results it will be evaluated whether a design decision was correct or whether a modification in the construction is necessary. A distinction will be made between the Airbus and AOA system-oriented working method and the generic studies from the German Aerospace Center (DLR) and the ZAL Centre for Applied Aviation Research GmbH. Whereas the former focuses on concrete construction and the relevant application, the other two partners conduct general investigations which can be used for the most varied of systems. Furthermore, there are feasibility analyses and the design of possible system architectures or specifications for new kinds of unconventional drives.

PARTNERS:

- a) Airbus Operations GmbH
- b) AOA Apparatebau Gauting GmbH
- c) Deutsches Zentrum für Luft- und Raumfahrt e. V.
- d) Zentrum für angewandte Luftfahrtforschung GmbH

PROJECT BUDGET/€:

- a) 1,909,147
- b) 1,214,037
- c) 1,934,569
- d) 635,815

FUNDING BUDGET/€:

- a) 820,933
- b) 546,317
- c) 1,741,112
- d) 381,490

COMMENCEMENT:

1 May 2017

CONCLUSION:

30 September 2019

» Innovative ideas are also to be developed on functional models, which could provide new impetus to air travel. «

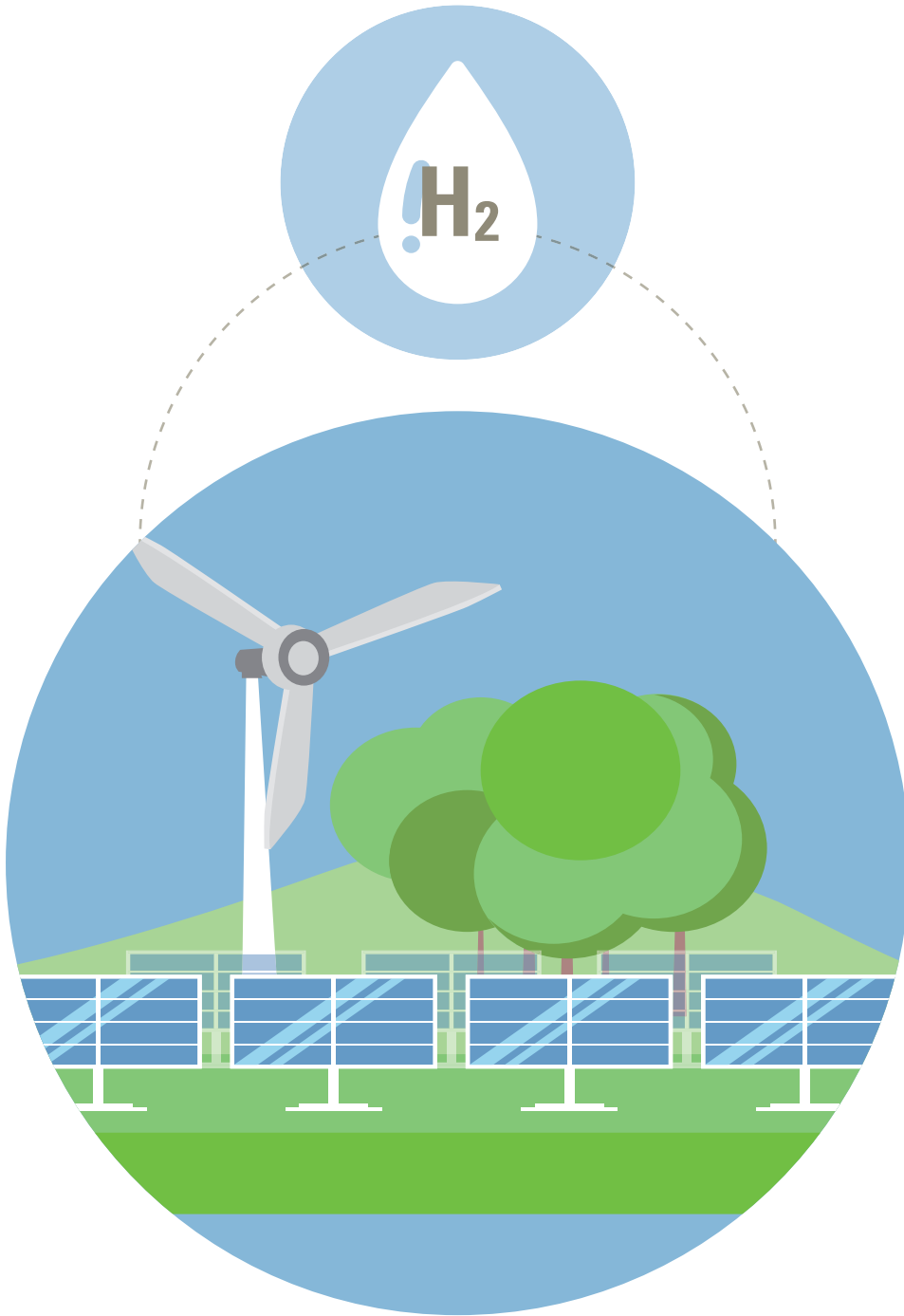
NIP – HYDROGEN PROVISION

In the hydrogen provision programme area of NIP, funding will be awarded to demonstration projects, research and development projects as well as to studies on the production, storage and distribution of hydrogen. The hydrogen will be manufactured primarily with renewable energies – wind and solar power as well as biomass, in accordance with energy concept targets, and will be used as a fuel for fuel cell vehicles and as storage for integrating large quantities of fluctuating renewable energies. Concrete applications also include stationary reconversion to electricity, feeding into the natural gas network as well as use as a climate-neutral industrial gas.

The use of renewable hydrogen can make a major contribution to achieving the objectives of the energy transition. On the one hand the substitution of fossil energies in the transport and energy industry is advanced, on the other energy storage capacities are created which are urgently required for the success of the energy transition. The particular economic appeal of hydrogen as a fuel facilitates the creation of a leading market, which paves the way for energy storage and other applications. Technologically-speaking, hydrogen production by means of highly efficient water electrolysis primarily on the basis of surplus wind power, forms the core of the programme area. Water electrolysis is a key technology for the integration of renewable energy in the transport and energy sectors, growing and emerging hydrogen markets create the preconditions for exploiting the considerable development potential of all electrolysis technologies.

Although the well-tried alkaline electrolysis method is currently mainly used, the technologically younger polymer electrolyte membrane (PEM) electrolysis is gaining ground. Demonstration projects on both technologies are being funded in the programme area. Apart from the established technologies of alkaline electrolysis and polymer membrane (PEM) electrolysis, high temperature electrolysis is now being commercially deployed as well. The goal of NIP activities is to achieve commercial operation of all three technologies. This makes the efficient use of water electrolysis systems for all application scenarios possible in future.

The economic viability of water electrolysis systems is necessary in order to be able to exploit the advantages of hydrogen in the energy system and thus achieve decarbonisation of the sectors. To this end, the potential of hydrogen and fuel cell technologies for the energy transition will be discussed in studies and analyses. The results aid in the classification of projects and other activities in NIP as well as their effects on the energy transition.



I/11 RSOC “REVERSIBLE SOLID OXIDE CELL”



The project focuses on the demonstration and optimisation of a reversible high temperature solid oxide cell (RSOC) in an industrial environment to generate sustainable fuels for different mobility modes. The reversibility of the technology demonstrated in the laboratory will be tested in real conditions in system operation. For this the integration, optimisation and operation of an RSOC in the existing system operation of an industrial power-to-gas system will be implemented. A reliable forecast should emerge on the technology readiness level (TRL) and connecting factors deduced for the further development and optimisation of future system generations.

Until now, the demonstration of the principle technological capabilities of an RSOC electrolysis module was conducted in isolated operation only, not under real conditions. In this project, two RSOC electrolysis modules will be integrated into the material and energy cycle of an industrial power-to-gas system and tested in realistic long-term operation.

RSOC technology provides the possibility of particularly efficient energy conversion and thus a more cost-effective generation of hydrogen as a means of storing energy or as a raw material in the chemical industry over the medium term.

PARTNERS:

- a) AUDI AG
- b) Deutsches Zentrum für Luft- und Raumfahrt e. V. (DLR)

PROJECT BUDGET/€:

- a) 3,298,341
- b) 388,182

FUNDING BUDGET/€:

- a) 1,319,336
- b) 349,364

COMMENCEMENT:

1 November 2017

CONCLUSION:

30 September 2019

» In this project, two RSOC electrolysis modules will be integrated into the material and energy cycle of an industrial power-to-gas system and tested in realistic long-term operation. «

» The overarching objective of the study is to work out a detailed roadmap with specific recommendations for action as a conceptual basis for the design of water electrolysis funding programmes in the area of R&D and demonstration projects. «

I/12 STUDY: INDUSTRIALISATION OF WATER ELECTROLYSIS IN GERMANY



The overarching objective of the study is to establish a detailed roadmap with specific recommendations for action as a conceptual basis for the design of water electrolysis funding programmes in the area of R&D and demonstration projects. The latest knowledge on electrolysis technology will be consolidated for this purpose, future hydrogen demand quantified and evaluated separately according to sector, the need for action determined and then further developed into a holistic strategy to achieve core technical and economic objectives.

The value chain of electrolysis systems in Germany is the focus here. Today's systems are normally manufactured on a small scale in workshop conditions. This raises the question of whether scaling up production capacity with rising demand for renewably produced hydrogen is possible. It will be shown for which components and at what points along the value chain bottlenecks occur and how they can be overcome with appropriate measures. This will then enable the hydrogen value chain to satisfy future demand.

PARTNER:

Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e. V.

PROJECT BUDGET/€:

437,609

FUNDING BUDGET/€:

437,609

COMMENCEMENT:

1 April 2017

CONCLUSION:

31 March 2018

NIP – STATIONARY ENERGY SUPPLY



Household energy

In the area of household energy, fuel cells are used as μ CHP systems in an output range of less than 100 W to several kW. Normally they supplement conventional heating systems and supply electricity in addition to the heat required. Through the highly-efficient generation of electricity, up to 40 % less CO₂ is produced compared to conventional solutions for heat generation and electricity drawn from the grid. Currently available systems can be operated with natural gas and thus can be directly integrated in the heating market. Over the medium to long term, operation with other fuels will be feasible (e.g. hydrogen). Along with the flexible control option, the fuel cell provides an optimal solution as a means of converting energy in the future heating market too. In NIP I fuel cell heating systems were introduced to the market through the funding of development projects and through field tests such as CALLUX. With the BMVI's funding guideline "Fuel cells for highly efficient cogeneration systems", some commercial fuel cell heating systems were able to be installed. Since September 2016, the systems have been funded through the KfW programme 433: "Energy-efficient construction and renovation – fuel cell grant". According to the KfW annual report, over 1,900 funding approvals were issued for fuel cell heating systems by the end of 2017.



Industry and commerce

Fuel cell modules for industrial and commercial application can produce electrical power of a few kW to several 100 kW. Combining modules can achieve electrical outputs in the multi-megawatt range. Depending on the application and technological maturity, a variety of fuel cell types are used. Fuel cells with high operating temperatures are particularly suitable for trigeneration and thus for use in industrial processes (cold storage, breweries, laundries) or applications with high energy demands (hospitals, office buildings, hotels). Because of the high level of efficiency over the full load range and low emissions, the systems are ideally suited to decentralised deployment in metropolitan areas. Thus large fuel cell systems can play a key role in future energy systems. With the BMVI's funding guideline "Fuel cells for highly efficient cogeneration systems", two commercial fuel cell systems were funded for industrial use and put into operation in 2016 and 2017 respectively. Large stationary fuel cells will be funded in the framework of the energy research programme in the continuation of NIP.



COGENERATION WITH FUEL CELLS IN THE HOTEL INDUSTRY

E.ON and Radisson Blu in Frankfurt implement innovative project

According to estimates, the hotel industry accounts for around five million tonnes of CO₂ emissions annually. As is the case with transport, industry and private households, the areas of trade, commerce and services – which includes the hotel industry – also face the challenge of reducing energy consumption and greenhouse gas emissions in terms of climate protection. Furthermore, sustainability is increasingly becoming a more important issue for consumers when selecting their hotels. The use of fuel cell systems to produce power and heat provides hoteliers with the benefits of reducing their energy costs while simultaneously being able to increase their environmental-friendliness – right up to climate neutrality.

Under the funding guideline “Fuel cells for highly efficient cogeneration systems” of the Federal Ministry of Transport and Digital Infrastructure, 6.8 million euros were approved in the autumn of 2016 on federal level to support testing of potential business models and the construction of larger energy supply systems using fuel cell technology. Aside from the purchase of fuel cell heating systems for domestic energy supply in an output range of up to 20 kilowatts, CHP (combined heat and power) facilities in the output range of between 100 and 400 kilowatts (electric) will also be funded under the guideline.

Supported through the funding programme, Europe’s first industrial class fuel cell in a hotel was able to commence operation in the Radisson Blu in Frankfurt at the beginning of 2018. It was developed by E.ON and the fuel cell suppliers, Fuel Cell Energy Solutions. The 400 kilowatt fuel cell CHP system is specifically tailored to the needs of the hotel industry. Energy-intensive processes such as water heating, lighting and refrigeration mean that hotels have high electricity and heat demands throughout the year and make ideal candidates for fuel cell use. In comparison to office buildings, the hotel industry has relatively high energy costs – on average between 5 % and 10 % of turnover.

The Radisson Blu Hotel in Frankfurt uses fuel cell technology to generate most of the energy required for hotel operation itself.



To date, the hotel has met the needs of its energy consumption of 400 rooms and suites, restaurants and bars, the fitness and spa area as well as its event facilities entirely from the grid. Using the fuel cell CHP system, the hotel operator wants not only to decrease its energy consumption and CO₂ footprint, but also optimise energy costs.

The supply system emits almost no harmful emissions such as nitrogen or particulates, as the natural gas is transformed into power and heat highly efficiently in a molten carbonate fuel cell system in a combustion-free chemical process.

At the same time, the hotel can itself generate the majority of the required energy for hotel operation in an environmentally-friendly way using fuel cell technology.

The entire installation and the required fittings and modifications in the hotel were carried out in 2017. With the start of operation, which occurred at the beginning of 2018, the fuel cell is delivering annually around three gigawatt hours (GWh) of electricity and two GWh of heat for the hotel over the next 10 years. At the same time, CO₂ emissions can be reduced annually by around 600 tonnes. This value reflects the CO₂ emissions of around 50,000 medium-class cars covering 100 kilometres. For the Carlson Redizor hotel group, which belongs to the Radisson Blu chain, this project confirms its commitment in the area of sustainability. The group wants to reduce its CO₂ consumption in its hotel by a further ten per cent by 2020.

The costs for the subsidised project total almost 1.8 million euros. More than 800,000 euros come from the budget of the fuel cell-CHP funding programme.



Shipping applications

Because of the similarities in the technology, fuel cells for shipping applications are categorised the stationary application area of NIP.

Fuel cells can be used on ships for on-board electricity supply (hotel operation, loading) but also for propulsion in hybridised systems. Aside from high efficiency and the low emissions, some additional features of fuel cells play an important role in shipping. The option of decentralised installation on the ship provides a significant advantage for economic efficiency, as space utilisation can be optimised. The low noise and vibration operation on passenger ships benefits customers. In the short term, fuels which are available today can be relied upon (LNG, diesel, methanol) but electricity-based fuels (hydrogen, synthetic fuels) can also be used. The latter's role must become more prominent in future. In the framework of the "e4ships" lighthouse project, the functioning of fuel cells on ships was successfully demonstrated in NIP I. In the continuation of NIP, the demonstrators that were developed there are to be brought to market maturity and the development of the necessary international regulations will be advanced.



Visitors can learn more about the technical specifications for maritime applications at the fuel cell demonstrator.



I/13 PA-X-ELL2: FUEL CELLS IN USE ON SEA-GOING PASSENGER SHIPS

In the current Pa-X-ell2 module under the overall e4ships 2.0 lighthouse research project, a new generation of high temperature (HT)-PEM fuel cells for use on seagoing passenger vessels will be studied and developed, building on the first Pa-X-ell project.

Pa X ell2 will focus on the integration of fuel cells on passenger vessels as an integral part of a decentralised energy network as well as the integration of a hybrid energy system equipped with energy storage systems. This includes developing the concept of a decentralised energy network and also developing and designing subsystems as well as their test operation under conditions which simulate their later application in the decentralised network. The main functionality of the hybrid energy network will also be verified in a test facility.

For both energy concepts, the development of a new generation of fuel cells and their production processes is necessary. The trial operation of the test facilities on passenger vessels is a relevant component of developing sustainable energy concepts.

PARTNERS:

- a) MEYER WERFT GmbH & Co. KG
- b) Serenergy A/S
- c) Fr. Lürssen Werft GmbH & Co. KG
- d) Deutsches Zentrum für Luft- und Raumfahrt e. V. (DLR)
- e) besecke GmbH & Co. KG
- f) EPEA – Internationale Umweltforschung GmbH
- g) Carnival Maritime GmbH
- h) DNV GL SE

PROJECT BUDGET/€/ FUNDING BUDGET/€:

- a) 3,140,737/1,664,591
- b) 5,607,477/3,014,019
- c) 1,309,711/694,147
- d) 534,780/213,111
- e) 391,210/203,429
- f) 208,335/41,667
- g) 97,109/50,497
- h) 252,717/131,413

COMMENCEMENT:

1 January 2017

CONCLUSION:

30 September 2019

I/14 SCHIBZ 2 – TESTING OF THE FUEL CELL PLANT ON LAND AND AT SEA



The SchIBZ 2 project is the continuation of the predecessor project SchIBZ. In the framework of this project the previously developed and constructed hybrid, diesel-operated fuel cell system will be tested on land and at sea. This should provide evidence of the seaworthiness of the components and the system as a whole.

The system was put into operation in several stages. Various improvements to the original design of different subsystems were made for this. The values achieved thus far are meeting expectations, particularly in the passenger ship market. By its integration in the e4ships 2.0 cluster, regulation development for authorising fuel cell systems in shipping will be supported, which is a basic prerequisite for market activation.



PARTNERS:

- a) thyssenkrupp Marine Systems GmbH
- b) Oel-Waerme-Institut gGmbH
- c) sunfire GmbH
- d) M & P motion control + power electronics GmbH
- e) DNV GL SE
- f) Leibniz-Universität Hannover

PROJECT BUDGET/€/ FUNDING BUDGET/€:

- a) 1,241,900/620950
- b) 245,820/245,820
- c) 362,043/217,227
- d) 176,843/88,422
- e) 99,692/49,846
- f) 197,339/197,339

COMMENCEMENT:

1 March 2017

CONCLUSION:

30 September 2019

The system will be also tested during sea trials.



Entry of the inland waterways pusher boat ELEKTRA into Berlin's Westhafen, together with heavy goods barge URSUS.

I/15 ELEKTRA – TECHNICAL APPROACHES TO A PUSH BOAT OPERATED BY FUEL CELLS AND ACCUMULATORS

The ELEKTRA research project focuses on the feasibility of alternative low-emission energy supply systems on inland waterway vessels and their economic deployment. For the first time, a fully-electric, hybrid drive concept comprised of fuel cells and accumulators is being designed for an inland waterway vessel and the dynamic interaction of the energy sources researched and optimised with respect to the maximum range of the canal push boat. Fuel cell technology will be used for a hydrogen-based base load energy supply of the drivetrain, with peak loads catered to by accumulators. This will provide Germany with a unique selling point as a centre for technological innovation. The project will demonstrate the feasibility of hydrogen in shipping as a means of storing energy with its specific features and requirements. Ideas on measures to build up infrastructure for charging accumulators with shore power and for the supply of fuel cells with hydrogen will also be developed within the project. Furthermore, an energy management system will be developed which facilitates the optimal use of existing on-board energy, thus strengthening economic efficiency and in turn, competitiveness compared to conventionally powered vessels. For the first time in inland water navigation, a driving assistant will be developed in order to facilitate range increases and thus raise economic efficiency against other modes of transport.



PARTNERS:

- a) Technische Universität Berlin
- b) BEHALA – Berliner Hafen- und Lagerhausgesellschaft mbH
- c) SER Schiffselektronik Rostock GmbH
- d) Imperial Shipping Services GmbH

PROJECT BUDGET/€:

- a) 804,397
- b) 273,291
- c) 231,150
- d) 243,401

FUNDING BUDGET/€:

- a) 804,397
- b) 136,645
- c) 115,575
- d) 121,700

COMMENCEMENT:

1 April 2017

CONCLUSION:

30 September 2019

I/16 RIVERCELL2 – FUEL CELL HYBRID SYSTEM FOR “RIVERCELL” RIVER CRUISER



The hybrid use of energy storage possibilities combined with sustainable energy generation using fuel cells offers huge potential in terms of improving emissions, efficiency and safety in ship operation. Great importance is attached to the development of hybrid energy and drive systems on ships for the future of mobility as well.

In the context of the research lighthouse project, e4ships 2.0, the modular hybridisation of the overall energy supply using fuel cells and alternative fuels for river cruisers were developed for the first time in RiverCell2 and tested at an onshore test facility and subsequently in a test installation on-board a river cruiser. RiverCell2 is the planned practical continuation of RiverCell1 and builds on the fundamental concepts and findings that were developed therein.

By the end of the project further insights on the suitability, application as well as on the profitability of a hybrid drive will be obtained from construction and testing. In addition, the project partners anticipate a substantial gain in experience in terms of handling new fuels with a low flashpoint. Safe operation will be demonstrated in actual application and the results will contribute to the development of regulations.

The “RiverCell” research project takes on the challenge of producing a complex, but above all sustainable on-board energy supply system. The resulting product will demonstrate to the public the feasibility and ecology of complex ship drives in terms of the fuel cell hybrid drive and provide fresh impetus for subsequent projects.

PARTNERS:

- a) MEYER WERFT GmbH & Co. KG
- b) NEPTUN WERFT GmbH & Co. KG
- c) Serenergy A/S
- d) Viking Technical GmbH
- e) DNV GL SE
- f) HADAG Seetouristik und Fährdienst AG
- g) Technische Universität Berlin
- h) Pella Sietas GmbH

PROJECT BUDGET/€/ FUNDING BUDGET/€:

- a) 626,237/313,118
- b) 1,351,592/675,796
- c) 1,428,948/714,473
- d) 137,631/68,816
- e) 296,382/148,191
- f) 85,868/42,934
- g) 73,257/73,257
- h) 178,027/89,013

COMMENCEMENT:

1 April 2017

CONCLUSION:

30 September 2019

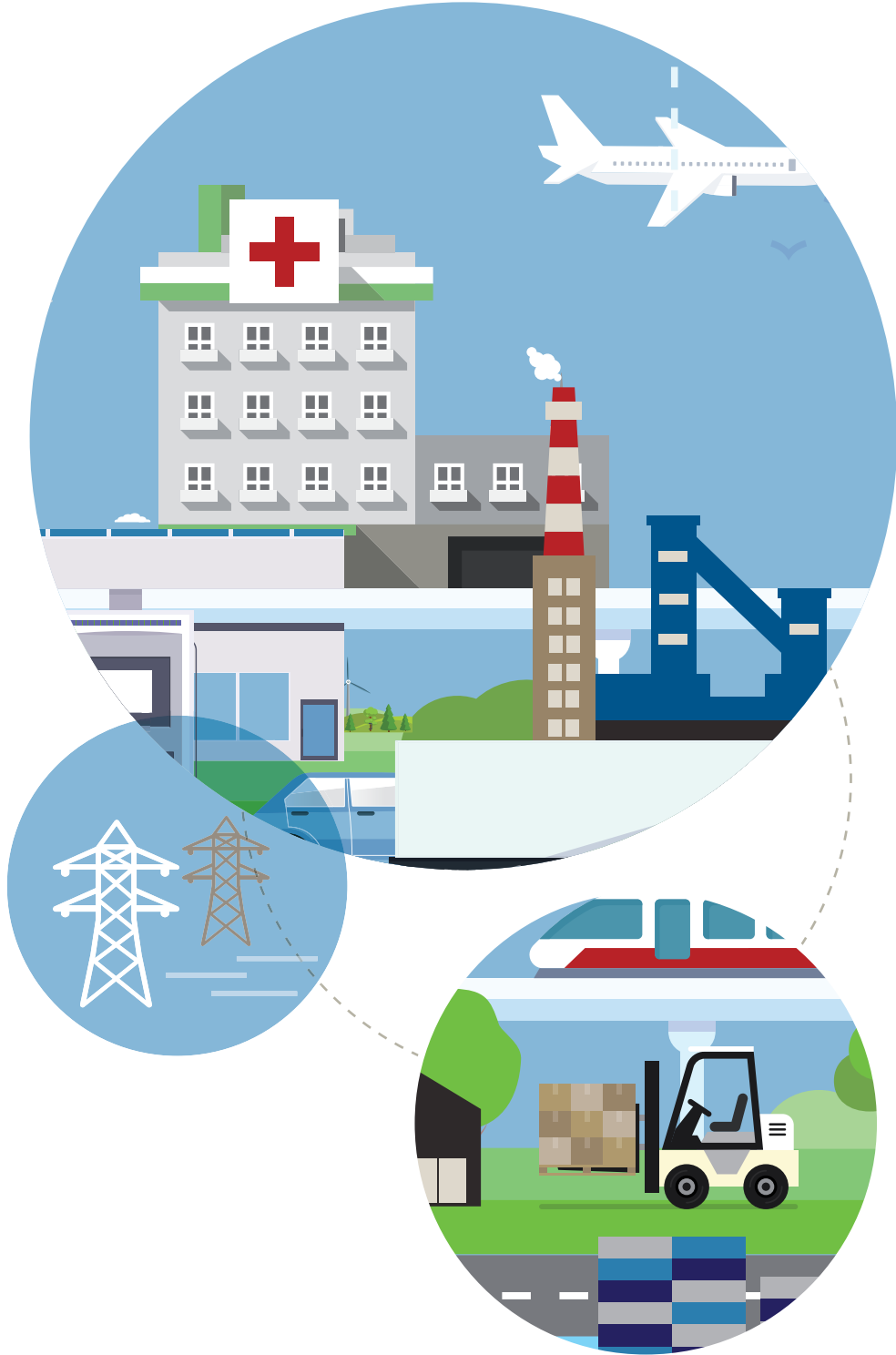
» Great importance is attached to the development of hybrid energy and drive systems on ships for the future of mobility as well. «

NIP – SPECIAL MARKETS

As part of NIP II¹ and in the actions of the Federal Ministry of Transport and Digital Infrastructure to continue the NIP, the special markets programme area comprises a number of fields of activity to contribute to the development of sustainable mobility. Among these are “Making infrastructure and drives for emission-free transport possible: logistics”, “Logistics and special applications” and “Securing critical infrastructure”. In particular this relates to:

- Power supply business (emergency power UPS, off-grid power supply, independent/hybrid power supply, emergency generating systems, e.g. in the areas of telecommunications, information technology, traffic control systems, transmission and distribution network operation)
- Intralogistic vehicles (cargo haulers, pallet trucks, conveyor belt cars, industrial trucks, forklifts, tugger train haulers, baggage tractors at airports)

¹ The Special Markets programme area is no longer explicitly mentioned as a term in the National Innovation Programme Hydrogen and Fuel Cell Technology (NIP 2).





Use of a fuel cell-powered industrial truck at the Daimler plant in Düsseldorf



CLEAN INTRALOGISTICS NET: GREEN INTRALOGISTICS WITH HYDROGEN AND FUEL CELLS

Government and industry has recognised the potential of hydrogen as a fuel for zero emission electric mobility. With the establishment of the Clean Intralogistics Net (CIN) industry network and its support as an innovation cluster, this development is being promoted in the area of intralogistics. It is being undertaken with the aim of making the conveyance of goods within industrial production processes, in trade and in goods handling as well as for airport ground support services emission-free, more efficient and subsequently also more cost effective.

Bundling individual projects

CIN is an open platform for the transfer of technology and know-how between users and manufacturers of fuel cell-powered material handling vehicles and tractors, suppliers of fuel cell systems, and providers of hydrogen. Superordinate tasks in individual projects from the NIP area "Enabling Infrastructure and Powertrains Zero-Emission Transport – Logistics" are synergistically bundled under the CIN umbrella

NOW GmbH acts as the moderating interface between the public sector, business and science, and is actively involved in CIN in the topic of green logistics with fuel cells.

CIN is supported by the German Mechanical Engineering Industry Association, VDMA Materials Handling, as an associated partner, while NOW GmbH moderates the activities of the eleven member companies. The innovation cluster is administered by EE Energy Engineers GmbH.



PARTNER:
EE Energy Engineers GmbH

PROJECT BUDGET/€:
235,308

FUNDING BUDGET/€:
117,654

COMMENCEMENT:
1 April 2017

CONCLUSION:
30 September 2019

The CIN partners:

- AIR LIQUIDE Advanced Technologies GmbH
- BMW Bayerische Motoren Werke AG
- Bosch Engineering GmbH
- Daimler AG
- ElringKlinger AG
- Fronius Deutschland GmbH
- Heraeus Fuel Cells GmbH
- Jungheinrich AG
- Linde Material Handling GmbH
- Linde AG – Gases Division
- STILL GmbH

Associated partners:

- VDMA Materials Handling
- Working group hydrogen, fuel cells and e-mobility at airports

The partner's common goal is to help hydrogen and fuel cell technology achieve its breakthrough in the area of intralogistics. For this reason, CIN is focusing on identifying and exploiting synergy potentials, expanding interdisciplinary cooperation, generating economies of scale in procurement and manufacturing processes, and strengthening European and international cooperation. This is always upon the backdrop of the successful activation and introduction of fuel cell technology in the market.

CIN is increasing the acceptance of fuel cell technology through cross-company communication measures while also generating accompanying multiplier effects through the bundled presentation of successful reference projects.

10 percent of the world's 500 largest companies use fuel cells in both the area of intralogistics and back-up power.

Projects involving the implementation of fuel cells in intralogistics are being successfully conducted domestically and internationally. For example: Prelodis, a logistics centre in the Paris region, distributing approx. 270,000 tonnes of fruit and vegetables annually; the Mercedes-Benz production facility in Düsseldorf; at DB-Schenker in Linz (Austria); and in the BMW plant in Leipzig.

CIN is supported as an innovation cluster within the scope of the NIP 2 funding programme of the Federal Ministry of Transport and Digital Infrastructure (BMVI – Bundesministerium für Verkehr und digitale Infrastruktur).

Further information at: ➤ www.cleanintralogistics.net

I/17 FFZ70: FUEL CELL SYSTEM INDOOR TOW TRACTORS FOR THE BMW PLANT IN LEIPZIG



Using the example of the conversion of 70 three-tonne indoor tow tractors, operational concepts are being developed in the FFZ70 project for real, value-added-oriented application in production settings, in order to overcome the current hurdles of using fuel cell technology. Aim of the project is to develop, test and deploy this hydrogen-powered fleet of industrial trucks for cost-effective operation in the BMW production plant in Leipzig, along with the establishment of the corresponding hydrogen infrastructure. Comprising a fuel cell producer, an MHV (materials handling vehicle) manufacturer, a trade/service provider as well as an end user, the consortium covers the entire value-added chain of hydrogen fuel cell systems for the area of intralogistics. With the additional accompanying research, challenges can thereby also be optimally tackled. The partners are working together in various work packages on the identified challenges that include: the operator concept; the standardisation of interfaces; a Plug & Play solution for fleet conversions; proof of the cost-effectiveness for fleet operations (scalable); service and training concepts; and validation of service life. The proposal for the "H2ready" industry standard provides other manufacturers with the opportunity to efficiently implement the topic in their products, in the future.

» Using the example of the conversion of 70 three-tonne indoor tow tractors, operational concepts are being developed in the FFZ70 project for real, value-added-oriented application in production settings, in order to overcome the current hurdles of using fuel cell technology. «

PARTNERS:

- a) Bayerische Motoren Werke AG
- b) Linde Material Handling GmbH
- c) Günzel Fördertechnik und Fahrzeugbau GmbH
- d) Fronius Deutschland GmbH
- e) Technische Universität München

PROJECT BUDGET/€:

- a) 3,893,677
- b) 223,478
- c) 739,876
- d) 156,804
- e) 215,145

FUNDING BUDGET/€:

- a) 1,752,155
- b) 91,626
- c) 429,128
- d) 75,266
- e) 215,145

COMMENCEMENT:

1 April 2017

CONCLUSION:

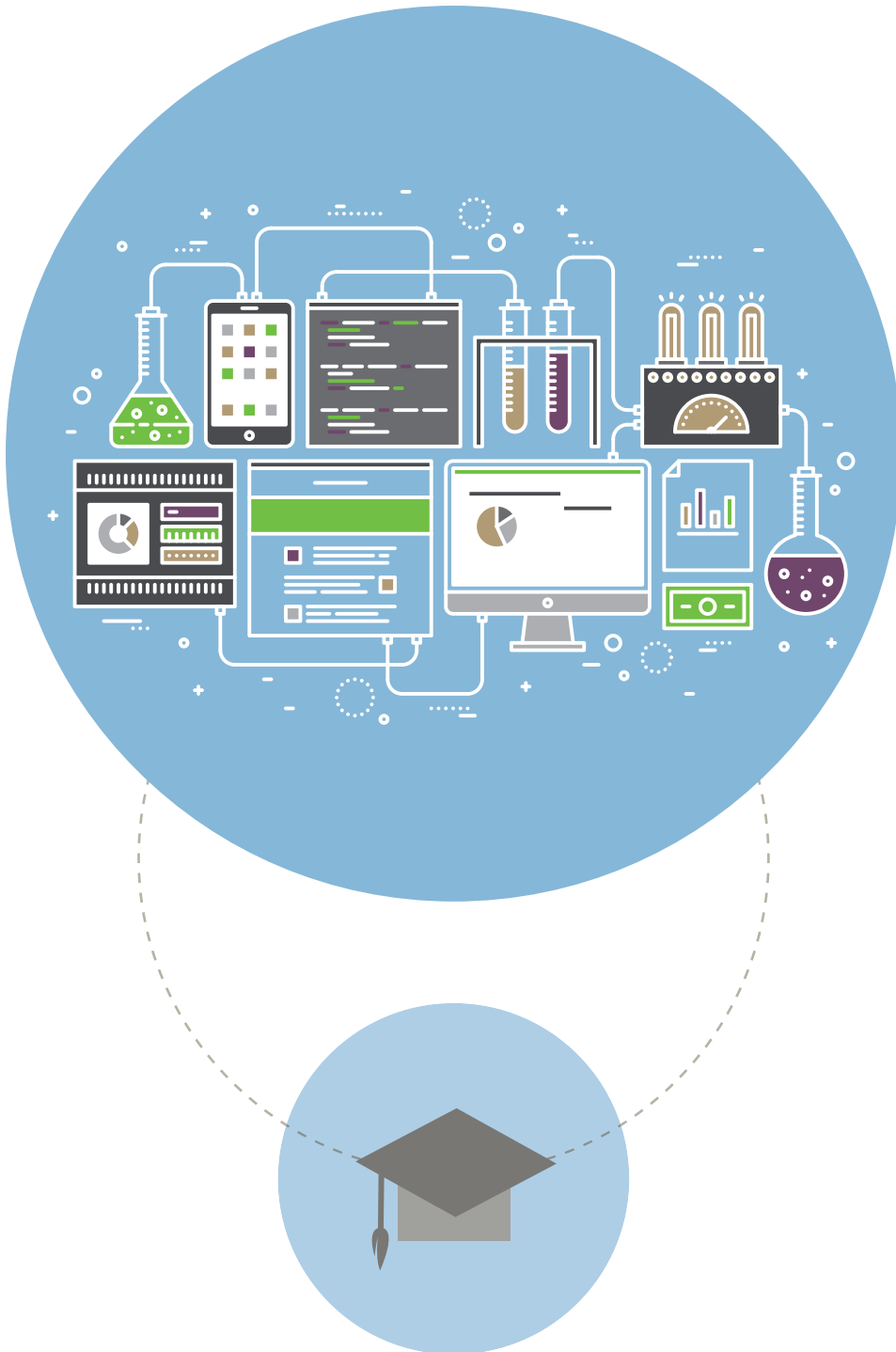
30 September 2019



Fuel cell-run tractors in the production supply system at the BMW plant in Leipzig

NIP – INTERDISCIPLINARY THEMES

Aside from transport or stationary applications, projects are also funded under NIP 2 which are primarily geared towards technologies and thus strengthen the hydrogen and fuel cell industry overall. For example, this refers to research work on fuel cell components to test methods and material properties, which assist in the design and updating of norms. Establishing practically applicable standards simplifies the market entry of new technologies and facilitates international trade. Through their research work, the project consortia make a decisive contribution towards the content design of international norms and strengthen Germany's position in the relevant committees.



I/18 QUALIFICATION OF FUEL CELL COMPONENTS (QUBK)



The goal of the qualification of fuel cell components project (QuBK) is to scientifically examine the internationally recognised test protocols in terms of their validity and validate them experimentally. In addition, the test protocols will undergo an experimental sensitivity analysis as well as a comparison with international protocols (– in particular from the USA (DOE), Japan and Europe as centres for leading international technology firms). Through extensive applications of these test procedures on numerous fuel cell components from different manufacturers and through the accompanying evaluation by means of scientific in-situ analytics, the scientifically reproducible interpretation of the measured values will be possible.

Furthermore, the test protocols of German suppliers of fuel cell components with a focus on membrane electrode assemblies (MEAs) will be made public. The test protocols will be specified in detail where necessary together with the component manufacturers and OEMs and the relevant experimental structures created in accordance with test stand developers.

PARTNER:

Fraunhofer-Institut für Solare Energiesysteme

PROJECT BUDGET/€:

1,972,499

FUNDING BUDGET/€:

1,775,249

COMMENCEMENT:

1 February 2017

CONCLUSION:

31 August 2019



Fraunhofer ISE test laboratory for the characterisation of fuel cell components

I/19 BEPPEL – BIPOLAR PLATES FOR FUEL CELLS AND ELECTROLYSERS



The goal of the “BePPel” joint project is the definition and standardisation of measuring physical parameters, especially electrical conductivity as well as contact resistances (in-plane and through-plane) at graphite and metallic bipolar metal plates for polymer electrolyte membrane-based cells in low temperature (LT) and high temperature (HT) applications in fuel cell systems. The project is making a decisive contribution to strengthening hydrogen and fuel cell technology in the transport sector and in the energy market through the development of an internationally competitive supply industry.

For this task six German research institutes with great expertise in this area have come together in a unique research alliance in order to together develop and implement a standard of uniform measurement regulations required by industry in keeping with future standardisation and quality control.

Based on this principle there are five major objectives:

- Clear definition of the physical parameters: “electrical conductivity”, in-plane and through-plane;
- Developmental characterisation to devise a standard measurement regulation, as to how the “electrical conductivity” parameter is to be determined for manufacturers and OEM customers in the context of manufacturing process and quality control;
- Development of standard measurement regulations for additional parameters such as thermal conductivity and mechanical stability;
- Provision of an industrial-standard and cost-effective measurement system accompanying production, to define conductivities as well as evaluation through a round robin test;
- Creation of guidelines for online process control in the framework of mass production of bipolar plates as well as the transferral of the measuring methods developed to an industrial standard.

For this purpose, the definition and development of a cost-effective and industrial-standard measuring station for exit controls for manufacturers as well as receiving controls for OEM customers is needed. The first step is a single measuring station as a preliminary stage for a measuring system in the framework of the future mass series manufacture for online process control. Guidelines for implementation in a continual process control during manufacture, must also be developed.

PARTNERS:

- a) DLR-Institut für Vernetzte Energiesysteme e. V.
- b) Zentrum für BrennstoffzellenTechnik GmbH
- c) Zentrum für Sonnenenergie- und Wasserstoff-Forschung BW
- d) Forschungszentrum Jülich GmbH
- e) Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e. V.

PROJECT BUDGET/€:

- a) 609,064
- b) 620,117
- c) 365,513
- d) 492,165
- e) 1,017,098

FUNDING BUDGET/€:

- a) 609,064
- b) 620,117
- c) 365,513
- d) 442,949
- e) 915,388

COMMENCEMENT:

1 April 2017

CONCLUSION:

30 September 2019

I/20 HY-LAB – DEVELOPMENT AND CONSTRUCTION OF TWO INDEPENDENT LABORATORIES FOR INTERNATIONAL STANDARD HYDROGEN QUALITY MEASUREMENT

Hydrogen-operated fuel cell vehicles facilitate emission-free electric mobility with long ranges and short refuelling times. Hydrogen can, however, contain impurities that damage the fuel cells. In order to be able to guarantee the required service life of fuel cells, the quality of fuelled hydrogen must be regularly checked at refuelling stations. The permissible limits for impurities are defined in international standard: ISO 14687-2. However there is currently no independent laboratory in Germany which can carry out these sophisticated analyses.

For this reason the analytics laboratories of the Hydrogen and Fuel Cell Center ZBT GmbH and the Center for Solar Energy and Hydrogen Research Baden-Württemberg (ZSW) will be expanded and optimised under the “Hy-Lab – Development and construction of two independent laboratories for international standard hydrogen quality measurement” project. As independent samplers and laboratories, they will be available in future for quality control at refuelling stations in Germany and throughout Europe.

ZBT and ZSW wish to evaluate and develop suitable methods of analysis and optimised sampling techniques to verify standards. On this basis hydrogen samples from the point of generation to delivery at the refuelling stations are to be taken, analysed and the main impurities established. In addition, comparative measurements will be made with international laboratories. All work is done in close coordination with associated partners, CEP and NOW.



PARTNERS:

- a) Zentrum für Brennstoffzellen-Technik GmbH (ZBT)
- b) Zentrum für Sonnenenergie- und Wasserstoff-Forschung Baden-Württemberg (ZSW)

PROJECT BUDGET/€:

- a) 1,567,591
- b) 1,514,522

FUNDING BUDGET/€:

- a) 1,567,591
- b) 1,514,522

COMMENCEMENT:

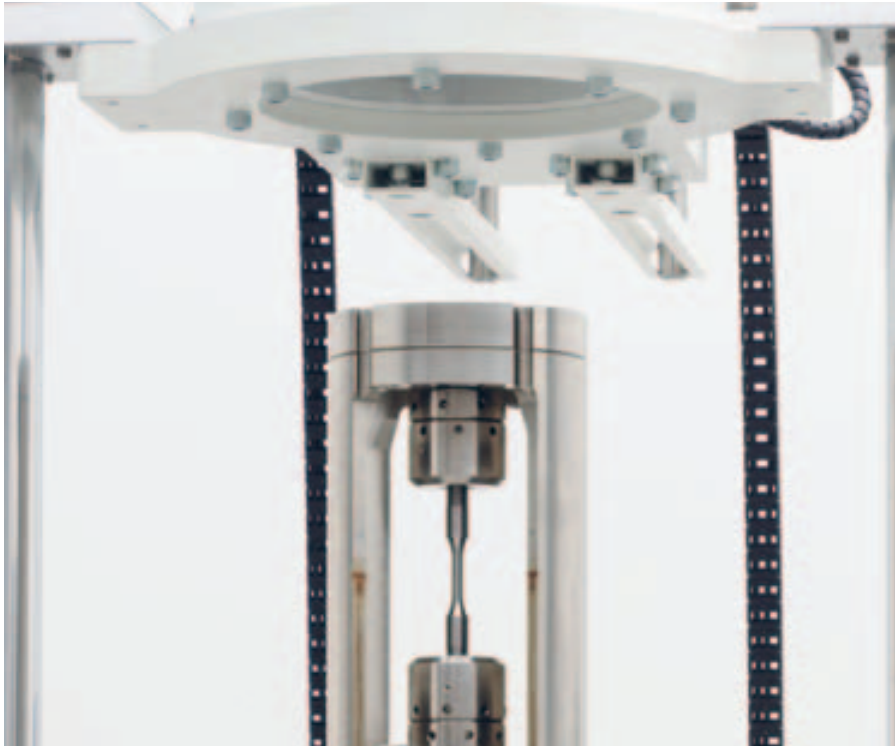
1 April 2017

CONCLUSION:

30 September 2019



Hydrogen analysis at the ZSW



Sample clamping in the 1000 bar hydrogen testing system

I/21 ROUND ROBIN – DEFINITION OF REQUIREMENTS FOR THE QUALIFICATION OF MATERIALS FOR USE IN HYDROGEN PRESSURE ACCUMULATOR SYSTEMS OF FUEL CELL-OPERATED VEHICLES

Fundamental questions on the demands of test performance and materials qualification will be addressed in the project through international cooperation between the partners of Kyushu University, Japan, Sandia National Laboratories, USA, and MPA Stuttgart, Germany, under the supervision of an industry committee. To this end, a round robin will be implemented as a first step, examining the comparability of the results of the participating testing systems and deriving parameters for carrying out hydrogen sampling. The next step involves jointly examining fundamental influencing factors on material behaviour in order to derive a recommendation about test conditions for materials qualification. By developing and evaluating these influencing factors within this project, the project's insights can be directly incorporated into standards and regulations. The project serves to improve design concepts and approval procedures in terms of optimising storage technology. This relates primarily to hydrogen tanks in cars. The project will generate directly applicable results on material behaviour in hydrogen. The direct involvement of an industry committee assures the relevance of the work for the future development of fuel cell vehicles.



PARTNER:
Universität Stuttgart

PROJECT BUDGET/€:
472,644

FUNDING BUDGET/€:
472,644

COMMENCEMENT:
1 April 2017

CONCLUSION:
30 September 2019

II. FEDERAL FUNDING CHARGING INFRASTRUCTURE



NEWLY APPROVED PROJECTS



COMPLETED PROJECTS



INTERDISCIPLINARY THEMES



CHARGING INFRASTRUCTURE

A central prerequisite for the further spread of electric mobility in Germany is a comprehensive charging infrastructure tailored to customer needs. For many people, buying an electric vehicle is only an option when it can be recharged nearby within a reasonable amount of time in a user-friendly manner. Since the Federal Ministry of Transport and Digital Infrastructure (BMVI) began its electric mobility activities, the development of a comprehensive charging infrastructure has played a central role and ultimately flowed into the launch of the BMVI funding programme “Charging infrastructure for electric vehicles in Germany” in February 2017.

NOW GmbH is meeting the needs of this rise in importance since 2016 and established the charging infrastructure department within the transport working area, which received an increase in staff in 2017 in the run-up to the beginning of the new charging infrastructure funding guideline. The main tasks are in the area of coordination and implementation of the BMVI’s federal funding programme “Charging infrastructure for electric vehicles in Germany”, coordination of the associated accompanying research, technical support to the on-site electric mobility funding programme, the development of opinions and strategy papers as well as close networking and coordination with technical committees and other stakeholders. Another priority is the important launch, development and coordination of a new location tool for alternative fuels, particularly for charging infrastructure. The tool will be able to calculate demand for alternative fuel infrastructure as well as for existing publicly accessible locations for regular and fast-charging, as well as display location data of the alternative fuels of hydrogen and natural gas. At external events, the BMVI’s funding programmes on charging infrastructure will also actively be promoted.

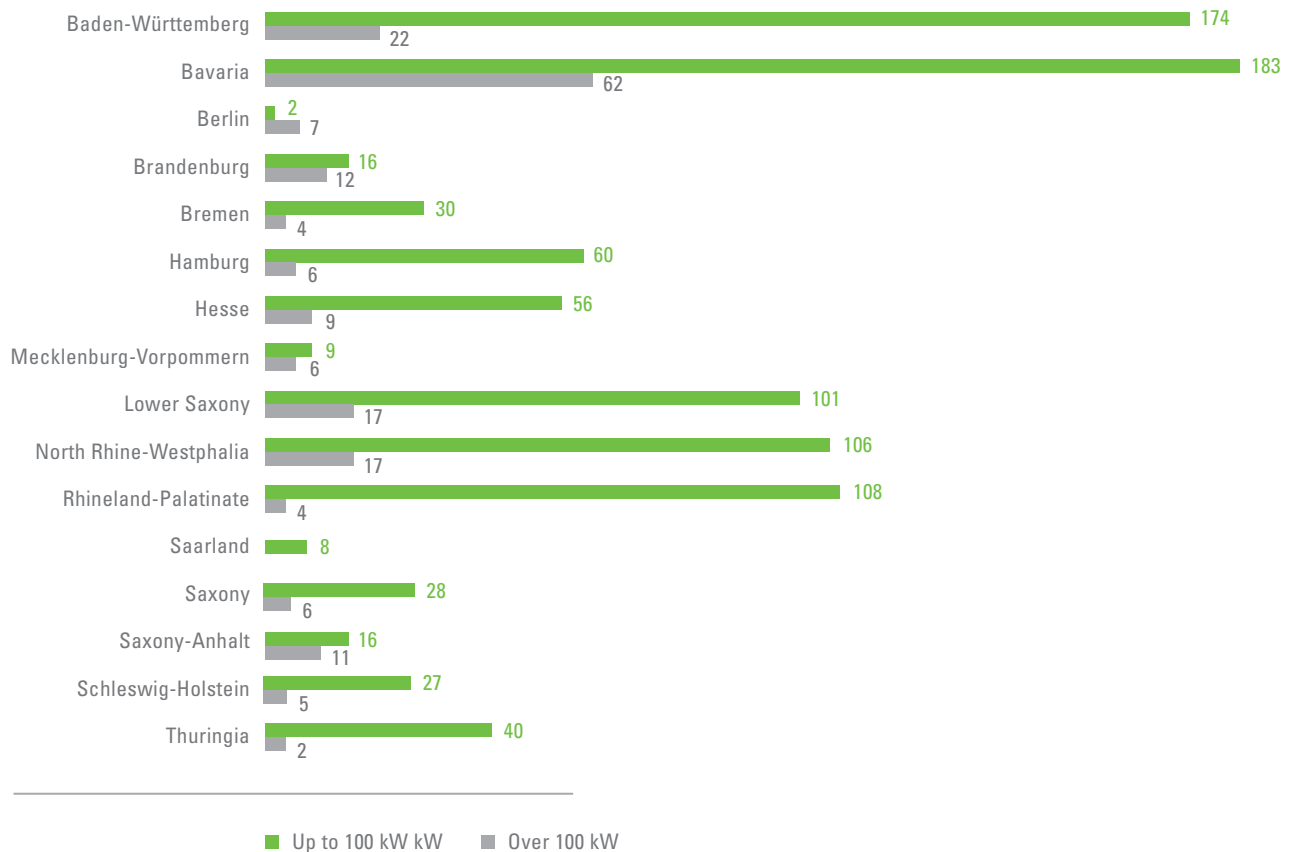


“Charging infrastructure for electric vehicles in Germany” federal funding programme

The BMVI's charging infrastructure funding guideline, which came into force on 15 February, makes a key contribution to building up a demand-based network of charging stations on a national level. The goal of the programme is to construct at least 5,000 fast-charging and 10,000 regular charging stations by the end of 2020. The BMVI is providing funding of 300 million euros to achieve this.

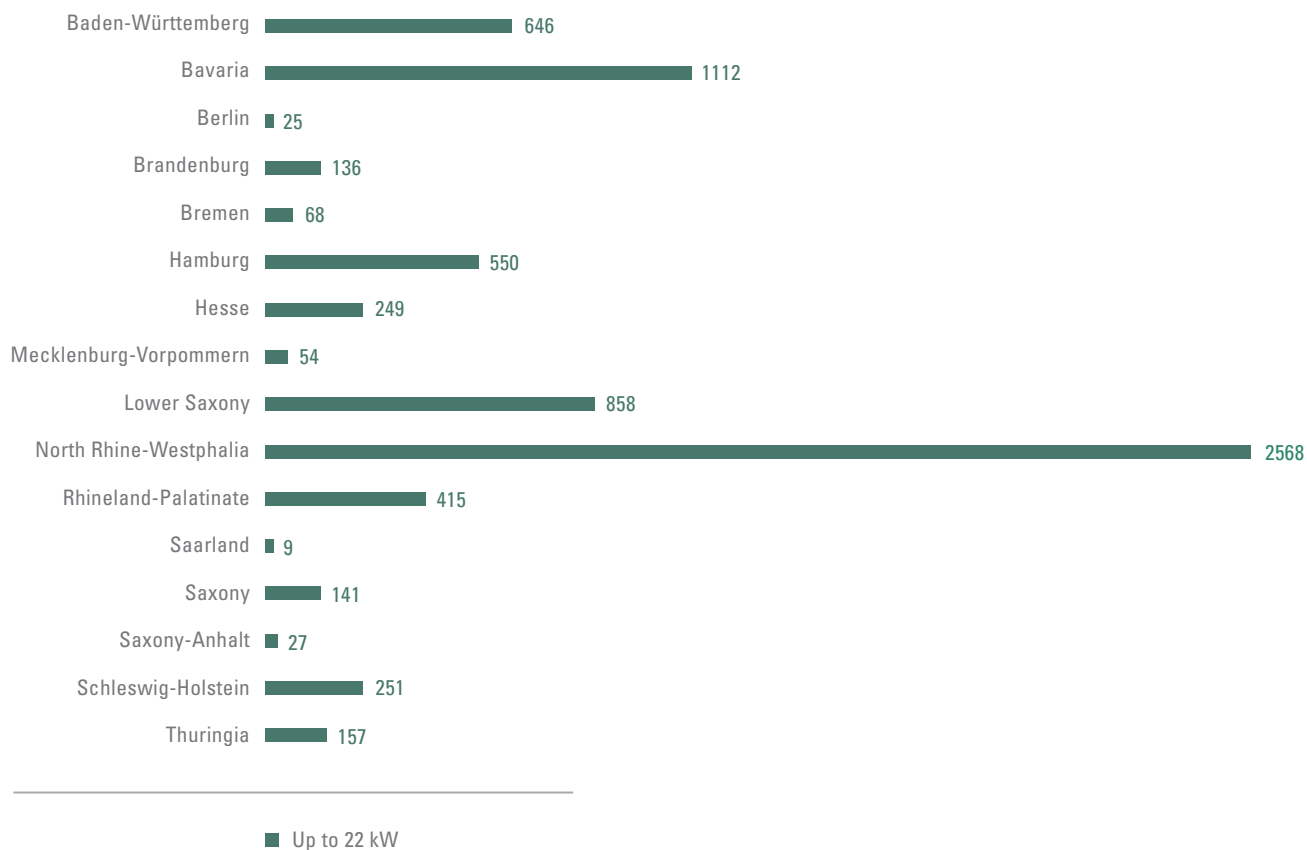
In 2017 two funding calls were opened, one from 1 March to 28 April, another from 14 September to 30 October. For the first call, funding was awarded on a ‘first come, first served’ basis. A total of 1,316 applications for grants were received. These applications were made by municipal authorities, municipal companies as well as private companies and are equally distributed throughout the regions of Germany (see following figure):

1st funding call: Performance classes for fast-charging points (approved, status as at 02.01.2018)



1st funding call: Performance classes for regular charging points

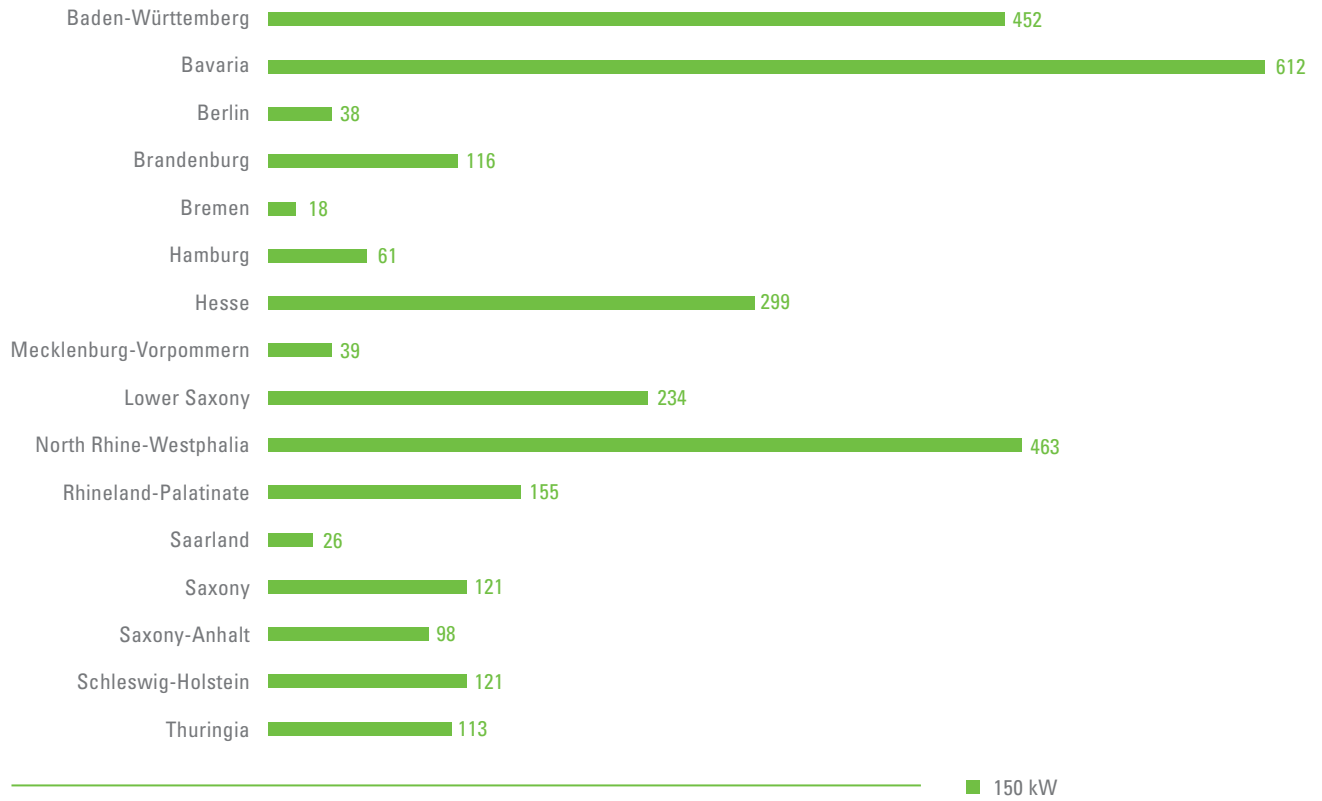
(approved, status as at 02.01.2018)



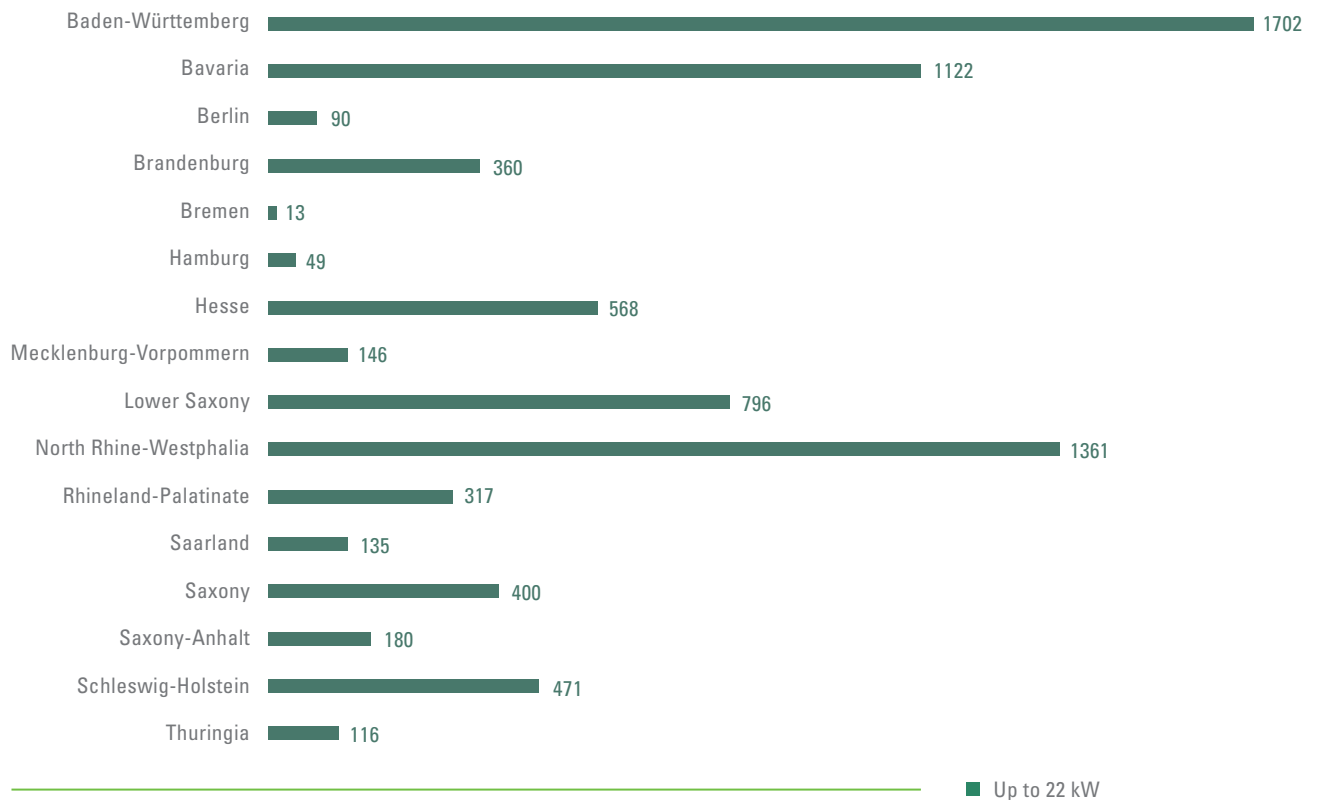
The second funding call was even more successful with 1,591 applications. The volume of funding applied for amounted to 135 million euros. Applications for the construction of fast-charging infrastructure with a charging capacity of 150 kW exceeded the available budget substantially. At present the Bundesanstalt für Verwaltungsdienstleistungen (BAV – Federal Agency for Administrative Services) is carrying out the approval procedure according to the feasibility study principle, i.e. the applications for which the least amount of funding is applied per kW charging capacity are approved first. These will be subdivided according to federal state and according to regular and fast-charging.

2nd funding call

Requested fast-charging points according to federal state

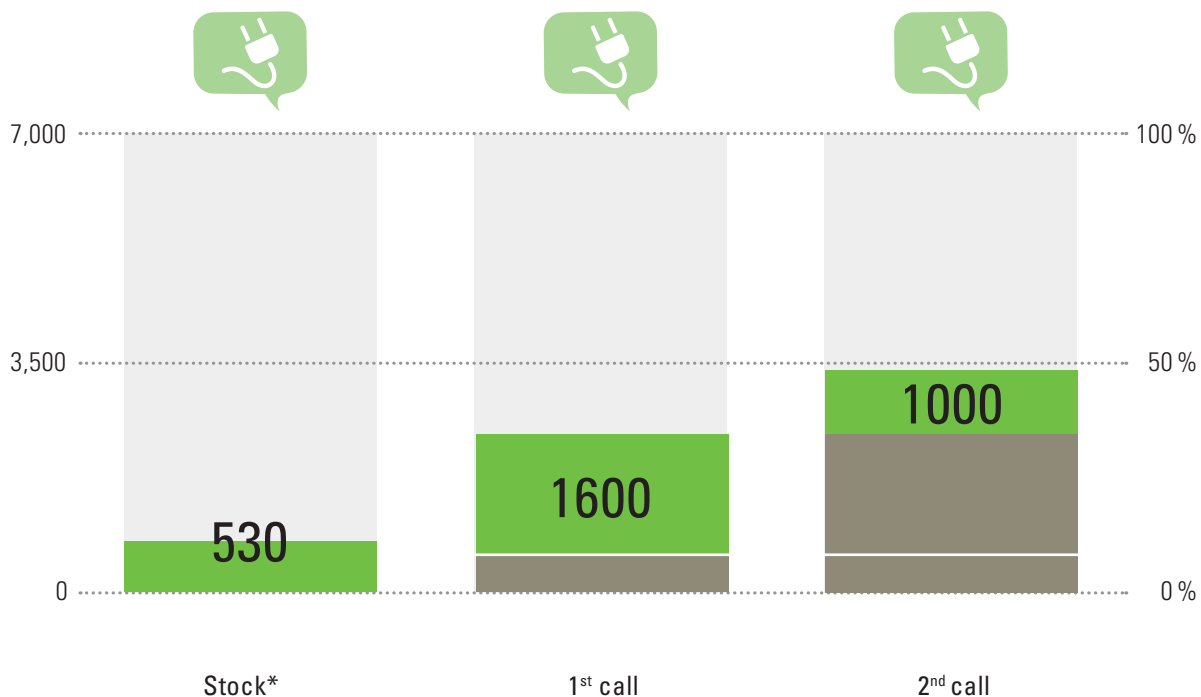
**2nd funding call**

Requested regular charging points according to federal state



In order to achieve the goals of the National Policy Framework (NPF) for infrastructure development of alternative fuels such as electricity, hydrogen and natural gas, the BMVI is initiating the Charging Infrastructure funding guideline with the support of NOW. The aim is to set up around 7,000 fast and 36,000 normal charging points.

On the path to 7,000 fast-charging points



*Source: BDEW survey: 30.06.2017

EXCURSUS: CHARGING TECHNOLOGY

Charging technology for every occasion

The charging of electric cars by cable is the most important charging technology because of its high prevalence. Batteries could not be exchanged in the past because, among other reasons, there are no standardised batteries for all electric vehicles. Inductive charging is still in the testing and development phase. Most vehicle types have a charging strategy that allows low alternating current charging capacity (AC) and high direct current charging capacity (DC). Therefore fast-charging is normally synonymous with direct current. How high the charging capacity is depends on the respective vehicle type and decisively, on the size of the battery. In smaller vehicle types a charging capacity of 50 kW upwards is foreseeable. Also larger vehicle types with a maximum charging capacity of around 150 kW are now expected, and in research projects higher charging capacities of over 400 kW are being technically tested.

Across Europe there are now uniform charging plugs for fast and regular charging. The so-called Type 2 plugs for alternating current and the so-called Combo 2 plugs for direct current charging of the Combined Charging System (CCS) are compulsory as the minimum standard for public charging points within the European Union. In Germany they will be provided at every charging point according to the charging column regulation of March 2016. Another type of plug for direct current charging of primarily Asian manufactured vehicles is the so-called CHAdeMO plug.

» There are now uniform charging plugs for fast and regular charging across Europe. «



Regenerative sources of energy can help fuel cell energy supply systems to be operated independently of the electricity grid.



ENBW BUILDS FAST-CHARGING INFRASTRUCTURE ALONG MOTORWAYS

EnBW Energie Baden-Württemberg AG is currently building a dense network of DC fast-charging infrastructure for electric vehicles at Autobahn Tank und Rast GmbH (ATR GmbH) locations. In this context EnBW AG has applied and received approval for a total of 5 million euros in funding for 80 locations under the first call of the BMVI funding guideline: "Charging infrastructure for electric vehicles".

With this project EnBW AG is expanding its existing DC fast-charging network in Baden-Württemberg beyond the state's boundaries. The company is first focusing on ATR GmbH sites along federal motorways in order to make a comprehensive network of DC fast-charging infrastructure available to electric vehicle users as quickly as possible and make electrified long-distance mobility as convenient as possible.

50 kW triple changers will be built at all subsidised locations, equipped with a Type 2 plug for AC charging, as well as both a CCS and a CHAdeMO plug for DC charging. Through an appropriately dimensioned grid connection, as well as the fitting of a 630 kVA transformer in the installation of the charging infrastructure, it is already being guaranteed today that higher loading capacities of up to 350 kW will also be possible via modular expansion at several charging points in future.

Several methods to authenticate, authorise and bill can be used at all DC fast-charging columns of EnBW AG. Aside from using the "EnBW mobility+" card, there is also the option of using the charging column through "intercharge direct" and through contactless credit cards as required.

Currently charging columns have been erected and are operating at 80 per cent of proposed locations. By the end of August 2018 at the latest, all funded charging columns will be installed and in operation.



PARTNER:
EnBW Kommunale Beteiligungen GmbH

PROJECT BUDGET/€:
12,000,000

FUNDING BUDGET/€:
5,000,000

COMMENCEMENT:
28 April 2017

CONCLUSION:
31 August 2018

LECHWERKE: DIRECT CURRENT FAST-CHARGING STATIONS FOR MOTORWAYS AND TRUNK ROADS

Lechwerke (LEW) is currently the largest operator of public charging infrastructure in the Bavaria-Swabia region with around 150 charging points for electric vehicles. In 2017 Lechwerke developed a regional concept that will considerably boost charging services once again, in particular in the area of direct current fast-charging technology. A subsidy note for this concept was awarded in the charging infrastructure for electric vehicles federal programme.

With the additional charging stations, which are funded through the charging infrastructure federal programme, Lechwerke is driving electric mobility further forward – above all with fast-charging stations along motorways and trunk roads. Electric cars can be fully charged in less than half an hour depending on the vehicle model. Time which can be spent taking a break, drinking a coffee or stretching the legs.

At the Lechwerke charging columns, recharging operates on the one hand through a contract-based option, but it can also occur spontaneously. This can then be paid through the “innogy eCharge-App” via credit card or PayPal. The planned charging columns will be integrated in the largest German roaming network, Hubeject.

At all public LEW charging columns e-cars are charged with green electricity from renewable energy. The development of the network constitutes another building block of the energy transition in the transport sector and secures a pioneering role for the Bavaria-Swabia region in terms of electric mobility.



PARTNER:
Lechwerke AG

PROJECT BUDGET/€:
5,600,000

FUNDING BUDGET/€:
2,900,000

COMMENCEMENT:
18 August 2017

CONCLUSION:
8 March 2018

Charging point for normal
charging at up to 22 kW





STUTT GART AIRPORT IS ESTBLISHING A FAST-CHARGING NETWORK FOR ELECTRIC VEHICLES

Since December 2017, Stuttgart Airport has provided 33 new charging points for electric vehicles as part of the federal charging infrastructure funding programme. Seven of the points belong to cutting-edge fast-charging stations at which suitable vehicles can be charged in the shortest possible time. 100 per cent of the energy for this comes from renewable sources.

The electric filling stations are located in car park P7 directly in front of the terminal building, on level 3 of car park P14 and in the "Kiss & Ride" area of the Stuttgart Airport Bus Terminal (SAB). Those buying a parking ticket can currently recharge there, free of charge. Vehicle batteries with an output of up to 150 kilowatts can be recharged even during just a short stop at one of the seven direct current connections for quick charging, including of one CHAdeMO and five CCS plugs. The other 26 charging points have a Type 2 plug with a maximum charging capacity of 11 kW. The electrification project is funded by the Federal Ministry of Transport and Digital Infrastructure. In the context of the first call for funding in spring 2017, the corresponding funding decision was issued.

Stuttgart Airport is to be climate-neutral by 2050. The expansion of the charging infrastructure is therefore an essential aspect of this strategy for the future. Road traffic to and from the airport currently contributes over a third of the airport's carbon footprint. With this measure, the airport intends to create an incentive to travel with more environmentally friendly battery-powered vehicles. The airport has set itself the long-term goal of becoming one of the most efficient and sustainable airports in Europe.



PARTNER:
Flughafen Stuttgart

PROJECT BUDGET/€:
809,800

FUNDING BUDGET/€:
273,000

COMMENCEMENT:
7 June 2017

CONCLUSION:
6 June 2019



Managing Director Walter Schoefer and Elias Siehler (FV-2) test the new charging point at car park P7.

SECURING MOBILITY, PROVIDING INFRASTRUCTURE, HAMBURG TAKES ACTION.

“MOIN, Hamburg”

The Free and Hanseatic City of Hamburg is a growing metropolis and an important northern European transport hub. As a former European environmental capital, Hamburg is particularly committed to the principle of sustainability and – in accordance with the city development strategy 2030 entitled “Green, fair, growing city by the water” – is continuously working to improve the social, economic and environmental conditions of the city’s citizens. The resolute switch to electric vehicles is a decisive step in this direction.

With the “Master Plan for the Further Development of the Publicly Accessible Charging Infrastructure for Electric Vehicles in Hamburg” adopted in August 2014, the Senate specified the framework conditions for the demand-oriented expansion of the charging infrastructure and set specific qualitative and quantitative targets for its operational implementation.

Following the successful completion of this first stage of expansion, the existing network of urban charging infrastructure in Hamburg is to be further expanded and significantly densified. For this concept of making the charging infrastructure denser, Hamburg is planning the further establishment of 241 AC regular charging stations, 59 DC triple chargers and a high-power charger. The city has received funds from the federal charging infrastructure programme of the Federal Ministry of Transport and Digital Infrastructure (BMVI) amounting to approx. 2.8 million euros, with the aim of having a total of 1,000 publicly accessible charging points in Hamburg by 2019.

Currently (as at 22.3.18), 278 charging points (105 AC and 33 DC) have already been implemented at 139 locations, bringing the total number of publicly accessible charging points available in Hamburg to 733 (691 of which are operated by Stadische Stromnetz Hamburg GmbH).



PARTNER:
Freie und Hansestadt Hamburg

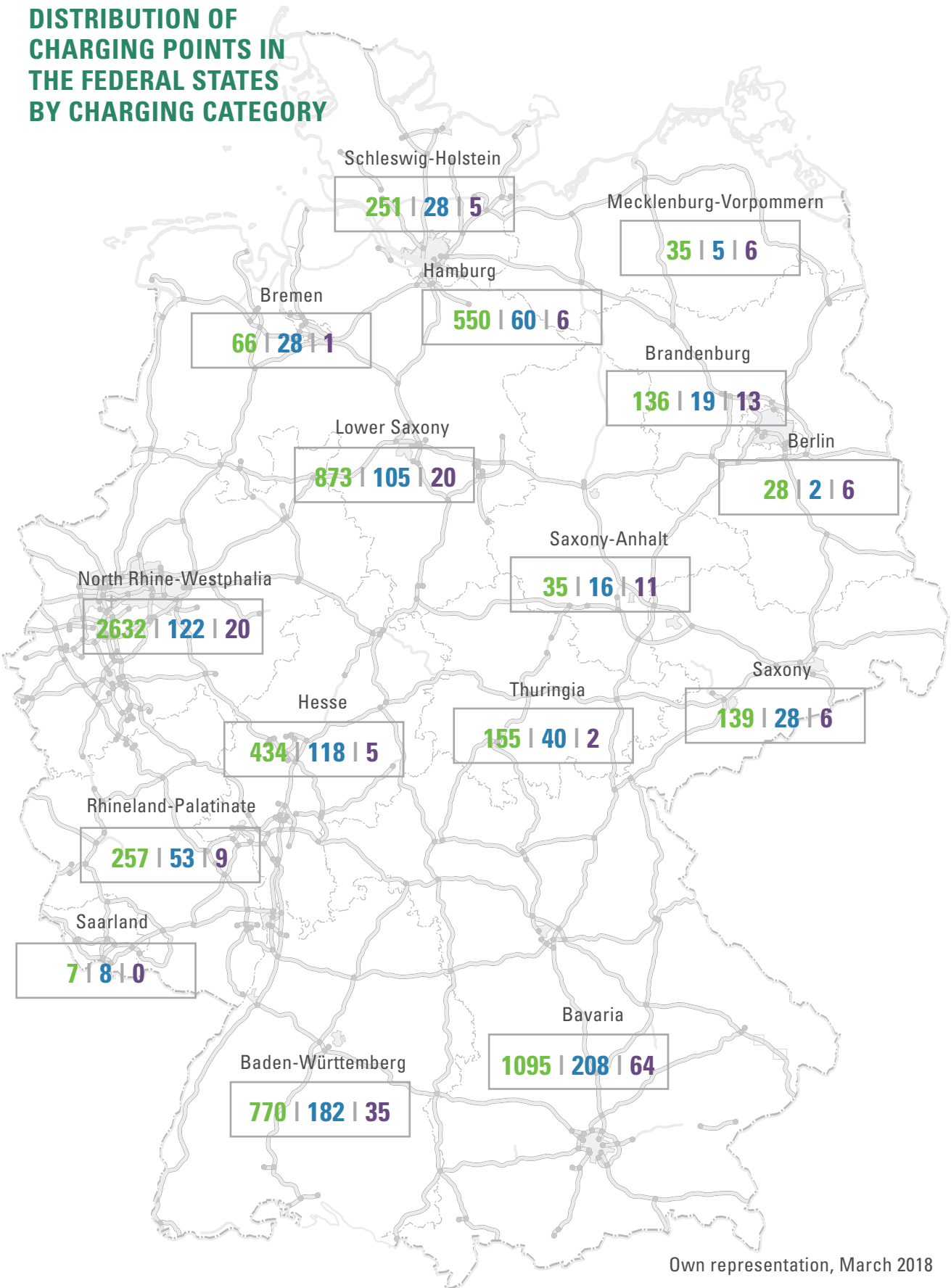
PROJECT BUDGET/€:
7,503,804

FUNDING BUDGET/€:
2,810,781

COMMENCEMENT:
1 May 2017

CONCLUSION:
30 April 2018

DISTRIBUTION OF CHARGING POINTS IN THE FEDERAL STATES BY CHARGING CATEGORY



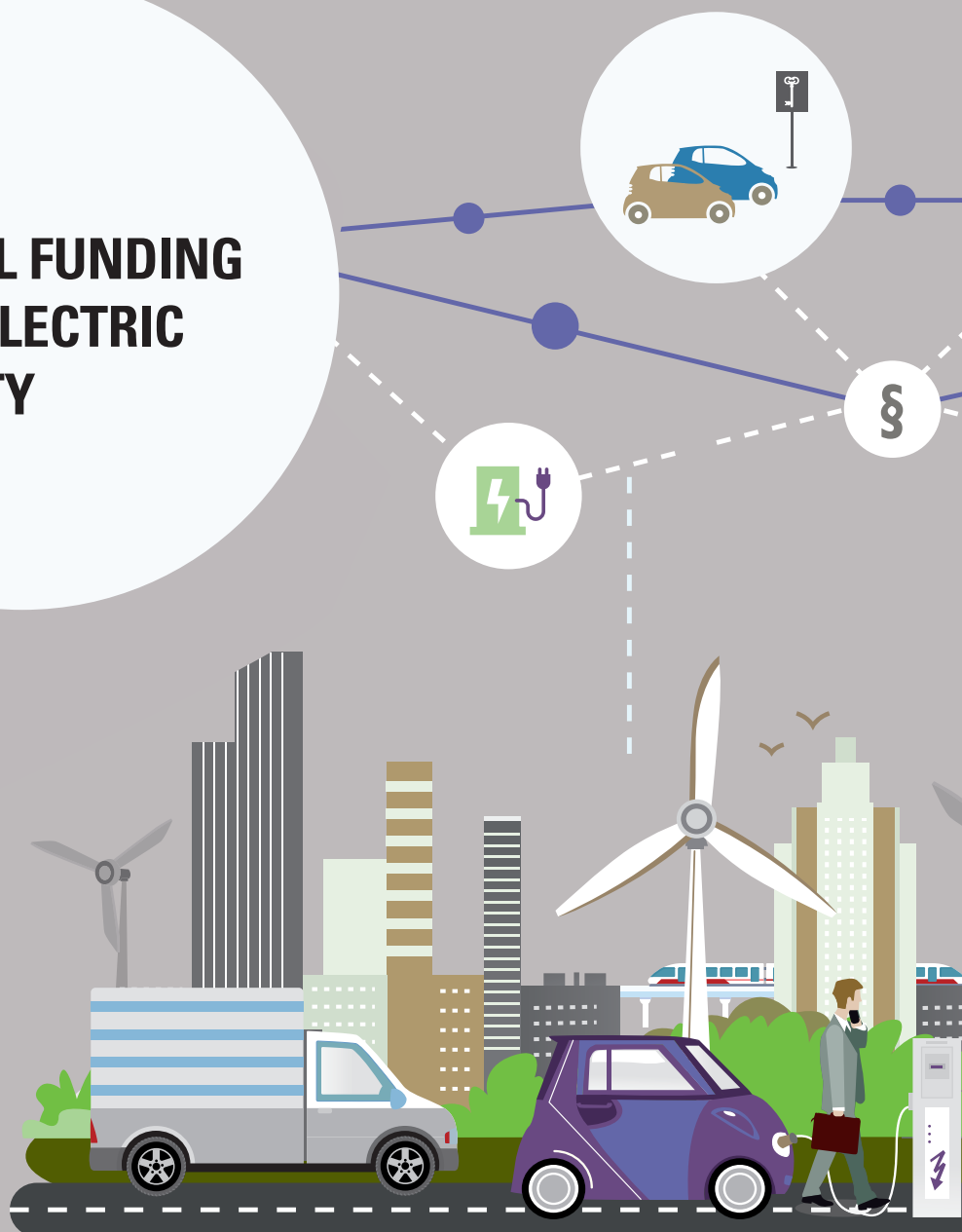
NORMAL CHARGING POINTS | FAST CHARGING POINTS UP TO 100 KW | FAST CHARGING POINTS OVER 100 KW

The Type 2 plug is the charging plug that has been defined by the European Commission as the standard for alternating current charging throughout Europe.





III. FEDERAL FUNDING LOCAL ELECTRIC MOBILITY



THE PROJECTS ON THE FOLLOWING PAGES ARE LABELLED WITH III / 01 – III / 08.



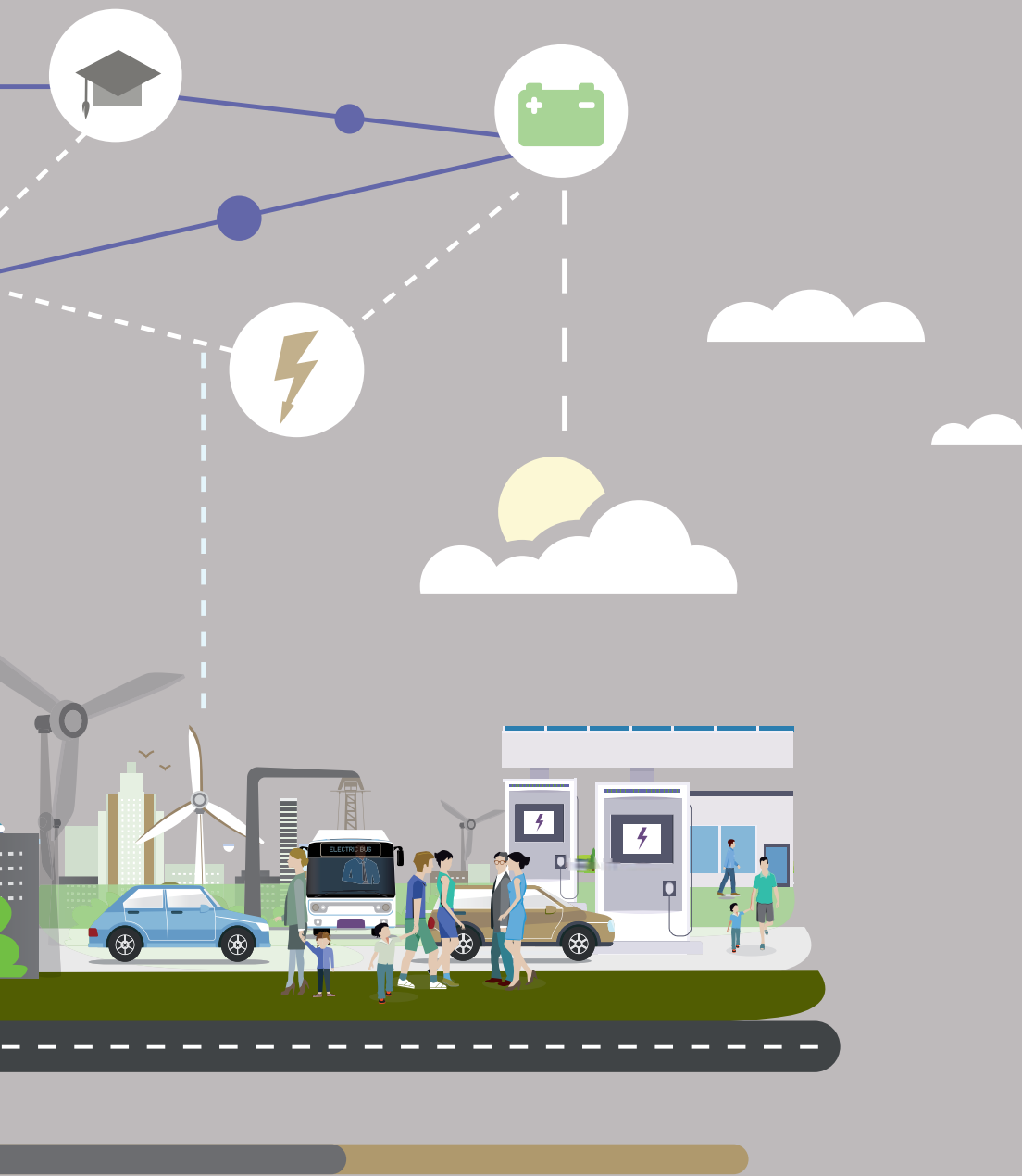
NEWLY APPROVED PROJECTS



COMPLETED PROJECTS



INTERDISCIPLINARY THEMES



ELECTRIC MOBILITY AS THE CORNERSTONE OF THE ENERGY TRANSITION



Funding priority: Electric mobility

The federal government supports the collaboration of industry, science and the public sector in order to help establish alternative mobility concepts which are open to all types of technology across all transport modes on the market. The electrification of the transport sector in particular serves the objective of making mobility more energy efficient, more climate- and environmentally-friendly in the future and of reducing dependence on fossil resources. On 9 June 2015 the BMVI's electric mobility funding guideline was published. It is the foundation for an uninterrupted continuation of the electric mobility funding programme. Through the guideline the BMVI supports the procurement of electric vehicles, particularly in municipal fleets, in order to increase overall vehicle numbers. Parallel to this, the coordinated establishment of a demand-based and strategically-located charging infrastructure including linking vehicles up to the electrical grid will be funded, combined with the development of renewable energy. Furthermore, municipal authorities can submit electric mobility concepts (so-called environmental studies), in order to better integrate the topic of electric mobility in the area of municipal decision-making. Apart from the procurement of electric vehicles and the funding of electric mobility concepts, research and development projects will also continue to be funded as the third instrument.

Based on the funding guideline, calls on the three funding areas are published annually. They facilitate adjustments in the programme and adaptations to market needs as well as providing the necessary leeway to support the market ramp-up as optimally as possible.



2017 was characterised by public discussion on reducing nitrogen oxide emissions in the municipalities. In the course of the diesel summit in August and both municipal summits in September and October of 2017, the “Immediate programme for clean air 2017-2020” was produced, which also impacts the existing electric mobility funding guideline. Its term was extended to December 2020 and now funding of private charging infrastructure for building up vehicle fleets will be facilitated as well. Furthermore, some formal adjustments took place in order to simplify the filing of submissions, especially for vehicle procurement. The “Call for submission filing for funding electric vehicles and the operation of necessary charging infrastructure” was published in December 2017. The electric mobility funding guideline is proving itself to be a good comprehensive instrument for reacting quickly to the current political concerns.



Organisational structure for implementation

The BMVI ensures anchoring in the political context and together with the federal government, is responsible for the content-related centre of gravity in the electric mobility area. NOW's core tasks include the definition and selection of programmatic priorities in coordination with the BMVI, the coordination of scientific accompanying research, programme coordination, strategic programme development as well as the management of individual projects.

Projektträger Jülich (PtJ) is responsible for project administration and supports the programme with funding consultancy. Coordination on the regional level takes place through regional networks (project coordination centres), occupied by regional stakeholders from the spheres of business development, municipal utilities, energy agencies and other public-private partnerships. They ensure exchange between local project partners and organise local and regional participation in the programme.

Interregional exchange takes place in the strategy circle of the BMVI. It forms the platform through which representatives from the regional networks, players from accompanying research as well as the BMVI, NOW and PtJ, determine programme activities.

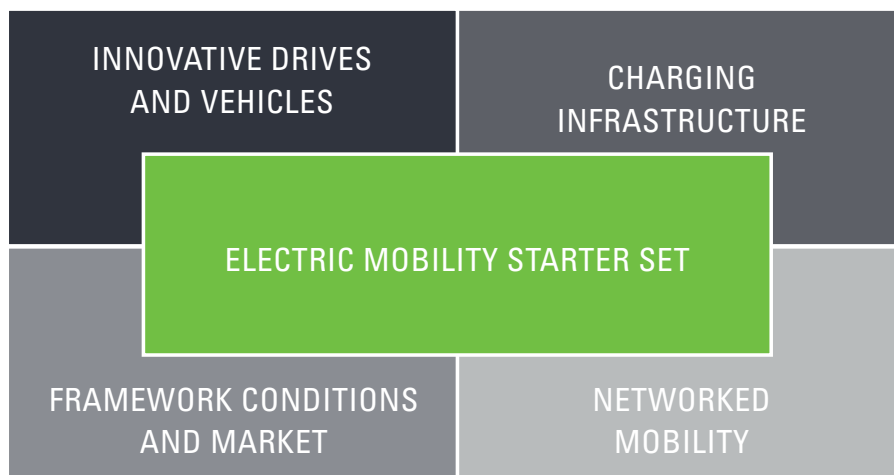


Local electric mobility accompanying research programme

With the market ramp-up underway and the publication of the funding guideline adapted to market requirements, in 2015 the focus turned to accompanying themes. With the clear objective of supporting the market ramp-up, four important topics were identified, which represent the pillars of the ongoing accompanying research to the programme.

The goal of the accompanying research is the consolidation and evaluation of project results from all three funding areas (vehicle procurement, electric mobility concepts and R&D projects). Together with all participating companies and organisations a lively exchange takes place, knowledge is deepened and new stakeholders empowered to enter the area of electric mobility.

The information is contained in the electric mobility starter set or directly transferred to the relevant stakeholders of the thematic fields and municipal actors. The compiled data overview from the projects was maintained through central data monitoring.



Focus of the accompanying research since 2015

ACCOMPANYING RESEARCH IN THE ELECTRIC MOBILITY PROGRAMME

Topic: Innovative drives and vehicles

The bus vehicle class is the focus of the innovative drives and vehicles topic of the accompanying research on the electric mobility funding programme. The call for proposals on the topic is being prepared and will be rolled out in 2018. The deployment of buses currently running will be monitored and technically evaluated in the accompanying research. Particularly relevant here are the buses' availability, energy consumption and maximum range. The focus of the accompanying research is not only on battery buses alone, fuel cell buses and trolley buses will also be examined. Different charging concepts will be considered for battery buses. Based on technical assessments the different drive types will be evaluated and compared. A practical decision-making aid for bus operators will be created on this basis.

The accompanying research will clarify how well the latest electric bus technology performs in real operation in terms of reliability, energy consumption and range, what influence auxiliary users have on energy efficiency, what effect charging and refuelling infrastructure has on availability and operation, how different electric drive types (battery, fuel cell, trolley) compare, and for which application cases (city bus vs. bus in rural areas) which drive types are most suitable.

Parallel to the accompanying research, the joint working group of the Federal Ministry of Transport and Digital Infrastructure (BMVI) and the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) will continue its work on the theme of buses. The inaugural meeting of bus operators, manufacturers, suppliers and political and municipal representatives took place in December 2017.

Topic: Framework conditions and market

The success of electric mobility is to a large extent dependent on political and societal framework conditions. The accompanying research “Framework conditions and market” observes these external influences and their relevance for the market penetration of electric mobility. The research deals with the mobility behaviour and needs of potential customers from the private, public and commercial area and the question of how electric mobility can serve these needs. In addition, recommendations for action for legal and political decisions will be prepared, which might help electric mobility achieve breakthrough. Developments in Germany will be comprehensively analysed and evaluated for this and compared with those from selected international markets.

The accompanying research will also explain how general framework conditions (laws, policy, market, societal trends) affect the market ramp-up of electric mobility, what recommendations for action can be made to individual stakeholders, to what extent empirical values from within and outside the EU can be drawn upon and for which fleet applications is the use of electric vehicles worthwhile from operational and financial perspectives.

The accompanying research “Framework conditions and market” conducted two workshops on the theme of “Electric mobility in urban logistics” with relevant stakeholders. Here obstacles and incentives, patterns of use, possible fleet concepts as well as the municipal role and existing funding gaps were discussed. At the thematic meeting: “Strategies for the spread of electric mobility: orientation on mobility behaviour” in September 2017, the Karlsruhe Institute of Technology (KIT) presented the results of the analyses of mobility behaviour and needs of private households, commercial and municipal fleets. It became clear that there are already now private and commercial user profiles and application areas which are both suitable for electric vehicle use and are profitable.

Topic: Networked mobility

Following its launch in July 2016, networked mobility accompanying research intensified its work in all fields. The focus is on the interface of different electric mobility applications and different transport operators as well as between electric mobility and the energy industry with an emphasis on the establishment and development of competencies on the municipal level.

The priorities of the accompanying research are electric mobility as a component of municipal mobility strategies, their contribution to linking the transport sector with the energy system, the evaluation of municipal electric mobility concepts in the electric mobility programme and the conducting of a town survey.

In the framework of the accompanying research, the first thematic meeting took place in 2017 with an emphasis on sector coupling as well as three workshops on the issues of evaluation methodology, distribution network operators and electrification of fleets.

The methodology for the evaluation of electric mobility concepts and mobility strategies has been concluded, thus the evaluation can begin in 2018. In addition, the questionnaire for the town survey was finalised and the survey commenced in November 2017. The first interim results were released at the electric mobility conference in Leipzig (26 & 27 February 2018). The final results of the town survey are expected to be published in June 2018.

The discussions in the area of sector coupling clearly demonstrate that when planning electric mobility, municipalities must address the challenges for distribution networks in a more committed way, in particular in terms of linking electric mobility with the use of local renewable energies. At present the theme of renewable energies is still dealt with in a secondary manner. Overall it should be noted that the customer desire for a charging procedure with maximum output conflicts with the efficiency guidelines of the network operators. High outputs are at first glance associated with network expansion. To avoid this development, load management and buffer storage is preferred. Smart grids can also result in load reduction on the network, hence an intelligent management of the networks will be facilitated in the future. On the municipal level, in future an electric mobility concept with scenarios on the market ramp-up must be a component and a requirement of awarding licenses. Crucially the question of the network expansion and making infrastructure available is accompanied by other question: what is the right to mobility? How much output does the distribution network operator make available to different user groups?

Interim results in the area of electric mobility concepts show that electric mobility is addressed in a very differentiated way (➤ **see electric mobility concepts chapter**). In transport development plans and climate protection concepts, electric mobility still plays a subordinate role. Through the electric mobility starter set a map on the concepts was created, where the final reports can be found in future.

➤ www.starterset-elektromobilität.de/Infothek/elektromobilitaetskonzepte

» The focus is on the interface of different electric mobility applications and different transport operators as well as between electric mobility and the energy industry with an emphasis on the establishment and development of competencies on the municipal level. «

Topic: Charging infrastructure

In 2017, NOW was tasked with conducting the charging infrastructure accompanying research. The team is currently being brought together and the accompanying research content defined. The research team will then actively begin its work in 2018.

The accompanying research on the charging infrastructure federal funding programme will examine the latter's influence on the expansion of charging infrastructure and develop recommendations for action for more content and/or funding programmes. It deals with the technical challenges of charging scenarios and integration in the renewable energy system (sector coupling). Furthermore, it looks at the operational challenges of charging scenarios for municipalities, public transport operators, fleet operators and special transportation and develops perspectives for the expansion of charging infrastructure and market development scenarios for the period after 2020/2025.

» The accompanying research on the charging infrastructure federal funding programme will examine the latter's influence on the expansion of charging infrastructure and develop recommendations for action for more content and/or funding programmes.«

Electric tractor: alternative drives are increasingly gaining in significance in the logistics sector.





PROCUREMENT PROJECTS SUPPORT MARKET RAMP-UP

The BMVI is supporting the start of the market ramp-up of electric vehicles through the projects approved under the *Electric mobility funding guideline*. Municipal authorities are at the focus of this funding. These are of central importance as catalysts and shapers for introducing electric mobility. By converting fleets or by operating local public transport, they can act as role models for companies as well as citizens.

One of the priorities of the current funding support is the procurement of e-vehicles (cars, commercial vehicles and e-buses) as well as the establishment and development of the required charging infrastructure. Applicants can be municipal authorities and municipal companies. Commercial companies that are a part of a municipal electric mobility concept will also be funded, however.

For the operators of municipal and commercial fleets, the use of electric vehicles is worthwhile from a number of perspectives. Through the successive integration of electric vehicles in their own fleets, harmful emissions (CO₂, NO_x) can be sustainably reduced. Because the daily mission profile of many trips is already known, electric vehicles can also be organised in a targeted way everywhere where distances are calculable or interim recharging is possible.

The use of electric commercial or special vehicles will be demonstrated under the funding programme. Within individual funding projects there is also the option for public sector staff to also use electric vehicles from the municipal fleet in car-sharing models. Through this staff can gain experience throughout their everyday business as well as private use and improve their emissions balance. Furthermore, overall costs decrease because the vehicles are better utilised.

Urban transport companies, which ensure public transport with buses on a local and regional level, can purchase battery-electric buses under the procurement funding and test them in line service. This can signal the start of changing the fleet over from diesel to electric buses.



The BMVI funds both the procurement of electric vehicles as well as the corresponding charging infrastructure.

Throughout three funding calls in the period of July 2015 to January 2017, the BMVI invited the submission of proposals for the procurement of electric vehicles and associated charging infrastructure. Over the three calls (July/August 2015, March to May 2016, November 2016 to January 2017), 158 applications were approved. The BMVI thus facilitated the procurement of 2,546 electric vehicles nationwide and 947 associated charging points and made a total of 31.9 million euros available in funding. Among the 2,546 approved electric vehicles, there were eight e-trucks, 108 battery buses and 84 special vehicles as well as 2,346 passenger cars.

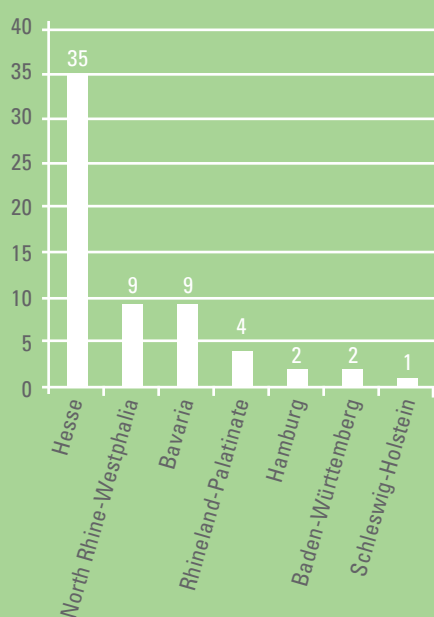
Of the 947 approved charging points, with 788 acquisitions, normal charging (11/22 kW) was the most sought after charging option, followed by DC fast-charging columns (87) and bus/ truck charging infrastructure (72).

Different lease providers also submitted applications for procurement funding. They are obliged to be a part of a municipal electric mobility concept and the funding must be passed on to the lessee in the municipalities. In all, 1,370 electric vehicles have been purchased through leasing providers over the three funding calls.

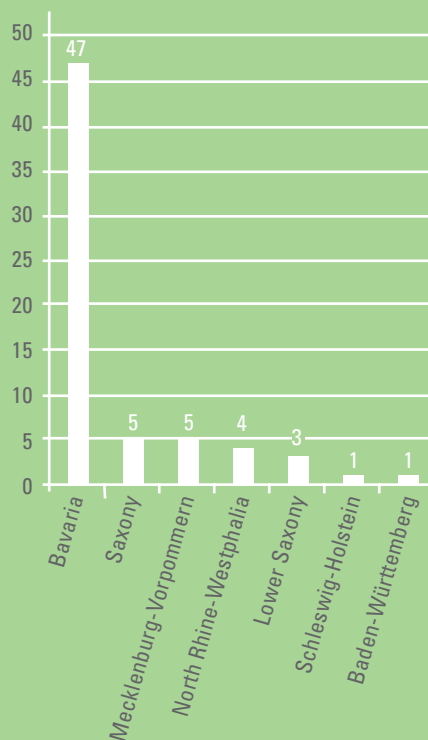
OVERVIEW OF PROCUREMENTS IN 2017

(cumulative figures from the funding calls 2015–2017)

Battery buses

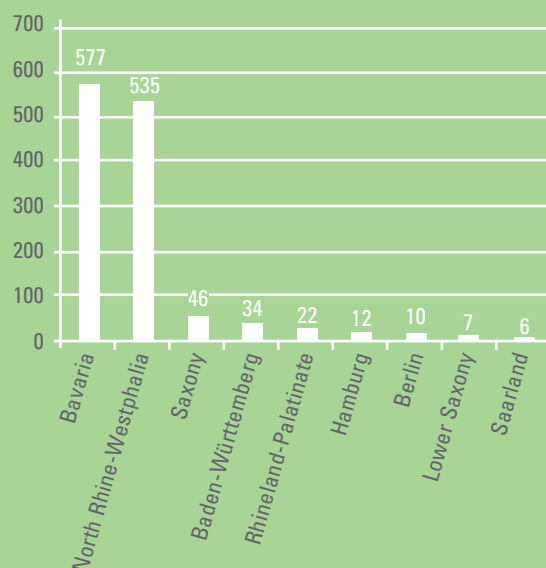


Special vehicles



Electric vehicles

(passenger and light commercial vehicles)





One of the first self-driving small electric buses – operating since December 2017 as a shuttle on the EUREF campus in Berlin.

APPROVED PROCUREMENTS IN THE BMVI ELECTRIC MOBILITY PROGRAMME 2017

PROJECT	COMMENCEMENT	CONCLUSION	FUNDING	PARTNER
			[€]	



03EMI101	01.01.2017	30.06.2018	392,814	Stadt Trebbin
03EMI108	01.01.2017	30.06.2018	781,644	Volkswagen Leasing Gesellschaft mit beschränkter Haftung
03EMI109	01.01.2017	31.12.2018	194,010	Stadtverkehr Eckernförde, Inh. Kerstin Bügler eingetragene Kauffrau
03EMI111	01.01.2017	30.06.2018	781,644	Volkswagen Leasing Gesellschaft mit beschränkter Haftung
03EMI122	01.01.2017	31.12.2018	295,040	SWEG Südwestdeutsche Verkehrs-Aktiengesellschaft
03EMI125	01.01.2017	31.12.2018	747,523	Flughafen München Gesellschaft mit beschränkter Haftung
03EMI126	01.01.2017	31.12.2018	30,743	Stadt Lichtenfels
03EMI128	01.01.2017	31.12.2018	43,252	Hannover Aviation Ground Services GmbH
03EMI131	01.01.2017	31.12.2018	27,036	Stadt Bonn
03EMI132	01.01.2017	31.12.2020	115,159	Autohaus von der Weppen GmbH & Co. KG
03EMI136	01.01.2017	31.12.2018	14,841	Gemeinde Mörlenbach
03EMI138	01.01.2017	31.12.2018	43,140	Stadt Kassel
03EMI144	01.01.2017	31.12.2018	19,953	Versorgungsbetriebe Elbe GmbH
03EMI147	01.01.2017	31.12.2018	13,427	Stadtwerke Radevormwald GmbH
03EMI150	01.01.2017	31.12.2018	55,817	Flecken Steyerberg
03EMI152	01.01.2017	31.12.2018	100,918	Stadt Bottrop
03EMI158	01.01.2017	31.12.2018	173,708	Hütter-Lidle Linienverkehr GmbH & Co. KG
03EMI161	01.01.2017	31.12.2018	150,844	Stadtwerke Düsseldorf AG
03EMI173	01.01.2017	31.12.2019	29,725	Stadt Geldern
03EMI174	01.01.2017	31.12.2018	52,519	Stadt Bad Windsheim
03EMI180	01.01.2017	31.12.2018	1,763,500	Verkehrsbetriebe Hamburg-Holstein GmbH
03EMI181	01.01.2017	31.12.2018	83,162	Abfallwirtschaft und Stadtreinigung Freiburg GmbH
03EMI182	01.01.2017	31.12.2018	232,088	BFS Business Fleet Services GmbH
03EMI183	01.01.2017	30.06.2017	50,964	Flughafen Hamburg Gesellschaft mit beschränkter Haftung
03EMI185	01.01.2017	31.12.2018	345,000	Reisebüro & Omnibusbetrieb Karsten Brust
03EMI233	01.01.2017	30.06.2018	12,000	Stadt Greding
03EMI216	01.02.2017	31.12.2018	36,927	Energie- und Wasserversorgung Bünde GmbH
03EMI231	01.02.2017	31.12.2017	60,483	Flughafen Dortmund GmbH
03EMI141	01.03.2017	28.02.2019	157,216	Vestische Straßenbahnen GmbH
03EMI160	01.03.2017	28.02.2019	17,065	Gemeinde Gottmadingen

PROJECT	COMMENCEMENT	LAUFZEITENDE	CONCLUSION	PARTNER
			[€]	

03EMI263	01.03.2017	31.12.2018	48,761	Okhan Özer
03EMI214	04.03.2017	31.12.2018	62,952	Stadtwerke Zweibrücken GmbH
03EMI104	01.04.2017	31.12.2018	753,349	Eichberger Reisen GmbH & Co. KG
03EMI201	01.05.2017	31.12.2018	16,200	MV Dresden Zustellservice GmbH
03EMI202	01.05.2017	31.12.2018	25,320	Stadtwerke Konstanz GmbH
03EMI205	01.05.2017	31.12.2018	214,806	Stadtwerke Tübingen GmbH
03EMI228	01.05.2017	31.12.2018	6,750	Nierste Gartenservice GmbH
03EMI230	01.05.2017	31.12.2018	21,337	Landratsamt Alb-Donau-Kreis
03EMI204	01.06.2017	31.12.2018	259,064	Duisburger Verkehrsgesellschaft Aktiengesellschaft
03EMI215	01.06.2017	31.12.2018	419,600	Stadtwerke Münster GmbH
03EMI219	01.06.2017	30.06.2018	23,762	Pflegedienst Strobel GmbH
03EMI229	01.06.2017	30.06.2018	54,798	Stadtwerke Gütersloh GmbH
03EMI237	01.06.2017	31.12.2018	21,930	Stadt Aschaffenburg
03EMI242	01.06.2017	30.06.2018	51,500	Stadt Bretten
03EMI245	01.06.2017	31.12.2018	4,145,850	ESWE Verkehrsgesellschaft mbH
03EMI248	01.06.2017	31.12.2018	456,996	Stadtwerke Neuss GmbH
03EMI250	01.06.2017	31.12.2018	57,843	Stadt Würzburg
03EMI251	01.06.2017	31.12.2018	53,874	Gemeinde Rasdorf
03EMI256	01.06.2017	31.12.2018	1,631,072	Alphabet Fuhrparkmanagement GmbH
03EMI123	01.07.2017	31.12.2020	151,809	Landeshauptstadt München - Stadtkämmerei II/22
03EMI203	01.07.2017	31.12.2018	62,782	Gemeinde Eching
03EMI206	01.07.2017	31.12.2018	29,922	Gemeinde Kahl am Main
03EMI207	01.07.2017	31.12.2018	209,445	Stadtwerke Neuss Energie und Wasser GmbH
03EMI208	01.07.2017	31.12.2018	161,600	Jagdschlossexpress und Ausflugsfahrten GmbH
03EMI209	01.07.2017	31.12.2018	91,102	EWIBO- Entwicklungs und Betriebsgesellschaft der Stadt Bocholt mbH
03EMI210	01.07.2017	31.12.2018	35,845	Stadtwerke Bamberg Verkehrs- und Park GmbH
03EMI211	01.07.2017	31.12.2018	6,069	Stadt Lohmar
03EMI217	01.07.2017	31.12.2018	38,340	GroundSTARS GmbH & Co. KG
03EMI218	01.07.2017	31.12.2019	28,260	Stadt Dülmen
03EMI220	01.07.2017	31.12.2018	28,045	Gemeinde Kall

PROJECT	COMMENCEMENT	CONCLUSION	FUNDING	PARTNER
			[€]	



03EMI221	01.07.2017	30.06.2019	76,426	Mobility Center GmbH
03EMI222	01.07.2017	30.06.2019	11,857	Stadt Bad Säckingen
03EMI224	01.07.2017	30.06.2019	23,002	Stadtwerke Service Meerbusch Willich GmbH & Co. KG
03EMI226	01.07.2017	30.06.2019	321,300	Brodtschelm Verkehrsbetrieb GmbH
03EMI227	01.07.2017	30.06.2019	20,990	Stadt Rennigen
03EMI235	01.07.2017	02.01.2019	15,407	Amt Hohe Elbgeest
03EMI239	01.07.2017	30.06.2019	197,742	ENSO NETZ GmbH
03EMI243	01.07.2017	30.06.2019	33,242	Stadt Andernach
03EMI244	01.07.2017	30.06.2019	249,380	Kreisverkehrsgesellschaft in Pinneberg mbH
03EMI247	01.07.2017	30.06.2019	253,840	STARS Special Transport and Ramp Services GmbH & Co. KG
03EMI249	01.07.2017	30.06.2019	37,372	Hannover Aviation Ground Services GmbH
03EMI252	01.07.2017	30.06.2019	44,479	Regional- und Energiegenossenschaft Aller-Leine-Weser eG
03EMI254	01.07.2017	30.06.2019	55,997	NEW AG
03EMI257	01.07.2017	30.06.2019	119,093	Stadt Waldkraiburg
03EMI258	01.07.2017	30.06.2019	22,483	Abwasserbetrieb Troisdorf, Anstalt des öffentlichen Rechts
03EMI259	01.07.2017	30.06.2019	2,674,213	RCI Banque S.A. Niederlassung Deutschland
03EMI262	01.07.2017	31.12.2018	44,430	Stadt Rheinberg
03EMI265	01.07.2017	30.06.2019	136,999	Hansestadt Lübeck
03EMI223	01.08.2017	31.07.2019	17,977	Stadt Ornbau
03EMI232	01.08.2017	31.07.2019	99,000	Scherm Logline Transport GmbH
03EMI234	01.08.2017	31.07.2019	288,800	Erlanger Stadtwerke Stadtverkehr GmbH
03EMI240	01.08.2017	31.07.2019	19,717	Stadt Meerbusch
03EMI253	01.08.2017	31.07.2019	28,858	Stadt Kolbermoor
03EMI255	01.08.2017	31.07.2019	118,136	Landkreis Südwestpfalz
03EMI261	01.08.2017	31.07.2019	90,400	Weißer Flotte Ostsee GmbH & Co. Schifffahrts KG
03EMI264	01.08.2017	31.07.2019	87,123	Gemeinde Weissach im Tal
03EMI266	01.08.2017	31.07.2019	66,532	Stadtwerke Pirmasens Versorgungs GmbH
03EMI212	01.09.2017	31.08.2019	258,649	Steinbacher-Consult Ingenieurgesellschaft mbH & Co. KG
03EMI241	01.09.2017	31.08.2019	513,920	Karl Kühne Omnibusbetriebe GmbH
03EMI260	01.09.2017	31.08.2019	676,800	Mainzer Verkehrsgesellschaft mbH
03EMI236	01.11.2017	31.10.2019	34,171	Stadt St. Ingbert
03EMI238	01.12.2017	30.11.2019	51,554	Johanniter-Unfall-Hilfe e. V.

WIESBADEN TRANSPORT COMPANY ESWE PROCURES 221 ELECTRIC BUSES

The overriding goal of ESWE Verkehrsgesellschaft is for Wiesbaden to be the first city in Germany to provide completely emission-free public transport. In addition to having no local emissions, an intelligent zero-emission energy supply represents a ground-breaking innovation that transcends the industry sector. To achieve the project's aim of zero-emissions, the entire public transport fleet must be converted. This includes the entire bus fleet as well as all auxiliary and small vehicles. Specific sub goals of the present project are:

- A 50 % substitution of the bus fleet to electric drive
- Reduction of local air pollutant emissions NO_x and CO₂ by 50 %
- A reduction of at least 60% in noise emissions caused by public transport
- An increase in public transport in the modal split.

The overall project comprises the complete electrification of public transport in Wiesbaden. It includes 221 electric buses including charging infrastructure, 4 fuel cell buses including hydrogen refuelling station and all auxiliary vehicles. Substitution will take place in four phases until the end of 2022.



PARTNER:
ESWE Verkehrsgesellschaft mbH

PROJECT BUDGET/€:
10,364,625

FUNDING BUDGET/€:
4,145,850

COMMENCEMENT:
1 June 2017

CONCLUSION:
31 December 2019

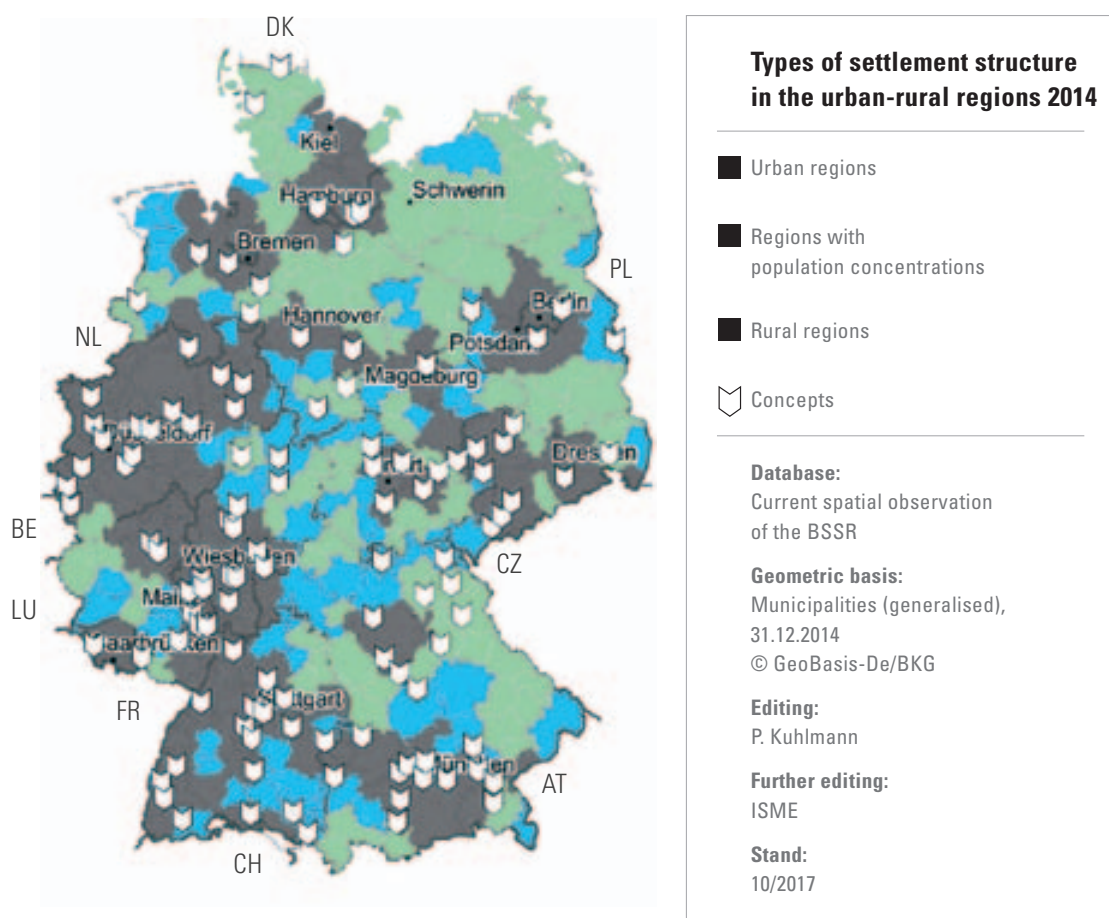
BUSES:
221 e-buses, of which
111 solo and
110 articulated buses
4 fuel cell buses:
2 as solo and
2 as articulated buses

E-AUXILIARY VEHICLES:
Due to the currently low TRL (Technology Readiness Level), these are to be electrified in the final expansion stage in 2022.

CHARGING STRUCTURE:
A charging infrastructure should be available for all vehicles. This is to be implemented with the CCS combo Type 2 connector and a charging power of max. 150 kW.

CONCEPT FUNDING STRENGTHENS MUNICIPALITIES IN IMPLEMENTING ELECTRIC MOBILITY

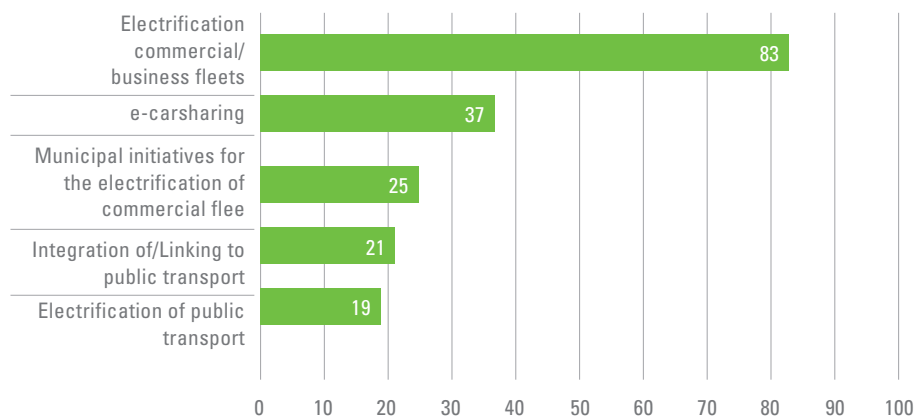
Within the electric mobility concepts funding guideline of 9 July 2015, there are currently 129 municipal electric concepts being funded by the BMVI following three funding calls. The regional authorities, companies and associations are mostly located in urban regions (73 %), in regions with population concentrations (15 %) and approx. one eighth (12 %) of all funded electric mobility concepts are found in rural regions



Regional distribution of electric mobility concepts

Funding options within the programme are diverse. They range from general concepts on the analysis of the potential of electric mobility in the municipality to very specific themes such as the establishment for example, of fast-charging infrastructure exclusively for e-taxis. Concepts on the electrification of municipal or commercial fleets as well as charging infrastructure topics were most frequently submitted. Along with the electrification of fleets, the establishment of e-carsharing often features as a further goal, partly in combination with pedelec-sharing. Concepts on the electrification of public transport as well as its integration in and connection to newly-created services (intermodal route chains) are increasingly becoming the focus.

Spheres of activity of funded electric mobility concepts



Overview of the priority areas of activity

Following three funding calls, five fields of activity have emerged that offer great potential for municipalities in establishing electric mobility. These areas of activity are the electrification of their own municipal/ commercial fleet, municipal initiatives on the electrification of commercial fleets, e-carsharing, charging infrastructure and e-public transport.

The areas of activity will be examined in the “Networked mobility” accompanying research. In addition, a series of workshops was launched in 2017. Two workshops on the electrification of fleets as well as communication strategies have already taken place, the findings of which are, specifically:

- Electrification of fleets cannot take place from combustion to electric vehicle in an ad hoc manner. It should instead be implemented in stages with a timetabled objective. Support through a funded concept is a useful step in electrification.
- Electrification of the fleet requires personnel capacities and clearly-defined responsibilities (“carers”). This generally leads to changes in staff behaviour in terms of their business mobility.
- Approaches to multiple uses of e-vehicles is being pursued through the opening up of the fleet to private use by staff or to the public after business hours (linking with e-carsharing).
- In bureaucratic procurement procedures, the “burden of proof” should be reversed within the framework of a guideline, in which electric vehicles become the standard.
- Without the relevant communication and activation measures, newly-created services will not be sufficiently exploited – whether charging infrastructure, e-vehicles in the fleet, but above all e-carsharing vehicles.

The stakeholders targeted the most in the concepts are municipal administrations (50), citizens (44) and companies (35). 24 of the concepts are open to all users and include a differentiated user analysis in the concept development. Also public transport operators (15), commuters (15) and tourists (12) are increasingly being targeted as user groups. Of lesser importance are delivery services (3), cooperatives, housing construction/industry, hospitals and second car owners (2 each). In addition, there is a concept each targeting churches, taxi drivers, pensioners, early adopters and agriculture respectively.

The diversity of concepts is to be welcomed, it can however already be deduced that some themes currently will not be exploited to their full potential. For example, the coupling of electric mobility with the electric grid remains largely ignored in terms of the applicants’ focus. The important mediating role of municipalities in the electrification of commercial fleets is still underrepresented; there is a substantially greater potential for

the market ramp-up here than in the municipal fleet itself. Municipalities could assume a similar role in dialogue with the housing industry, which evidently still has not recognised its electric mobility potential – especially in the areas of charging infrastructure and e-carsharing; lastly there are immense costs involved in the retrofitting required. The reason why there are relatively few municipal utilities (11) and transport companies (6) among the applicants, is that they are already involved in numerous procurement projects to support the market ramp-up.

The strategic integration of municipal electric mobility concepts is highly relevant to their implementation. By interlinking with existing concepts in the areas of climate protection, transport or urban development, chances of implementation and success can be greatly increased.



129 municipal electric mobility concepts are currently being supported by the BMVI.

APPROVED CONCEPTS IN THE BMVI ELECTRIC MOBILITY FUNDING PROGRAMME 2017

PROJECT	COMMENCEMENT	CONCLUSION	FUNDING	PARTNER
			[€]	



03EMK009	01.01.2017	31.07.2018	73,200	Stadt Ortenberg
03EMK103	01.01.2017	31.12.2018	32,725	Caritasverband für die Diözese Osnabrück
03EMK105	01.01.2017	30.06.2018	60,632	Stadt Dortmund
03EMK111	01.01.2017	30.06.2019	61,988	Stadt Delmenhorst
03EMK114	01.01.2017	31.12.2017	10,260	WestVerkehr GmbH
03EMK118	01.01.2017	31.12.2017	79,840	Freie und Hansestadt Hamburg
03EMK125	01.01.2017	30.06.2018	78,913	Gemeinde Gärtringen
03EMK126	01.01.2017	30.06.2017	13,930	Klimapakt Flensburg e. V.
03EMK128	01.01.2017	31.12.2017	62,048	Landkreis Northeim
03EMK130	01.01.2017	31.05.2018	40,223	Leipziger Verkehrsbetriebe (LVB) Gesellschaft mit beschränkter Haftung
03EMK131	01.01.2017	31.03.2019	235,847	Verkehrsbetriebe Hamburg-Holstein GmbH
03EMK133	01.01.2017	30.04.2018	76,446	Stadt Baunatal
03EMK107	01.02.2017	30.04.2018	30,300	EUV Stadtbetrieb Castrop-Rauxel
03EMK113	01.02.2017	31.01.2018	20,800	Altmühl-Jura GmbH
03EMK033	01.03.2017	30.06.2018	50,000	Wirtschaftsförderungsgesellschaft Hamm mbH
03EMK275	01.03.2017	30.06.2017	4,970	Gemeinde Mönchweiler
03EMK102	01.04.2017	31.12.2018	59,440	Kreis Soest
03EMK119	01.04.2017	31.03.2018	80,000	Bezirksamt Marzahn-Hellersdorf von Berlin
03EMK127	01.04.2017	31.03.2018	39,381	Stadt Flensburg
03EMK241	01.04.2017	31.12.2017	40,000	Entwicklungsgesellschaft Niederschlesische Oberlausitz mbH
03EMK276	01.04.2017	31.12.2018	2,250,000	Sortimo International GmbH
03EMK284	01.04.2017	31.12.2017	17,040	Gemeinde Oberwolfach
03EMK220	01.05.2017	30.10.2018	58,241	Stadt Radolfzell
03EMK266	01.05.2017	31.08.2018	24,800	Gemeinde Bergkirchen
03EMK277	01.05.2017	30.04.2018	60,080	Landkreis Havelland
03EMK281	01.05.2017	30.04.2019	205,760	Stadt Bad Liebenzell
03EMK203	01.06.2017	31.12.2018	69,200	Gemeindeverwaltungsverband Raum Bad Boll
03EMK206	01.06.2017	30.11.2018	41,200	Gemeinde Eching
03EMK215	01.06.2017	31.08.2018	42,840	Stadt Stollberg
03EMK217	01.06.2017	31.05.2019	40,550	LTB Leipziger Transport und Logistik Betriebe GmbH

PROJECT	COMMENCEMENT	CONCLUSION	FUNDING	PARTNER
			[€]	

03EMK223	01.06.2017	30.11.2018	47,940	Energieversorgung Mittelrhein AG
03EMK224	01.06.2017	31.12.2018	48,480	Marktgemeinde Ottobeuren
03EMK226	01.06.2017	31.05.2018	80,000	Stadt Ettenheim
03EMK247	01.06.2017	30.11.2018	44,650	Duisburger Verkehrsgesellschaft Aktiengesellschaft
03EMK250	01.06.2017	30.11.2018	22,982	Stadt Lützen
03EMK252	01.06.2017	31.05.2018	40,910	Offenbacher Verkehrs-Betriebe GmbH
03EMK255	01.06.2017	30.11.2018	80,000	Landkreis München
03EMK261	01.06.2017	30.11.2018	15,448	Bocholter Energie- und Wasserversorgung GmbH
03EMK271	01.06.2017	30.09.2018	79,840	Stadt Vilsbiburg
03EMK272	01.06.2017	30.11.2018	50,000	ESWE Verkehrsgesellschaft mbH
03EMK205	01.07.2017	31.12.2018	44,268	Stadt Oldenburg
03EMK207	01.07.2017	31.12.2018	76,464	Landkreis Coburg
03EMK209	01.07.2017	30.06.2018	25,899	Markt Murnau am Staffelsee
03EMK211	01.07.2017	31.12.2018	41,200	Gemeinde Weissach im Tal
03EMK213	01.07.2017	31.12.2018	23,112	Gemeinde Büchen
03EMK216	01.07.2017	31.12.2018	19,112	Amt Büchen
03EMK218	01.07.2017	31.12.2018	80,000	Gemeinde Lossatal
03EMK219	01.07.2017	31.12.2018	72,160	Gemeinde Großbeeren
03EMK221	01.07.2017	31.12.2018	80,000	Saarpfalz-Kreis
03EMK222	01.07.2017	31.12.2018	80,000	Ev.-Luth. Kirchenkreis Hamburg-West /Südholstein
03EMK229	01.07.2017	31.12.2018	80,000	Stadt Heidelberg
03EMK231	01.07.2017	28.02.2019	48,000	Landkreis Emsland
03EMK234	01.07.2017	31.12.2018	48,320	Landkreis Bautzen
03EMK235	01.07.2017	31.12.2018	36,200	Stadt Jena
03EMK236	01.07.2017	31.12.2018	20,000	Stadt Rheinberg
03EMK237	01.07.2017	31.12.2018	14,765	Stadt Schwabach
03EMK238	01.07.2017	31.12.2018	79,776	Gemeinde Kirchweidach
03EMK239	01.07.2017	31.12.2018	71,089	Gemeinde Flein
03EMK240	01.07.2017	31.12.2018	80,000	Landkreis Waldeck-Frankenberg
03EMK242	01.07.2017	28.02.2019	43,050	Technische Werke Schussental GmbH & Co.KG

PROJECT	COMMENCEMENT	CONCLUSION	FUNDING	PARTNER
			[€]	



03EMK245	01.07.2017	31.12.2018	57,200	Höchststadt a.d.Aisch
03EMK246	01.07.2017	31.12.2018	41,555	Stadtwerke Neuwied GmbH
03EMK248	01.07.2017	30.12.2018	61,200	Verbandsgemeinde Monsheim
03EMK251	01.07.2017	30.06.2019	73,200	Stadt Waldkraiburg
03EMK254	01.07.2017	30.04.2018		ViP Verkehrsbetrieb Potsdam GmbH
03EMK263	01.07.2017	31.12.2018	23,776	Samtgemeinde Grafschaft Hoya
03EMK264	01.07.2017	31.12.2018	76,032	Stadt Kölleda
03EMK267	01.07.2017	31.12.2018	17,200	Kreisstadt Merzig
03EMK269	01.07.2017	31.12.2018	78,567	Stadt Ditzingen
03EMK270	01.07.2017	31.12.2018	23,995	Landkreis Nordsachsen
03EMK274	01.07.2017	31.07.2018	56,000	Landratsamt Kyffhäuserkreis
03EMK280	01.07.2017	31.12.2018	20,850	Stadt Homberg (Efze)
03EMK282	01.07.2017	31.12.2018	72,481	Wissenschaftsstadt Darmstadt
03EMK285	01.07.2017	31.12.2018	80,000	Stadt Bad Krozingen
03EMK201	01.08.2017	30.06.2018	79,206	Stadt Langenau
03EMK208	01.08.2017	31.12.2018	70,202	Landkreis Ebersberg
03EMK210	01.08.2017	28.02.2019	36,500	Stadtwerke Osnabrück Aktiengesellschaft
03EMK212	01.08.2017	31.01.2019	74,016	Stadt Hilpoltstein
03EMK214	01.08.2017	31.12.2018	44,375	Kreiswerke Main-Kinzig GmbH
03EMK228	01.08.2017	30.09.2018	76,246	Stadt Frankfurt am Main
03EMK230	01.08.2017	31.01.2019	79,816	Landeshauptstadt Wiesbaden
03EMK249	01.08.2017	31.01.2019	74,080	Stadt Frankfurt (Oder)
03EMK256	01.08.2017	31.01.2019	74,637	Stadt Paderborn
03EMK257	01.08.2017	31.01.2019	31,216	Ortsgemeinde Enkenbach-Alsenborn
03EMK262	01.08.2017	31.07.2018	31,626	Stadt Vogtsburg im Kaiserstuhl
03EMK268	01.08.2017	31.03.2019	64,960	Universitätsstadt Tübingen
03EMK204	01.09.2017	28.02.2019	40,210	RegioENERGIE GbR
03EMK225	01.09.2017	28.02.2019	57,254	Stadt Wuppertal
03EMK227	01.09.2017	31.12.2018	56,016	Stadt Koblenz
03EMK233	01.09.2017	28.02.2019	79,909	Landkreis Lüneburg
03EMK259	01.09.2017	30.08.2019	80,000	Landkreis Neustadt a. d. Waldnaab
03EMK260	01.09.2017	28.02.2019	79,992	Stadt Braunschweig
03EMK265	01.09.2017	28.02.2019	40,800	Markt Scheidegg
03EMK279	01.09.2017	31.08.2018	48,480	Kommunen in der Metropolregion Hannover Braunschweig Göttingen Wolfsburg e. V.
03EMK243	01.10.2017	31.03.2019	80,000	Stadt Albstadt
03EMK253	01.10.2017	30.06.2019	79,360	Region Hannover
03EMK258	01.10.2017	31.03.2019	24,562	Verwaltungsgemeinschaft Bad Tennstedt
03EMK202	01.11.2017	30.04.2019	44,662	Stadtwerke Stuttgart GmbH

The largest electric truck with road approval is in operation at the BEHALA site.

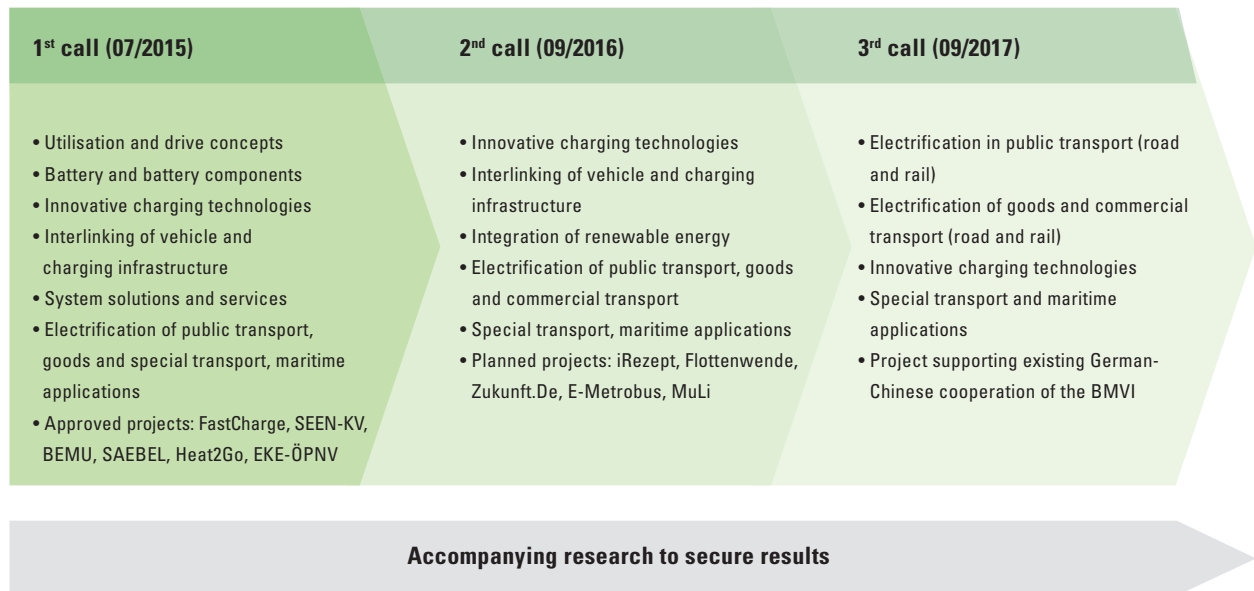


RESEARCH AND DEVELOPMENT (R&D) FUNDING PRIORITY

Apart from the procurement of electric vehicles, the charging infrastructure needed for their operation and the funding of electric mobility concepts, a third, strategically important funding instrument is anchored in the BMVI's electric mobility funding guideline of June 2015: the funding of research and development (R&D) projects to directly support market ramp-up. It is a key component of the continued market launch of electric mobility. The projects make a special contribution to the topics of the BMVI's accompanying research programme.

After the funding guideline came into force in 2015, three funding calls in the R&D area were rolled out. The focus of the accompanying research studies are practical technology testing and further development in the following areas:

- Projects on testing electric mobility utilisation and operating concepts in the relevant vehicle segments.
- Application-oriented projects on batteries and battery components with an emphasis on vehicle integration.
- Projects on development and testing of innovative charging technologies.
- Projects on developing integrated approaches to interlinking infrastructure and the vehicle.
- Projects on the technological implementation of system solutions and services in the broader context of electric mobility.
- Projects to strengthen electrification in the areas of public transport, goods and special transport.
- Maritime and other applications relevant to transport policy.



Overview of the Research and Development (R&D) funding priority

The calls focused on key technologies and applications. In the third call a project was submitted to support existing BMVI German-Chinese cooperation for the first time.

This will be supplemented by cooperation projects between national and regional research funding institutions under ERA-NET Plus, which aims to pool Europe's scientific competence. At present there are approximately 25 projects from the first two calls being implemented or in development. The third funding call is under evaluation.

» The funding of research and development (R&D) projects to directly support market ramp-up is a key component of the continued market launch of electric mobility. «

Linde

The electrification of special, freight and commercial transport is an important component of all three R&D calls for funding.





BEHALA

III/01 FASTCHARGE

The “FastCharge” project focuses on research into the technical and physical limits of all components and systems involved in recharging – in both the vehicle and in infrastructure. As early as July 2016, the companies involved began researching and prototyping electric vehicles with significantly shorter charging times along with the corresponding recharging infrastructure. Loading capacities of up to 450 kilowatts are targeted. It is planned to cool the charging cable, plug and vehicle socket during power transmission. This makes it possible to use more flexible cables with a smaller cross-section, allowing handling that is similar to today’s fuel hoses. “FastCharge” uses the connectors and standards of the Combined Charging System (CCS), which has already proven itself in everyday series-production electric vehicles. In addition to increasing recharging performance, the foundations and processes for the operation of ultra-fast charging systems, including automated registration and invoicing processes for the customer, are also being researched. The entire system is to be implemented in prototypes and presented to the public in 2018. “FastCharge” therefore makes an important contribution towards increasing suitability for long-distance journeys and subsequently the overall acceptance of battery-electric vehicles.

» FastCharge makes an important contribution towards increasing suitability for long-distance journeys and subsequently the overall acceptance of battery-electric vehicles.«



PARTNERS:

- a) Bayerische Motoren Werke AG
- b) Allego GmbH
- c) PHOENIX CONTACT E-Mobility GmbH
- d) Dr. Ing. h.c. F. Porsche AG
- e) Siemens AG

PROJECT BUDGET/€/FUNDING BUDGET/€:

- a) 5,582,440/2,791,220
- b) 2,348,452/1,174,226
- c) 1,102,024/495,911
- d) 3,527,465/1,763,732
- e) 3,254,845/1,562,325

COMMENCEMENT:

1 July 2016

CONCLUSION:

31 May 2019

Four prototype charging stations with a total of eight charging points will be set up. Three of them at the project partners Siemens, BMW and Porsche and a charging station at Euro Rastpark Jettingen-Scheppach. A CCS charging point with a continuous charging capacity of 450 kW is provided at each charging station. Both BMW and Porsche will develop, assemble and present a vehicle prototype to the public.

» It comprises the basis for the potential use of almost the entire relevant charging infrastructure within Germany and also creates the nucleus for a sustainable European platform approach. «

III/02 EPID – EROAMING PLATFORM NETWORKING IN GERMANY



The ePiD project aims to link the leading two platforms, e-clearing.net and Hubeject, in terms of IT technology, so that the respective providers or operators can cooperate with those on the other platform. On the one hand, this comprises the basis for the potential use of almost the entire relevant charging infrastructure within Germany and, on the other hand, creates the nucleus for a sustainable European platform approach. This development is particularly favoured in the present case by the fact that both platforms are already active outside Germany. Only through technical development in the form of a common technical protocol and the resulting simplified use of publicly accessible charging stations can “customer-friendly charging for electric vehicles” without barriers become a reality. Derived from this prototypical link and continuous evaluation by user groups, the results are to be transferred to a standardized interface and then implemented. The implementation of the project should be carried out within the framework of an iterative development process and take into account the requirements of as many stakeholders as possible as well as current standardization activities. For this reason, requirements and developments within the scope of so-called “user groups” will be introduced as an integral part of the project in order to facilitate further development and implementation in line with the market and in regard to the accompanying research. This ensures the continuous involvement of all relevant stakeholders in the requirements, development and implementation process, taking into account relevant standardization activities.

PARTNERS:

- a) Hubeject GmbH
- b) smartlab
Innovationsgesellschaft
mbH

PROJECT BUDGET/€:

- a) 388.690
- b) 294.574

FUNDING BUDGET/€:

- a) 155,476
- b) 117,830

COMMENCEMENT:

1 November 2017

CONCLUSION:

31 October 2019

III/03 WIRTSCHAFT AM STROM

In this project, 795 battery-powered passenger cars and light commercial vehicles in fleets of various sizes were operated for commercial transport purposes by small and medium-sized enterprises as well as by public authorities and public companies. Included were industries of special importance for Hamburg as a business location, such as port management, logistics and aviation, as well as a large number of service companies and the retail sector. In addition to technical testing, the study also focused on the analysis of various operational deployment concepts and possible business models. The interface to the energy sector is provided by the demonstration of innovative charging infrastructure and network load management solutions.



As part of the project, the so-called “reversal of the burden of proof” was developed for the procurement of vehicles for municipal fleets in Hamburg. In other words, electric vehicles are always to be procured unless objective reasons necessitate the purchase of an internal combustion vehicle (range, charging possibility, availability, etc.).



PARTNERS:

- a) hySOLUTIONS GmbH
- b) Vattenfall Europe Innovation GmbH
- c) Technische Universität Hamburg-Harburg
- d) RCI Banque S.A., Niederlassung Deutschland
- e) Freie und Hansestadt Hamburg
- f) HSBA Hamburg School of Business Administration GmbH
- g) HKS Handelskammer Hamburg Service GmbH
- h) Volkswagen Leasing GmbH
- i) Daimler AG
- j) DB FuhrparkService GmbH
- k) Mercedes-Benz Leasing GmbH

PROJECT BUDGET/€/FUNDING BUDGET/€:

- a) 310,218/155,109
- b) 3,324,211/1,662,105
- c) 1,616,394/1,616,394
- d) 5,343,064/1,668,061
- e) 3,082,915/1,565,325
- f) 152,952/137,656
- g) 178,207/124,745
- h) 1,733,206/791,555
- i) 142,823/71,411
- j) 422,153/153,326
- k) 2,096,868/732,880

COMMENCEMENT:

1 September 2012

CONCLUSION:

30 November 2017

A total of 795 vehicles of various makes and models were used in the project by commercial and municipal vehicle users.



eMOMA Project Leader Jonas Sägger beside an electric vehicle fitted with real-time data acquisition equipment



PARTNERS:

- a) juwi AG
- b) EcoLibro GmbH
- c) CSB-System AG

PROJECT BUDGET/€/FUNDING BUDGET/€:

- a) 1,608,818/804,409
- b) 731,755/585,404
- c) 153,375/76,075

COMMENCEMENT:
1 September 2012

CONCLUSION:
31 August 2017

A total of 34 vehicles were procured.

- 1 Audi A3 e-tron
- 5 BMW i3
- 3 Daimler A-Class E-CELL
- 1 Daimler B-Class electric
- 9 Mitsubishi i-MiEv
- 3 Mitsubishi Outlander PHEV
- 5 Nissan Leaf
- 2 Opel Ampera
- 1 Renault Fluence Z.E.
- 1 Renault Zoe
- 1 VW e-up!
- 2 VW Passat GTE

III/04 EMOMA – ELECTRIC MOBILITY MANAGEMENT – 100% RENEWABLE ENERGY, INTELLIGENT CORPORATE FLEET AND COMMUNICATING E-VEHICLES – MOBILITY MANAGEMENT OF THE FUTURE

The aim of the project was to develop, implement and test utilisation concepts and solutions for the optimal use of electric vehicles in company fleets. For this purpose, a cost-oriented and multimodal mobility concept was developed at the company headquarters of renewable energy pioneer juwi in Wörrstadt, for the changeover of fleet vehicles and personal-use company cars to electric mobility. The basis for this were special analysis tools as well as a holistic, company mobility concept which was designed and created by the company EcoLibro. EcoLibro also developed a concept and IT system for a mobility budget that can be used as a mobility guarantee for electric vehicle users. As part of the project, new reservation software for electric vehicles was further developed to make access to vehicles in the electric fleet as straightforward, reliable and secure as possible for all employees. The software relieves the user of having to determine whether an electric vehicle is actually suitable for the intended journey. Based on real-time data and vehicle profiles, the software determines the actual mobility requirements and assigns the appropriate vehicle to the user. The aim is to achieve maximum utilisation and cost-effectiveness of the electric vehicles and to increase user acceptance among a broad group of users. In the project, 34 electric vehicles were procured and put into operation. However, due to the current limited actual range and the still too-small selection of vehicles available to date, many interested users have unfortunately not yet been able to switch to an electric company car, despite their willingness to change.



Electric "eLift" catering lift trucks are to reduce noise and emissions at airports.

III/05 ELIFT – CATERING LIFT TRUCK OF THE FUTURE



LSG Sky Chefs, the world's largest service provider of on-board service in the aviation sector, has a particular interest in the development of new, environmentally-friendly drive concepts within the framework of its sustainability strategy, in order to thus contribute to the reduction of harmful emissions, noise pollution and energy consumption. In Frankfurt alone, the company provides inflight meals and other equipment for more than 400 flights per day. Approximately 170 so-called lift trucks undertake the transport of goods from the catering firm to the aircraft.

The »eLift« project aims to develop electric-based catering lift trucks of the future. »eLift«, under the leadership of LSG Sky Chefs, is a collaboration between Doll Fahrzeugbau, Euro Engineering Technical Universities of Kaiserslautern and Berlin.

Different concepts for the electrification of individual components of the trucks, e.g. the lifting mechanism and the drive, are being considered in the project. The basis for the new vehicle is an e-truck. The box-type truck body should fulfil the same functions with the corresponding electric drives as a conventional truck.

In addition, all types of emissions, particularly noise and CO₂ emissions, should be considerably and sustainably reduced through the use of electrical drive energy. The catering lift truck of the future should facilitate a mechanical and energetic separation of truck chassis and box body, in order to thus ensure an independent supply of the lifting system and for independence of future vehicle developments.

PARTNERS:

- a) LSG Sky Chefs Frankfurt ZD GmbH
- b) euro engineering Aktiengesellschaft
- c) Doll Fahrzeugbau GmbH
- d) Technical Universities of Kaiserslautern and Berlin.

PROJECT BUDGET/€/FUNDING BUDGET/€:

- a) 1,004,349/502,174
- b) 1,286,205/643,102
- c) 274,377/137,188
- d) 372,780/372,780

COMMENCEMENT:

1 January 2013

CONCLUSION:

31 December 2017

III/06 E-QUARTIER HAMBURG

With this project, the conceptual linkage of innovative mobility and energy concepts based on the use of battery electric vehicles with urban development policy objectives was examined and realised. The project encompassed the development and testing of mobility offers with electric vehicles, both in the development of new residential areas and in existing ones. This provided fundamental insights for future market development in the sense of an integrative approach to the introduction of electric mobility in private households. The funds used in the project have led to the development of a scientifically sound and transferable analysis model for future planning decisions in the development of neighbourhoods involving electric mobility.



PARTNERS:

- a) hySOLUTIONS GmbH
- b) Aurelis Asset GmbH
- c) D&K drost consult GmbH
- d) DB Rent GmbH
- e) GfG Hoch- Tief- Bau GmbH & Co. KG
- f) HafenCity Universität Hamburg
- g) Mindways GmbH
- h) Sparda Immobilien GmbH
- i) STAR CAR GmbH Kraftfahrzeugvermietung
- j) Vattenfall Europe Innovation GmbH
- k) cambio Hamburg CarSharing GmbH

PROJECT BUDGET/€/FUNDING BUDGET/€:

- a) 254,238/127,119
- b) 97,500/48,750
- c) 718,560/359,280
- d) 278,824/139,412
- e) 180,396/90,198
- f) 784,990/784,990
- g) 229,104/114,552
- h) 104,422/52,211
- i) 73,886/36,943
- j) 129,238/64,619
- k) 148,231/74,115

COMMENCEMENT:

1 February 2013

CONCLUSION:

31 October 2017

The project included an accompanying poster campaign in the city area that used the "Our city – our future – electric mobility".

III/07 EMERGE II

Aim of the “eMERGE II” project was to evaluate and further develop usage, charging and marketing models in the field of electric mobility based on real customer data.

The objective was to develop vehicle innovations and create acceptance for business models so that electric vehicles can establish themselves on the market in the long term. To achieve this goal, a fleet of up to 200 vehicles has been deployed in the Model Regions of Berlin-Potsdam, Stuttgart, Rhine-Ruhr and Rhine-Main.

“eMERGE II” was the further development of the predecessor project “eMERGE: ways to integrate energy, vehicle and traffic requirements”, in which interdependencies, external effects and dependencies from the domains of traffic, energy, vehicles and users were holistically examined. eMERGE pursued the goal of viewing and further developing the “electric mobility” system as a whole. To assess this, smart fortwo electric drive vehicles were examined in a fleet test in two Model Regions. The holistic approach was adopted in the follow-up project. The results obtained in the fleet test of the eMERGE project were further expanded upon and transferred to the higher penetration rates of electric vehicles in the follow-up project. The main added value of eMERGE II compared to eMERGE and the fleet trials in the programmes of the Model Regions 1.0 was the more detailed consideration of specific questions using the results obtained from previous projects. This made it possible to fashion business model approaches and test user behaviour for robustness. The approach made it possible for the levers that can be used to further develop electric mobility towards a broadly successful market launch, to be identified. In eMERGE II, fully electric compact vans (B-Class Electric Drive) and plug-in hybrid vehicles (C-Class 350e) from Mercedes-Benz were used to analyse new vehicle concepts and compare customer usage and charging behaviour with the results of the eMERGE fleet test. Based on the different vehicle types and different technical equipment, different usage motives can be assumed among project participants with the B-Class Electric Drive than with the smart fortwo electric drive, which was investigated in the previous eMERGE project. By integrating plug-in hybrid vehicles into the study model, the usage behaviour of a further customer group can fundamentally be compared with the behaviour of customers with all-electric vehicles.



PARTNERS:

- a) Daimler AG
- b) Technische Universität Berlin
- c) Forschungsinstitut für Kraftfahrwesen und Fahrzeugmotoren Stuttgart (FKFS)
- d) Rheinisch-Westfälische Technische Hochschule Aachen
- e) Universität Siegen

PROJECT BUDGET/€:

- a) 1,682,971
- b) 510,111/
- c) 287,102
- d) 215,954
- e) 163,532

FUNDING BUDGET/€:

- a) 841,485
- b) 510,111
- c) 258,392
- d) 215,954
- e) 163,532

COMMENCEMENT:

1 January 2015

CONCLUSION:

30 September 2017

» The objective was to develop vehicle innovations and create acceptance for business models so that electric vehicles can establish themselves on the market in the long term. To achieve this goal, a fleet of up to 200 vehicles has been deployed in the Model Regions of Berlin-Potsdam, Stuttgart, Rhine-Ruhr and Rhine-Main.«

III/08 NO LIMITS

The main objective of No LimITS was to invoke a positive change to the anchoring of electric mobility in the mobility landscape by closely networking with related mobility services in combination with digitalisation and communication technologies (such as ETSI ITS G5 and mobile communications). In this way, an approach was presented to make mobility in Germany more sustainable overall and thereby also address the energy and climate policy goals of the federal government in the context of the energy transition. Technically, the focus was on the development of an intelligent network of mobility services. On this basis, existing offers can be better combined and new business models, such as an integrative mobility provider, can be developed. In addition, electric mobility has been made ITS-compatible, which includes the consideration of issues such as straightforward accessibility to the recharging infrastructure and the efficient use of vehicles.

No LimITS has undertaken a joint consideration of economic and technical roles in order to define adequate institutional roles in the electric mobility environment and to transfer these aspects into new ITS role models. The defined use cases show that the mobility offer surrounding electric mobility can be improved by providing a cross-technology system and linking new and existing communication solutions. By combining technological and economic components, a symbiotic optimisation of the transport systems towards greater economic efficiency, environmental compatibility and performance was initiated. For this purpose, communication architecture was designed that integrates all relevant stakeholders into a network without being dependent on any single one of them, thus ensuring high system stability. To demonstrate the practical suitability and the verification of transferability to other regions, one of the developed use cases – multimodal travel planning – was implemented not only in the Bremen Model Region, but also at the ITS testing ground in Merzig. The idea involves being able to transfer infrastructure solutions that have proven successful in one region, to another. Different communication approaches were combined with different user interfaces and modes of transport for this purpose. The dissemination of electric mobility offers is thus promoted through better integration with existing mobility offers.



PARTNERS:

- a) Siemens
Aktiengesellschaft
- b) Deutsches Forschungszentrum für Künstliche Intelligenz GmbH
- c) Hochschule für Technik und Wirtschaft des Saarlandes
- d) Schulz – Institute for Economic Research and Consulting GmbH

PROJECT BUDGET/€/FUNDING BUDGET/€:

- a) 974,789/487,394
- b) 382,389/344,150
- c) 762,618/762,618
- d) 147,482/117,985

COMMENCEMENT:

1 January 2015

CONCLUSION:

30 September 2017



The project was based on the use and integration of an intelligent transport system (ITS).

The project demonstrated that mobility offers can be improved by providing a cross-technology system and linking existing and new communication solutions.

IV. MOBILITY AND FUELS STRATEGY



THE PROJECTS ON THE FOLLOWING PAGES ARE LABELLED WITH IV/01 – IV/06.



NEWLY APPROVED PROJECTS



COMPLETED PROJECTS



INTERDISCIPLINARY THEMES



MOBILITY AND FUELS STRATEGY (MFS) – A FRAMEWORK FOR THE ENERGY TRANSITION IN TRANSPORT



Mobility and Fuels Strategy

The federal government's Mobility and Fuels Strategy (MFS) is the central platform for shaping the energy transition in the transport sector and thereby for achieving the energy and climate protection policy goals of the federal government. The MFS (in German: MKS – was developed based on a wide-ranging expert dialogue and adopted by the federal cabinet in 2013. The Federal Ministry of Transport and Digital Infrastructure (BMVI – Bundesministerium für Verkehr und digitale Infrastruktur) thus created the platform for an information and orientation framework on technologies, energy and fuel options across transport modes as well as on innovative and contemporary mobility and transition concepts. It bundles existing knowledge and actively advances the generation of new knowledge.

Ambitious measures are required in view of the decisions taken in the Climate Protection Plan 2050, which provides for an interim target of a 40–42 % CO₂ reduction for transport by 2030. This is further reinforced by the continued growth in transport volume, especially in freight transport.

The MFS takes a technology-neutral and cross-modal approach to identifying appropriate measures to achieve the energy and climate policy objectives in transport. In this context, the modes of transport are considered from the point of view of which technical developments and innovations can enable more efficient drives and alternative energy sources (fuels) to be used and their necessary infrastructure to be expanded. Not only for each mode of transport, but also for the individual applications, the options that can make a decisive contribution in the short, medium and long term are examined. From the sum of the individual test results, conclusions are drawn for an overall optimization of the transport system.



The MFS describes which drive and fuel options the transport sector has and which energy infrastructures are needed to meet the objectives of the German government's energy concept by 2050.

One main focus of the MFS is currently on the design of climate-friendly freight transport. The reason for this is the strong growth anticipated in this area, which will be achieved to a considerable extent by diesel trucks on the roads. Alternative drive and fuel options are only at the very beginning of their development here, much less advanced than is the case with passenger cars. As such, the optimisation and modification of drives and energy sources as well as the transfer of transport services to other modes of transport, e.g. to electrified rail and inland waterway vessels, is urgently required.

Within the scope of the MFS, the BMVI is funding pilot projects for particularly promising approaches and thus enabling the application and examination of new approaches to technological solutions and concepts under real conditions. To support technologies that have already reached their technical market maturity but are not yet competitive, an initial market ramp-up phase can be supported by appropriate funding programmes.

In addition to specific projects on certain technologies, the MFS is also investigating on a strategic level how individual measures and developments can work together to achieve the climate protection targets agreed by the federal government. This allows for the promotion of an integrated view of the electricity and transport sectors (termed sector coupling), which can bring about important synergies for both sectors. In this context, NOW GmbH is coordinating the study entitled "Regulatory framework for an integrated energy concept 2050 and the integration of renewable fuels" (original German title: *"Regulatorischer Rahmen für ein integriertes Energiekonzept 2050 und die Einbindung von EE Kraftstoffen"*), on behalf of the BMVI.

The aim of the study is to identify ways in which the energy production and consumption sectors can be better linked in terms of supply and demand in legal and regulatory terms.

Based on various energy scenarios for 2050, all relevant national and EU regulations will be analysed, interrelationships examined and, finally, practical recommendations for action will be proposed to achieve the climate targets. The study project is framed in such a way to be open to technology and the final results that will be attained. In order to deal with the individual subtasks involved in the study – the development of energy scenarios, the analysis of the regulatory framework, the implementation plan and the recommendations for action – critical aspects and controversial points of view will be tabled and discussed with the involved project committees.

Besides the developments on a national level, relevant developments from a European and international perspective must also be taken into account. Interrelationships on an international level are particularly important for air and sea transport. Measures for sustainable transport are therefore often linked to corresponding implementation requirements such as EU directives. Relevant here is the implementation of Directive 2014/94/EU on the development of an alternative fuels infrastructure (AFID) and the revised Renewable Energy Directive (RED II) within the scope of the MFS.



Structure

NOW GmbH is commissioned to accompany the BMVI in the further development of the Mobility and Fuels Strategy and for the implementation of specific funding measures. This includes the technical evaluation of pilot projects, the (further) development of funding measures to support the implementation of the AFID, and to generally provide relevant advice to the BMVI.

The BMVI also receives support for the continued development of the MFS from a scientific consortium consisting of five institutions. The aspects assessed by the consortium include: transport and climate policy measures with regard to their contribution to achieving objectives; the potential of new mobility concepts; sustainable logistics concepts; and the effects of transport policy on the energy industry.

Other areas of activity include the market ramp-up of vehicles with alternative drives, analyses of sustainable mobility solutions, energy system analyses and technical approaches for the production of electricity-based and biogenic fuels.

In addition, the MFS project office, which is managed by IFOK GmbH, coordinates the integration of key specialist stakeholders in the MFS within the framework of a specialist dialogue. To supplement this dialogue, the project office also coordinates the communication and public relations activities regarding the MFS.



Participants of the 2nd meeting of the steering committee of the “climate-friendly freight transport” initiative.



Network

Due to the broad range of topics the MFS covers, a large number of stakeholders are involved. Specific topics are discussed with industry and research in regular technical workshops that are usually conducted in connection with ongoing study projects of the scientific consortium. In this way, a targeted exchange with relevant stakeholders is assured.

Between November 2016 and April 2017, a roadmap for the decarbonisation of heavy goods road transport was developed through the “climate-friendly freight transport” initiative (original German title *“Initiative klimafreundlicher Straßengüterverkehr”*). Together with science and industry, the topics of electricity-based fuels, liquid natural gas (LNG) and hydrogen infrastructure as well as vehicles (LNG and fuel cell trucks) were discussed in three working groups. These efforts resulted in concerted recommendations for further measures to be implemented, e.g. the preparation of a pilot project for hydrogen as fuel for fuel cell trucks. NOW GmbH has accompanied the freight transport initiative from the very beginning, being involved in the initial concept development, the moderation of the steering committee, participation in the working groups as well as providing input on content. During this process, experience could be drawn from various pilot projects conducted in the past within the context of the MFS.

The debate on pollutant emissions from diesel vehicles is also resulting in an increase in the perception of the significance of commercial transport in terms of its share in the generation of harmful emissions such as CO₂, particulate matter and noise. Forecasts also predict a strong increase in this mode of transport. Urban commercial transport must therefore make a significant contribution to the energy transition in the transport sector. In October 2017, NOW GmbH therefore invited 30 experts from the logistics sector, commercial vehicle manufacturers, politicians, scientists as well as users to Berlin to discuss the extent to which urban commercial transport can be changed over to alternative drive systems. The results of the workshop were published as a brochure.



Funding measures

Two support measures are currently available for the implementation of the MFS. The funding guideline on support for equipping and retrofitting seagoing vessels to use LNG as a marine fuel aims to increase the demand for LNG in seaports and thus stimulate infrastructure development. And within the scope of the MFS pilot project funding, it is possible to demonstrate new technologies being implemented in their real application context for the first time.

Funding guideline on the use of LNG in shipping

The BMVI is funding the equipping and retrofitting of seagoing vessels to use liquefied natural gas (LNG) as a marine fuel. The goal of the funding programme is to promote the use of LNG in German maritime transport. Funding is made available from the Mobility and Fuels Strategy.

As a marine fuel, LNG contributes to the reduction of greenhouse gas and air pollutant emissions. As opposed to conventional, oil-based marine fuels, LNG produces zero sulphur oxide emissions (SO_x). Nitrogen oxide emissions (NO_x) are reduced by up to 90 per cent, and particle emissions by approximately 98 per cent compared to conventional fuels. The guideline on grants for equipping and retrofitting seagoing vessels for the use of LNG as a marine fuel from 17 August 2017 advances the adoption of LNG in German maritime transport. The aim of the guideline is to increase demand for LNG as a marine fuel in Germany, and thus provide incentives for building the requisite LNG supply infrastructure in ports. An important reason for the use of LNG in shipping is that the North Sea and the Baltic Sea have been defined by the International Maritime Organisation (IMO) as Emission Control Areas (ECA). Since 2015, the proportion of sulphur in these waters must not exceed 0.1 per cent, for example. Following the latest decision of the Maritime Environmental Protection Committee (MEPC) of the IMO, the Baltic Sea was also regulated as a nitrogen ECA.

Project proposals can be submitted on each current call for proposals under the guideline. Funding will be granted in the form of non-repayable subsidies for the partial financing of extra investment costs involved in equipping and retrofitting of seagoing vessels for LNG operation. The target of the aid is either the equipping of newly-constructed ships or the retrofitting of existing seagoing ships for the use of LNG as a marine fuel either in pure gas or in so-called dual-fuel operation for the main drive. If the equipping or retrofitting for the main drive is funded, equipping or retrofitting auxiliary machinery for LNG operation also qualifies for funding. Companies owning a ship or planning a new ship build, as well as public sector entities and institutions are eligible to apply. A first funding call was published on 13.12.2017.

Pilot projects

By funding pilot projects, it is possible for new technologies to be tested and demonstrated in real deployment contexts.

The aim of pilot project funding is to integrate the use of alternative drives and fuels into existing operating processes and settings. The overriding criterion for pilot projects is a unique selling point, i.e. a corresponding application is demonstrated for the first time in this way.

Within the framework of the pilot project funding, the focus is currently on applications in which there are presently only few alternatives to fossil fuels available. This applies, for example, to shipping and air traffic as well as applications in road freight transport and public transport.

Current pilot projects from the MFS focus, for example, on the use of LNG in maritime and truck transport, on hybrid trolleybuses, the use of renewable kerosene in air traffic or the equipping of bus depots with charging infrastructure.

IMPLEMENTATION OF AFID

One of the most important European legislative texts in the context of the transition of transport is the directive on the development of infrastructure for alternative fuels 2014/94/EU (Alternative Fuels Infrastructure Directive – AFID). While other segments of the European legal framework impose obligations on fuel suppliers or vehicle manufacturers, AFID is aimed directly at the member states. With the aim of reducing carbon emissions and cutting dependence on oil for transport, it compels the member states to draw up plans for the development of recharging and refuelling infrastructure, in particular for electricity, hydrogen and natural gas. The directive thus creates a common legal framework for the establishment of a European internal market and an interoperable transport network in this area.

The plans, known as the National Policy Framework (NPF), needed to be submitted to the European Commission by 18 November 2016. In addition to a description of the status quo, they contain objectives for the development of infrastructure at specific points in time. The German NPF was submitted to the Commission within the deadline and together with seven others, received the best evaluation of the 28 NPFs submitted by the member states. NOW GmbH played a leading role in drafting the NPF and contributed in particular to the sections on recharging infrastructure for electric vehicles and hydrogen supply infrastructure for fuel cell vehicles.

Germany's infrastructure development targets are the most ambitious in the European Union: 36,000 regular-charging points and 7,000 fast-charging points for electric vehicles are to be built by 2020. For the supply of hydrogen for fuel cell vehicles, 100 filling stations are to be available by 2020 and around 400 by 2025.

NOW has remained involved in the implementation of the AFID, even after the drafting of the NPF. In the programme areas recharging infrastructure (LIS – *Ladeinfrastruktur*), National Innovation Programme Hydrogen and Fuel Cell Technology (NIP) and within the framework of the Mobility and Fuels Strategy (MFS), measures to achieve the objectives are pursued using various approaches.

The development of recharging infrastructure is accompanied directly by NOW and managed in cooperation with the Federal Ministry of Transport and Digital Infrastructure (BMVI).

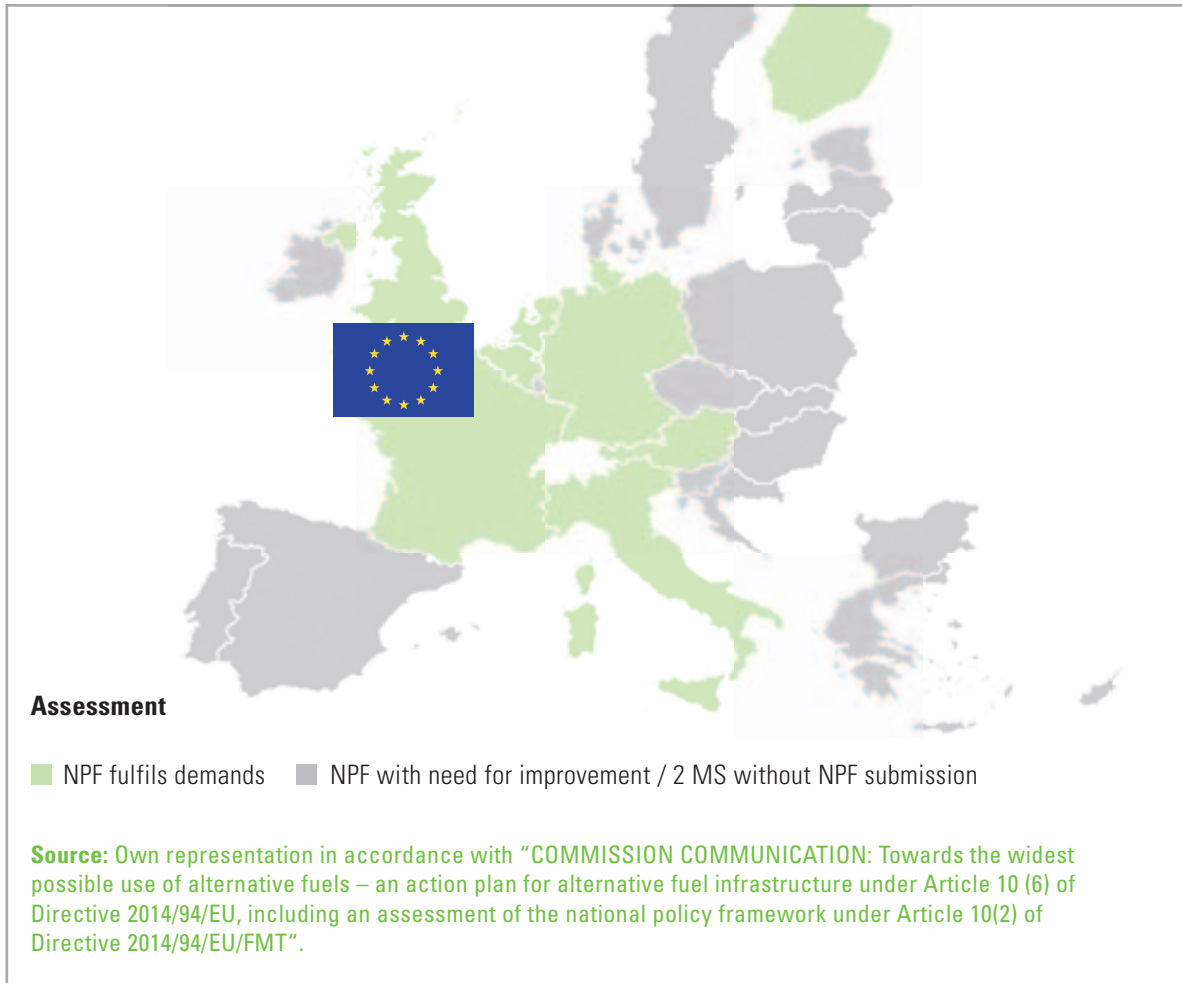
Unlike the case with other fuels, AFID leaves it to the member states to choose whether to set up a hydrogen refuelling infrastructure. Besides Germany, 13 further member states have decided to do so. In 2017, NOW made a significant contribution to the implementation of AFID in this area by organising regular calls for funding proposals within the framework of the NIP.

As Germany can already boast a sufficient network of refuelling stations for gaseous natural gas (CNG), the German NPF does not envisage any further measures to expand this network. However, the situation is different for liquefied natural gas (LNG) for heavy goods transport: six new LNG filling stations will be required by 2025 to ensure coverage on Europe's main transport axes. Pilot projects to test LNG as a fuel for heavy goods transport will be carried out as part of the MFS, for which NOW provided significant support to the BMVI during implementation.

A unique approach was adopted for the development of tank and bunkering infrastructure at sea and inland ports. Rather than providing direct support for the infrastructure as is more commonly the case, the conversion and equipping of ships is being initially funded in this instance in order to increase the demand for facilities for refuelling. Following a pilot project that was undertaken within the scope of the MFS, where a container ship was converted to LNG propulsion and a strong demand for similar projects from industry was subsequently identified, NOW supported the BMVI in the establishment of a funding guideline for the equipping and conversion of sea-going ships. The first call for proposals took place in December 2017 and is being managed by NOW.

AFID requires member states to report to the Commission on progress in implementing the directive, initially in November 2019 and then every three years. Besides providing information on the policy and legislative measures taken, it is necessary to estimate how many vehicles with alternative fuels are expected to be in operation on German roads by 2030 and to what extent the national targets for the use of alternative fuels and the development of infrastructure will be achieved. In order to fulfil this reporting duty, continuous monitoring of current developments is necessary. NOW was commissioned by the BMVI to design and implement such a monitoring process and to subsequently prepare such reports. To this end, NOW has been developing the "monitoring of alternative fuels and infrastructure" (MAIK – *Monitoring alternativer Kraftstoffe und Infrastrukturen*) since summer 2017, in coordination with the BMVI. In order to support the BMVI in the analysis of strategic key issues in regard to the transition of the transport system, MAIK monitors the developments of alternative fuels, associated drive technologies and infrastructure – beyond the usual reporting obligations – and also from a technical, economic and ecological point of view, as well as with regard to practical use. In addition, with the support of NOW, the BMVI put a location tool out to tender for the demand-oriented development of recharging infrastructure – the data and results of which will not only be used for strategic funding purposes but also for monitoring.

**Commission assessment:
National Policy Framework (NPF) for AFID implementation**



In addition to its contribution towards the national development of infrastructure through the individual programmes, NOW also plays an important role in international cooperation. Member states are called upon to intensify their cooperation in order to develop cross-border interoperable infrastructure within the internal market. To meet this requirement, the Government Support Group (GSG) was established as an informal forum of member states, whose secretariat is run by NOW together with the Dutch partners. In 2017, besides several bilateral meetings, two GSG Steering Committee meetings were held in Paris and Warsaw to discuss progress and challenges in fuel infrastructure development.

MS “WES AMELIE”: FIRST LNG CONVERSION OF A CONTAINER SHIP TO DUAL FUEL OPERATION

In September 2017, the “WES Amelie” became the first European container ship to use liquefied natural gas (LNG) as its fuel. The Reederei Wessels shipping company commissioned the MS WES AMELIE Schiffahrts GmbH & Co. KG to convert the 1,015 TEU capacity container ship at German Dry Docks in Bremerhaven. All installations, piping and steel structures were carried out at the shipyard (see Fig. 2). The project marks the first successful LNG conversion completion of a container ship.



The world's first container ship converted to LNG: the Wes Amelie

MAN Diesel & Turbo undertook the task of converting the main engine. Almost all components of the combustion chamber were converted. Cylinder bores were enlarged, injection components added and new valve cams, a new turbocharger engine and new sensors were also installed. A pilot oil system required for gas operation was also fitted. All gas equipment and the gas control unit are supplied by TGE Marine Gas Engineering, including the approx. 500 m³ LNG tank.

Custom-built products and services were provided by specialist suppliers. This particularly included the electronics and automation of the new overall system. The design of the LNG conversion was penned by SMB Naval Architects & Consultants.



The MS "Wes Amelie" is currently being bunkered with LNG from Rotterdam and used by charterer UNIFEEDER in feeder services between Hamburg and St. Petersburg. Following the initial filling of the tank, the first four to five-day test voyage in LNG operation consumed 68 tons of LNG alone. A continuously high demand for LNG is therefore ensured with regular voyages of this ship.

With the experience gained in the successful LNG conversion project, Wessels also intends to convert the MS "Wes Amelie" sister ships. Projects to equip and convert the vessels of other ship owners are also in the starting blocks. With the world's first conversion project for a container ship powered by LNG, the German maritime industry has learned many lessons. With the aid of federal funding from the MFS, within the framework of the guidelines on funding for equipping and converting seagoing ships to use LNG as a marine fuel, corresponding plans can be implemented. The successful commissioning of the converted MS "Wes Amelie" occurred at the same time as the commencement of the funding programme for the use of LNG as marine fuel. NOW GmbH accompanied the LNG conversion project for the MS "Wes Amelie" container ship and supports the BMVI in the implementation of the funding programme.



PARTNER:
MS WES AMELIE Schifffahrts
GmbH & Co. KG

PROJECT BUDGET/€*:
9,675,223

FUNDING BUDGET/€*:
5,805,133

COMMENCEMENT*:
20 July 2015

CONCLUSION*:
30 September 2017

* According to the status of
approval in 2017

In the Wes Amelie engine
room: the LNG dual fuel
main engine



In Solingen, a diesel bus line is being converted to purely electric operation with hybrid trolleybuses.



IV/01 BOB SOLINGEN: ON THE ROAD TO ZERO EMISSION PUBLIC TRANSPORT WITH THE BOB BATTERY TROLLEYBUS AND INTELLIGENT INFRASTRUCTURE

BOB – Batterie-OberleitungsBus (Battery trolleybus): The aim of the pilot project is to convert a diesel bus line to purely electric operation with battery trolleybuses (hybrid trolleybuses), whose batteries are recharged while driving under the overhead electricity lines. Moreover, a driver information assistant is also being developed to create a driver interface to promote efficient driving. Insights for technological improvements for a second BOB generation are to be obtained (pantographs, thermal management, energy saving potentials) during the course of the pilot project.

eÖPNV (ePublic Transport): The aim of the “eÖPNV” sub-project is to develop intelligent substations for the bidirectional connection of the overhead line network to the public energy supply network. To this end, inverters are being developed for connecting charging stations for electric vehicles to the overhead line network. Furthermore, stationary storage will be built up from decommissioned bus batteries. A communication infrastructure will be created for the entire Smart Trolley System (STS). The results of this project module will lead to the conceptual design of an overall BOB network of routes.

Electricity grid: As part of the “Electricity grid” sub-project, control strategies are being developed to market subsequent energy surpluses and to increase energy efficiency in the overhead line network and in the upstream grid.

The major challenges of this pilot project include the determination of the mass of vehicles for predicting energy requirements, the creation of the communication infrastructure and the integration of further systems (photovoltaic systems, stationary storage facilities, charging infrastructure) into the overhead line network. A further challenge lies in guaranteeing the stability of the supply grid. Based on the test of system suitability in the fleet test, preparations will be made for the conversion of further bus lines to electric operation. Due to the unique characteristics of this project (BOB real test), primarily only the test values in the planned fleet test will be able to be applied for the system changeover.

» The major challenges of this pilot project include the determination of the mass of vehicles for predicting energy requirements, the creation of the communication infrastructure and the integration of further systems into the overhead line network. «



PARTNERS:

- a) Stadtwerke Solingen GmbH
- b) Bergische Universität Wuppertal
- c) Bergische Gesellschaft für Ressourceneffizienz mbH
- d) SWS Netze Solingen GmbH
- e) NetSystem Netzwerk- und Systemtechnik GmbH
- f) Stadt Solingen
- g) Voltabox Deutschland GmbH

COMMENCEMENT:

1 February 2017

CONCLUSION:

31 January 2022

» In this joint project, bus depots are being equipped for the first time for the large-scale supply of a pure battery bus fleet. «

IV/02 EQUIPPING AND CONVERTING DEPOTS FOR THE CHANGEOVER OF THE BUS FLEET IN HAMBURG TO ELECTRIC MOBILITY

The two public transport authorities Hamburg HOCHBAHN and the Verkehrsbetriebe Hamburg-Holstein (VHH) will expand their operations with electric buses on their city bus routes in Hamburg over the next few years. In this joint project, bus depots are being equipped for the first time for the large-scale supply of a pure battery bus fleet. This requires a direct connection to the medium or high voltage grid.

As part of the project, Hamburg's HOCHBAHN is equipping the new Gleisdreieck bus depot for supplying a fully battery-powered bus fleet. This includes, above all, the supply of sufficient energy as well as the higher-level management and monitoring of the bus fleet in order to ensure its safe operation at all times.

Within this project, Verkehrsbetriebe Hamburg-Holstein (VHH) will gradually convert the existing Hamburg-Bergedorf bus depot to electric bus operation. The charging infrastructure will be designed in such a way that ensures the highest possible level of reliability, smallest space requirements and the possibility of modular expansion in line with the anticipated further growth in electric buses. A special unique characteristic of the project is the integration of a large "2nd-Life" battery storage facility. This ensures resource-efficient energy supply to the battery bus fleet, especially during peak demand for overnight charging.

Independent scientific monitoring being undertaken by the Helmut Schmidt University is intended to compare and evaluate the selected electrification solutions with one another and also to ensure that the results also show transferable solutions for other transport companies in Germany.



PARTNERS:

- a) Hamburger HOCHBAHN AG
- b) Verkehrsbetriebe Hamburg Holstein GmbH (VHH)
- c) Helmut-Schmidt-Universität

COMMENCEMENT:

28 December 2017

CONCLUSION:

31 December 2020

IV/03 INTEGRATED POWER SUPPLY ON SHIPS: LNG POWERPACS

With the “LNG PowerPacs”, Becker Marine Systems is implementing a concrete pilot project for the creation of a modern, environmentally friendly, safe and economical power supply based on LNG for container ships. A world first, the special industrial containers are being used on board of ships during layover times in the port of Hamburg.

With LNG hybrid, Becker Marine Systems established a further line of business in 2011 dealing with environmentally friendly drive and power generation concepts. The use of LNG as a low-pollution energy source in combination with cogeneration and hybrid energy storage technologies are among its main elements. For the implementation of the “LNG PowerPacs” pilot project, the company is contributing its experience from the construction and practical trials of the LNG Hybrid Barge “Hummel”. This has been used since 2015 for the external LNG-based power supply of cruise ships in the port of Hamburg. In this pilot project, Becker Marine Systems is responsible for project management, conceptual preparatory work, the detailed design and the creation of safety and approval specifications. Chart Ferox is responsible for the construction and design of the vacuum-insulated LNG tank and gas processing plant. The complete system, consisting of the gas engine generator, gas processing plant as well as control and instrumentation systems, will be assembled by Zeppelin Power Systems. The field trial for the implementation of the LNG PowerPacs is being undertaken with the support of Hamburg’s Department of Economics, Transport and Innovation and Department of the Environment and Energy along with the Hamburg Port Authority, terminal operators HHLA and Eurogate as well as selected shipping companies.



PARTNER:

Becker Marine Systems GmbH
& Co. KG

COMMENCEMENT:

1 October 2015

CONCLUSION:

31 December 2018

» A world first, the special industrial containers are being used on board of ships during layover times in the port of Hamburg. «

IV/04 IMPLEMENTATION OF RENEWABLE KEROSENE AT LEIPZIG/HALLE AIRPORT

The use of renewable fuels in aviation could make a significant contribution to reducing emissions in air transport. Various production processes for renewable kerosene are already approved for use in aviation. However, there has been no practical study undertaken to date on the widespread use of renewable kerosene. Within the framework of the MFS, the BMVI has therefore commissioned a research and demonstration project on the use of renewable kerosene at Leipzig/Halle Airport (project name: DEMO-SPK). The project is carried out by the DBFZ as its prime contractor. Subcontractors for completing individual work packages include the Technical University of Hamburg (TUHH), MEO Carbon Solutions GmbH, the Aviation Initiative for Renewable Energy in Germany e.V. (aireg) and IFOK GmbH.

The pilot project aims to test the behaviour of different blends of fossil and renewable kerosene under realistic conditions in the fuel supply infrastructure at a major airport. The goal is to examine how it is best possible to ensure smooth and safe operation with such blends and which technical adjustments may be necessary.

Furthermore, the project is to address the implementation of practicable sustainability documentation as well as a standardised crediting procedure for renewable kerosene in emissions trading.



PARTNER:

DBFZ Deutsches Biomasse-
forschungszentrum
gemeinnützige GmbH

COMMENCEMENT:

November 2016

CONCLUSION:

November 2019

The workshop participants discussed practical sustainability documentation and standardised crediting procedures for renewable kerosene in emissions trading.



Opening of the LNG refue-
ling station on the premises
of Meyer Logistik at the
Berlin Ost Freienbrink freight
centre.

IV/05 DEPLOYMENT OF 20 ENVIRONMENTALLY FRIENDLY LNG TRACTOR UNITS FROM IVECO STALIS IN A FOOD LOGISTICS COMPANY'S FLEET

For the first time in Germany, heavy-duty trucks powered by liquefied natural gas (LNG) were added to an existing fleet of diesel vehicles and deployed in the real operations of a food logistics company. The procurement of 20 vehicles was supported within the framework of the MFS pilot project.

A provisional mobile refuelling station was installed on the company premises in Grünheide (Brandenburg). Its construction was supported by the EU "LNG Blue Corridor" project. LNG refuelling is also possible for third parties at the site.

Assuming an annual mileage of 120,000 km per vehicle and five years of operation, savings of 54,610 kg CO₂ are to be achieved over that of a comparable diesel vehicle. In addition, noise and particulate dust pollution is to be reduced, especially when making deliveries to supermarkets in urban areas.



PARTNER:
Ludwig Meyer GmbH & Co. KG

COMMENCEMENT:
24 May 2016

CONCLUSION:
24 May 2019

IV/06 Deployment of CNG trucks for the pre and onward carriage of containers in intermodal transport



The freight forwarding company transports containers between the seaports of Hamburg and Bremerhaven as well as between an automotive plant and the packaging site in Leipzig. Empty containers are transported by rail in advance to the loading terminal in Schkopau and then by truck to Leipzig. After loading, the goods are transported back. The diesel-powered trucks currently running on the Schkopau-Leipzig line (42 km for a single leg) are to be replaced by CNG trucks. The use of biomethane as a fuel is planned, which can be tanked at an existing natural gas refuelling station. The aim of the project is to reduce greenhouse gases, fine particulate dust and noise within the transport chain.

A special feature of this project is the combination of electrified rail and natural gas-powered truck transport. The unique characteristic of the project is that the natural gas-run trucks operate completely with biomethane. The project is the first heavy goods transport project using 100% renewable energy in road transport.

PARTNER:

Konrad Zippel Spediteur
GmbH & Co. KG

COMMENCEMENT:

December 2017

CONCLUSION:

30 June 2018

» A special feature of this project is the combination of electrified rail and natural gas-powered truck transport. The unique characteristic of the project is that the natural gas-run trucks operate completely with biomethane. The project is the first heavy goods transport project using 100% renewable energy in road transport. «



Alternative drives are also playing an increasingly important role in logistics and factory transport.



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