

ANNUAL REPORT 2009



Table of contents

| | |
|--|-------|
| » Welcome message by Dr. Peter Ramsauer, Federal Minister of Transport, Building and Urban Development | » 02 |
| » Foreword by Dr. Klaus Bonhoff, Managing Director (Chair), NOW GmbH | » 04 |
| » NOW – NIP – Electromobility Model Regions | » 06 |
| » Fuel and the future – Transport and Infrastructure Programme Area | » 14 |
| » Efficiently produced power and heat – Stationary Energy Supply Programme Area | » 44 |
| » Close to the market – Special Markets Programme Area | » 66 |
| » Everyday mobility in the cities of tomorrow – Electromobility Model Regions | » 82 |
| » Events | » 102 |

MY GOAL IS THAT
WE CREATE A MORE
ENVIRONMENTALLY
FRIENDLY, AND IN THE
FUTURE ALSO »
MORE AFFORDABLE
TRANSPORT SECTOR.

Dr. Peter Ramsauer,
Federal Minister of Transport, «
Building and Urban Development

Market leadership in new efficient and sustainable technologies

Mobility and energy supply are essential elements of our lives. Our participation in social and cultural life, our commute to work, the transportation of our goods, power and heat for our houses – all this will only be possible in the future with modern emission free and efficient technologies.

Faced with climate change, we find ourselves in a process of fundamental change. My goal is that we create a more environmentally friendly, and in the future also more affordable transport sector. Rather than focusing on restrictions, I count on innovation and new technologies – especially on hydrogen and fuel cell technology.

Technologies of the future such as these present a great opportunity which, for the sake of our climate and our industries, we simply cannot afford to miss. Our future economy will only be globally competitive through market leadership in new efficient and sustainable technologies. Alongside batteries, hydrogen and fuel cells play a key role in the mobility and energy supply of tomorrow.

German industry is world-class in this sector, and we want to build on this position. Germany must become the leading electromobility market globally.

To achieve this we have approved two extensive and groundbreaking programmes: the National Innovation Programme Hydrogen and Fuel Cell Technology (NIP) and the Electromobility Model Regions Programme.

Through NIP, we are pursuing the objective of bringing products and applications from hydrogen and fuel cell technology up to marketability stage via demonstration projects. Federal government and industry are allocating €1.4 billion to this end until 2016. The NIP offers a common and connective framework for numerous projects from science and industry. The cooperation of companies and the joint development of marketable solutions are therefore at the forefront.



Hydrogen and fuel cell technology on the one hand and battery electric power drives on the other are complementary solutions. Both are key technologies for mobility of the future. In the eight electromobility model regions it is our objective to firmly anchor electromobility in the public sphere. To reach this goal we are providing €115 million until the end of 2011.

The further advancement of battery and fuel cells must be regarded and promoted in the context of a holistic, comprehensive energy concept. This is why both programmes are implemented through the National Organisation Hydrogen and Fuel Cell Technology. It has proved to be a successful organisation managing programmes at the interface of politics and industry.

A handwritten signature in black ink, which appears to read 'Peter Ramsauer'. The signature is fluid and cursive, written on a light background.

Dr. Peter Ramsauer
Federal Minister of Transport, Building and Urban Development



Industry is strongly committed to clean, future-oriented technologies

We need new technologies in order to reach our climate targets. A multitude of products and solutions for sustainable mobility and energy supply from different technological areas are required. For Germany this means that only through market leadership in efficient and zero emission technologies will we remain globally competitive.

Because their products are clean and efficient, the technology fields of hydrogen and fuel cell technology as well as battery electric power drives will play a central role in the everyday mobility and power supply of the future. The state of knowledge and technology of German industry in this area is world-class.

In this context the federal government, industry and science have developed the National Innovation Programme Hydrogen and Fuel Cell Technology (NIP), for whose implementation the National Organisation Hydrogen and Fuel Cell Technology (NOW) was founded in 2008. In addition NOW was assigned to coordinate the Electromobility Model Regions Programme of the Federal Ministry of Transport, Building and Urban Development (BMVBS, Bundesministerium für Verkehr, Bau und Stadtentwicklung) in 2009.

Market preparation from a single source is therefore the motto, because fuel cells and batteries are complementary technologies and both will be needed for the future of mobility.

The high number and quality of project proposals presented to NOW in 2009 shows us that industry is working on the development of future-oriented products emphasising hydrogen and fuel cell technologies as well as battery electric power drives. This is how within the ten year NIP programme, projects totalling around €350 million from the BMVBS budget could already be granted after only two years of operation. We are discussing an overall number of projects in the area of demonstration activities with a budget of up to €815 million. In the area of electromobility model regions there are substantially more project ideas than there are funds available.

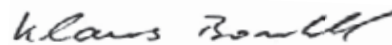
THE STATE OF KNOWLEDGE AND TECHNOLOGY OF GERMAN INDUSTRY IN THIS AREA IS WORLD-CLASS.

» Dr. Klaus Bonhoff,
NOW Managing Director (Chair) «

This tells us that both programmes – NIP and Model Regions – and the implementation method through NOW at the interface of politics, industry and science, constitute the right way ahead in preparing future-oriented technologies for the commercial market. Embedding these technologies in the market will not happen through normal operation alone. Comprehensive and targeted supporting measures from the public sector are also needed.

Looking at application areas, automotive manufacturers are preparing themselves for market entry of series production passenger cars from around 2015. This does not begin with hundreds of thousands of cars per year, but with a ramp-up curve. Hydrogen infrastructure must be simultaneously established nationwide. In the stationary area fuel cell systems vary greatly. Industrial combined heat and power systems or household power supply systems could probably go through the market preparation phase within the next five years, in order to then be introduced as commercial products to the market. Special markets furthermore, are also assuming an important role. They are characterised by early market opportunities as well as pioneering sales potential for suppliers and are therefore leaders in the mass market.

The NOW Annual Report 2009 offers you an overview of NIP and of the Electromobility Model Regions of the Federal Ministry of Transport, Building and Urban Development (BMVBS) on the market preparation of these technologies. Furthermore you can gain a detailed insight into each individual project approved in 2009 under the NIP framework with partners from industry and science.



Dr. Klaus Bonhoff
Managing Director (Chair)

THE MOST IMPORTANT ROLE OF NOW IS THE INITIATION, EVALUATION AND BUNDLING OF PROJECTS.

About NOW

NOW GmbH National Organisation Hydrogen and Fuel Cell Technology was founded in 2008 by the federal government, represented by the Federal Ministry of Transport, Building and Urban Development (BMVBS). Its mission is to coordinate and manage two federal programmes: the National Innovation Programme Hydrogen and Fuel Cell Technology (NIP) and the Electromobility Model Regions Programme of the BMVBS.

The most important role of NOW is the initiation, evaluation and bundling of projects within these programmes. In addition there are cross-cutting issues such as production technology, education and training, communication at the interface of government and industry as well as an active public relations function, to raise the public profile of these technologies and products. On the advisory board of NOW are representatives from politics, industry and science. The board advises the organisation on the implementation of NIP, especially with regard to current market demands.



Participating partners bring their specific knowledge to the table and within the framework of an integrated process, work on formulating political objectives, promoting technology and preparing the market.

The actual processing of subsidies from the BMVBS is carried out by the project administrator Jülich (PtJ). Because the implementation of clean, economically sustainable technologies is a global challenge, NOW also promotes international collaborations. The IPHE (International Partnership for Hydrogen and Fuel Cells in the Economy) brings governments from all over the world into these discussions. Germany holds the chair of the IPHE during 2010 and 2011, and the IPHE Secretariat is located at NOW.

About NIP

Hydrogen and fuel cell technology will play an essential role in the future of mobility and energy supply. In 2006 government, industry and science initiated the National Innovation Programme Hydrogen and Fuel Cell Technology (NIP) as a strategic alliance. NIP is intended to speed up the process of market preparation of products based on this future-oriented technology. The total budget of NIP to be invested over a period of ten years amounts to €1.4 billion. The Federal Ministry of Transport, Building and Urban Development (BMVBS) and the Federal Ministry of Economy and Technology (BMWi, Bundesministerium für Wirtschaft und Technologie) provide half of this sum, while the other half is contributed by participating industry.

Besides large-scale demonstration projects, NIP also focuses on research and development projects. The demonstration projects are grouped into comprehensive lighthouse projects and take place under real-life conditions. Project partners thus work together and more efficiently on issues and challenges which they otherwise would have to face alone and with considerably higher individual effort.



Nationales Innovationsprogramm
Wasserstoff- und
Brennstoffzellentechnologie

NIP is divided into three programme areas in order to advance in equal measure, numerous hydrogen and fuel cell technology product and application options, and to be able to address in the application-specific challenges of market preparation in a targeted way.

The particular programme areas are: »Transport and Hydrogen Infrastructure«, »Stationary Energy Supply«, and »Special Markets«. With an eye to series production of components, the explicit focus in all programme areas is on the strengthening of the supply industry.

Further information on the precise content of projects under NIP can be seen from page 12 onwards.

About Electromobility Model Regions

The BMVBS Electromobility Model Regions Programme has the objective of promoting battery-electric mobility and developing it from a regional focus (clusters), thereby positioning Germany as a lead market.

Electromobility is becoming increasingly more important and provides an economic and efficient alternative in the transport sector. The Federal Ministry of Transport, Building and Urban Development (BMVBS) is making €115 million available in the Electromobility Model Regions Programme for the targeted build-up and operation of an electromobility infrastructure. The funds come from the second economic stimulus package of the federal government.

The programme should serve to anchor electromobility in the public sphere and develop it from selected model regions. NOW coordinates and manages its implementation in the eight model regions of Berlin/Potsdam, Bremen/Oldenburg, Hamburg, Munich, Rhine-Main, Rhine-Ruhr, Saxony and the region of Stuttgart.



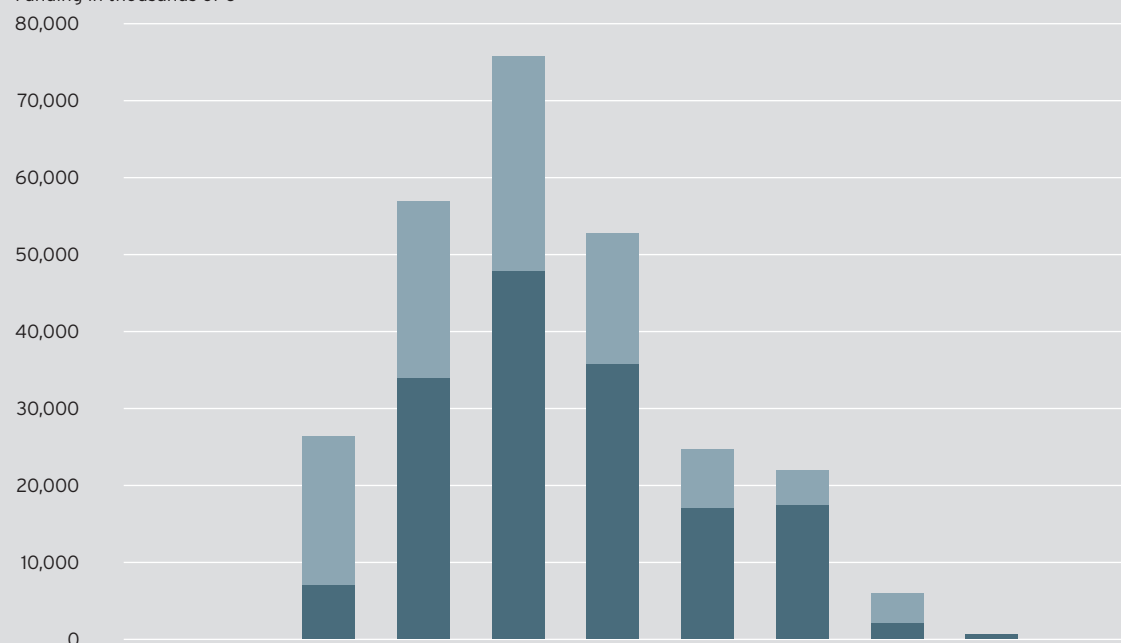
Vehicle fleets and relevant infrastructure that are easily visible to the public will be particularly promoted. Activities in the model regions are embedded in regional funding structures, and superordinate sustainability and transport strategies.

Further information on the programme and the eight model regions can be found from page 82 onwards.

NIP – Source of funding

Demonstration (BMVBS) and R&D (BMWi)

Funding in thousands of €

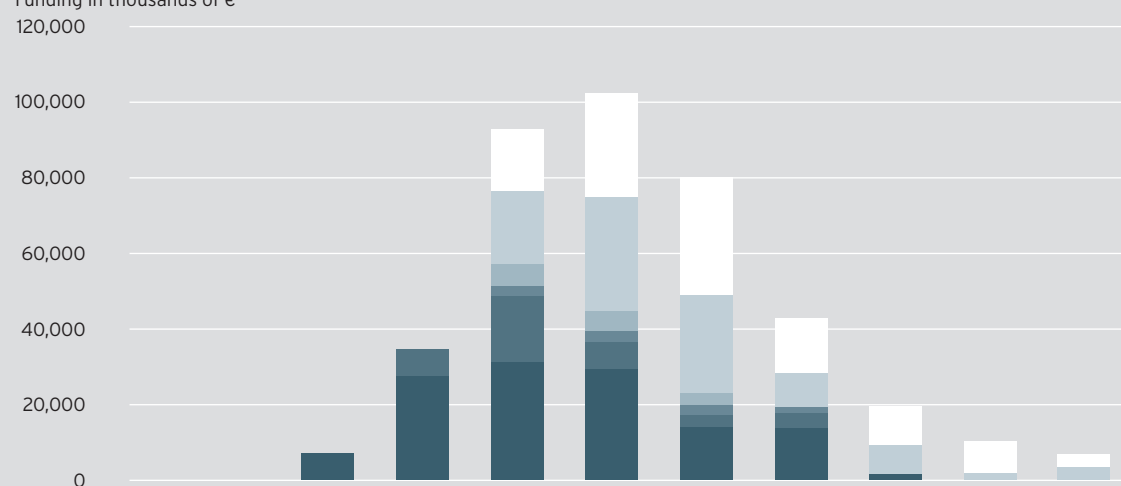


| | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|-------|--------|--------|--------|--------|--------|--------|-------|------|------|
| BMWi | 19,611 | 23,398 | 28,337 | 17,176 | 7,667 | 4,613 | 3,931 | | |
| BMVBS | 7,153 | 34,468 | 48,764 | 36,432 | 17,265 | 17,629 | 2,151 | 600 | 0 |

NIP – Project status

(As at December 2009)

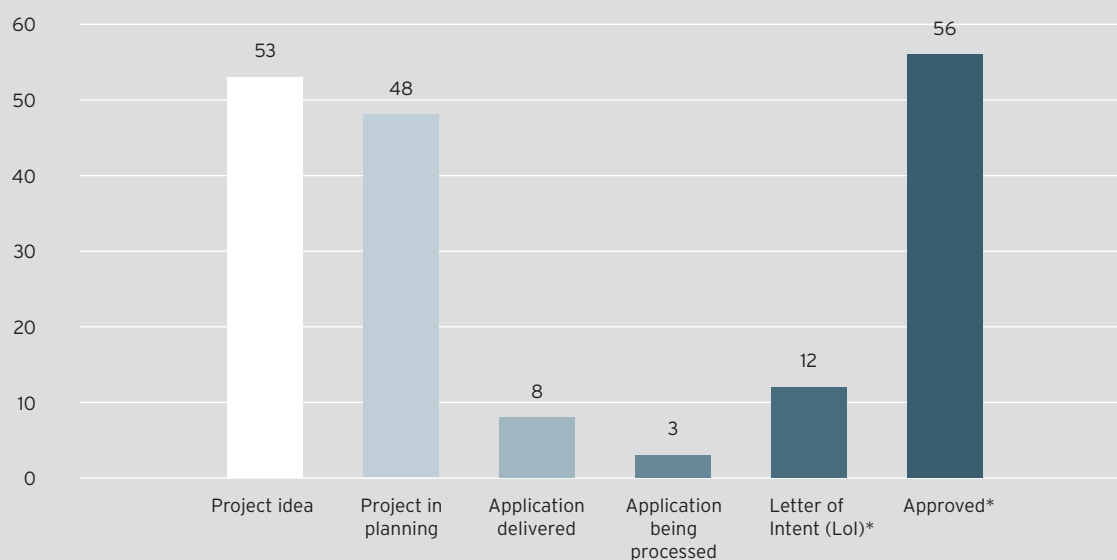
Funding in thousands of €



| | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|-----------------------------|-------|--------|--------|--------|--------|--------|--------|-------|-------|
| Project idea | | | 16,266 | 27,372 | 31,196 | 14,300 | 10,245 | 8,201 | 3,401 |
| Project in planning | | 0 | 19,354 | 29,903 | 25,856 | 9,033 | 7,561 | 2,364 | 600 |
| Application delivered | | 316 | 5,802 | 5,499 | 3,230 | 314 | 314 | 0 | 0 |
| Application being processed | 0 | 311 | 2,498 | 3,015 | 2,679 | 1,611 | 0 | 0 | 0 |
| Letter of Intent (LoI) | 0 | 6,888 | 17,458 | 7,013 | 3,260 | 3,918 | 725 | 600 | 0 |
| Approved | 7,153 | 27,580 | 31,305 | 29,419 | 14,004 | 13,711 | 1,426 | 0 | 0 |

BMVBS funds

NIP – Processing status (As at December 2009)



BMVBS funds

* 68 projects (160 submissions) are either approved or a Letter of Intent exists

NIP – Application sectors (As at December 2009)

| Programme area €k | Budget €k | Funding €k | In discussion €k | LoI & approved |
|-----------------------------|----------------|----------------|------------------|----------------|
| Transport | 300,820 | 143,894 | 43,396 | 100,498 |
| H ₂ production | 62,103 | 30,038 | 23,213 | 6,824 |
| Stationary industry | 170,923 | 81,142 | 64,041 | 17,102 |
| Stationary household energy | 89,940 | 43,171 | 29,323 | 13,848 |
| Special Markets | 184,889 | 88,727 | 66,234 | 22,493 |
| Cross-cutting themes | 12,047 | 6,543 | 5,080 | 1,463 |
| Total | 820,722 | 393,516 | 231,288 | 162,228 |

BMVBS funds

THE DECLARED OBJECTIVE OF GERMANY AS IPHE CHAIR IS TO DRAW POLITICAL ATTENTION TO THE RESULTS OF THE IPHE'S WORK

2010-2011 – NOW: Secretariat of the IPHE



The International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE), is an international organisation with the goal of establishing hydrogen and fuel cell technologies as a central element of a diversified energy industry. The IPHE provides its members with a platform to exchange experiences and advances global cooperation between policy-makers, research and industry. Founded in 2003, the IPHE now counts the following among

its membership:

Australia, Brazil, Canada, China, France, Germany, Iceland, India, Italy, Japan, South Korea, New Zealand, Norway, Russia, United Kingdom, USA, South Africa and the European Commission.

The IPHE primarily adopts a coordinating function and moderates the exchange of experiences and information between senior government officials and experts from industry as well as research and development. IPHE activities are especially concentrated on promoting the market introduction and commercial use of hydrogen and fuel cell technology in addition to the establishment of the associated infrastructure.

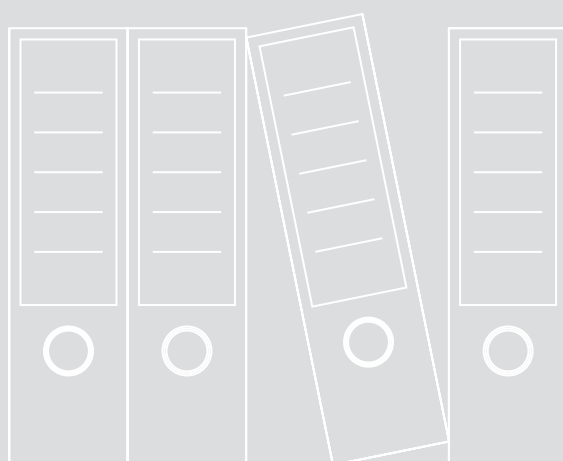
Another issue important to IPHE is communication to partners and industry regarding the challenges and opportunities hydrogen and fuel cells offer the energy industry.



Germany took over the chair of the IPHE in December 2009, which until then was in the hands of Canada. NOW GmbH will serve as the IPHE secretariat for two years, during which time it will coordinate and organise IPHE activities. Among other activities, structural changes to streamline the organisation will be sought under Germany's chairmanship. The IPHE profile shall, however, be simultaneously raised and communication measures expanded. The topic of »IPHE Workshops« will receive special priority.

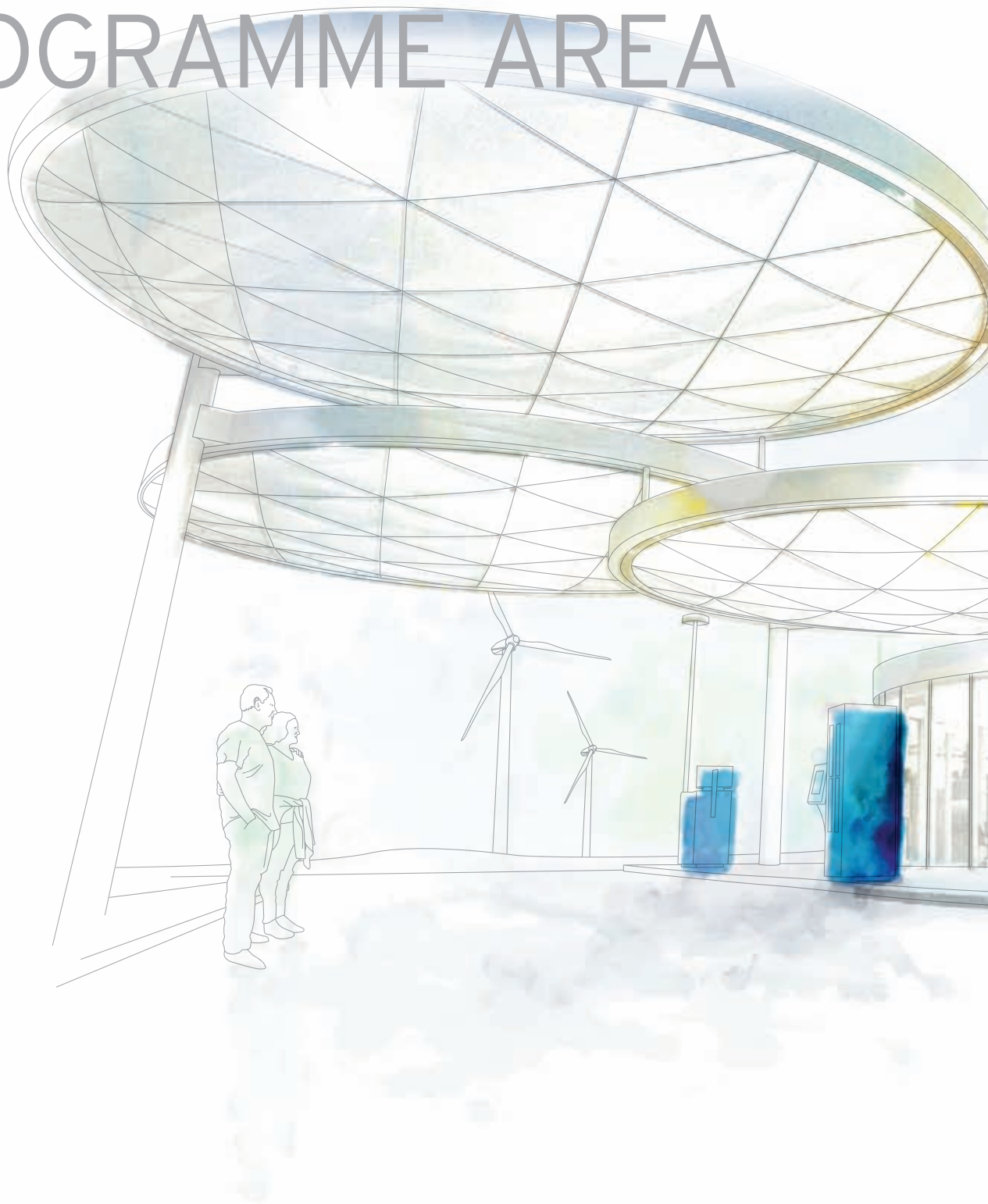
The interchange between parties is to be promoted, and a forum will be created to provide members with more opportunity to orientate themselves and be in a better position to compare domestic developments and develop them further. The declared objective of the German IPHE chairmanship is to draw political attention to the hydrogen and fuel cell-related activities of its members.

PROGRAMME AREAS



- » Fuel and the future » Transport and Infrastructure Programme Area » 14
- » Efficiently produced power and heat » Stationary Energy Supply Programme Area » 44
- » Close to the market » Special Markets Programme Area » 66
- » Everyday mobility in the cities of tomorrow » Electromobility Model Regions » 82

FUEL AND THE FUTURE TRANSPORT AND INFRASTRUCTURE PROGRAMME AREA





- » [Future emission targets can only be attained with hydrogen](#) » 16
- » [Clean Energy Partnership \(CEP\)](#) » 18
- » [Project profiles](#) » 20
- » [Hydrogen production](#) » 36 » [H₂ Mobility](#) » 40
- » [Cross-cutting themes](#) » 42

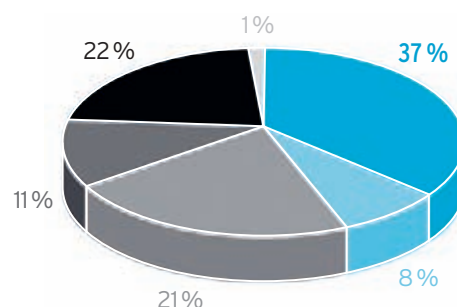
THE MAXIM FOR THE TRANSPORT SECTOR OF THE » Thorsten Herbert, NOW Programme Manager « Transport FUTURE MUST BE: LOW EMISSIONS, HIGH EFFICIENCY.

Future emission targets can only be attained with hydrogen

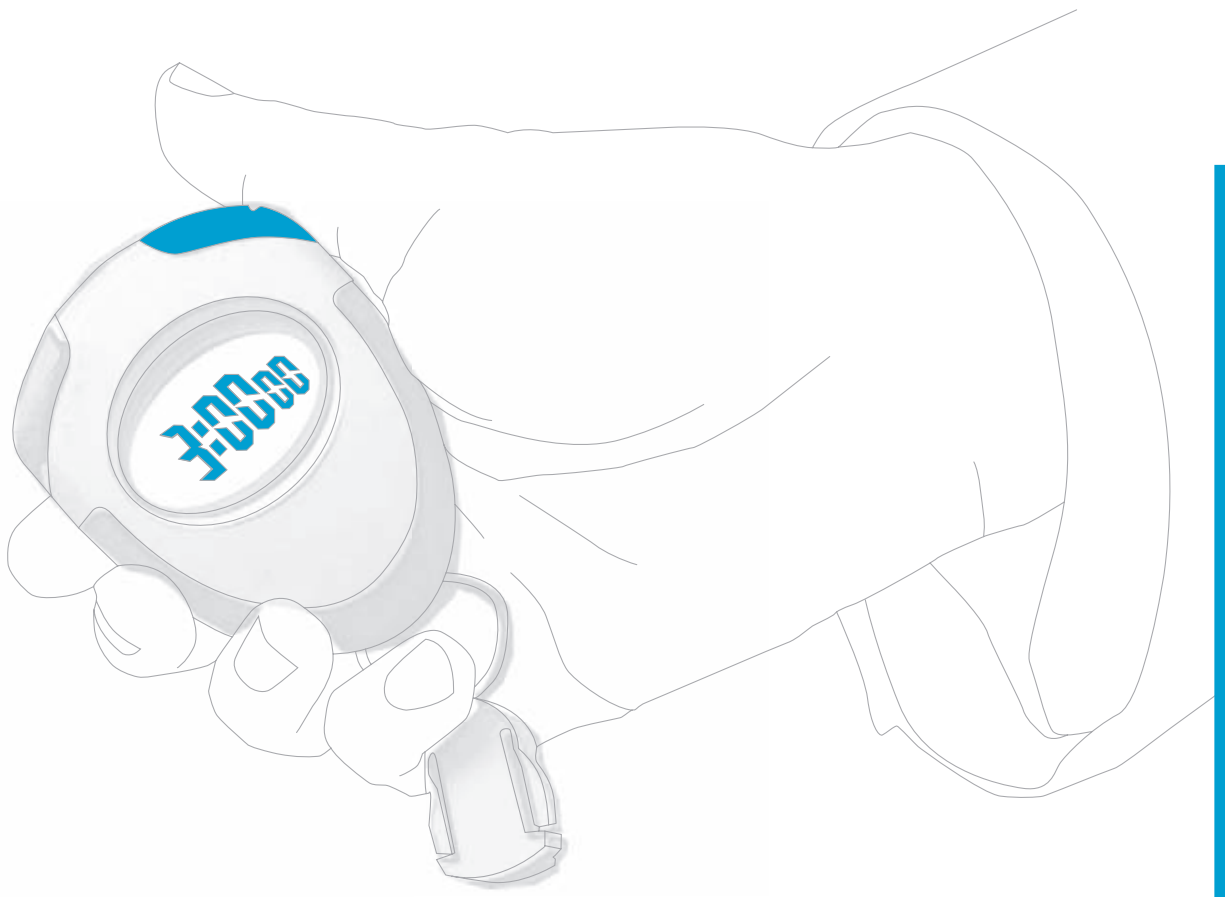
Economic and environmental challenges demand new solutions for mobility. »The technologies currently entrenched in the markets are insufficient to reach global climate targets,« explains Dr. Klaus Bonhoff, NOW Managing Director (Chair).

For example, in the transport sector, an 80% reduction in greenhouse gas emissions by 2050 – which is necessary to remain within the 2 degree target – requires maximum permissible emissions in new vehicles of approximately 80g CO₂ per km by the year 2020. By 2030, this figure must be reduced even further to under 60g CO₂ per km. The optimisation of today's fuels and power drive technologies needed to meet these goals will in all probability not be achievable. It is therefore crucial that renewable energy sources and more efficient power drive technologies are implemented to enable the transport sector to meet its requisite environmental targets.

»The maxim for the transport sector of the future must be: low emissions, high efficiency«, says Thorsten Herbert, NOW Programme Manager Transport. The development and embedding of new technologies for improved efficiency and sustainability will bring about a paradigm shift away from oil to a range of solutions taking regional considerations into account. An area offering vast potential is hydrogen with fuel cell technology, alongside battery electric power drives.



« « « « « «



Hydrogen with fuel cells and battery electric power drives are complementary

When monitoring the public debate, one often gets the impression that industry is increasingly backing battery electric mobility. »Closer inspection of the strategic direction of car manufacturers, energy providers, supply firms, small and medium-sized enterprises in the fields of heating equipment and systems manufacture, as well as local authorities and federal government departments show that each of these partners have recognised that both technologies provide the environmentally friendly mobility and energy supply solutions required for tomorrow,« explains Klaus Bonhoff, NOW Managing Director (Chair).

Electromobility is based on two key complementary technologies: fuel cell power drives and pure battery electric power drives. Vehicles with highly efficient battery electric power drives have their largest potential particularly in urban traffic situations where short distances are generally covered. Fuel cell vehicles, meanwhile, additionally offer mobility with zero emissions with a long range and fast refuelling. They are therefore also suited for longer, cross-country journeys as well as short trips.

« « « « NIP STATISTIC: APPLICATIONS | AS AT DECEMBER 2009 | Share of application sectors in NIP

■ Transport
 ■ H₂ production
 ■ Stationary industry
 ■ Stationary household energy
 ■ Special Markets
 ■ Cross-cutting themes

The diagram comprises planned NOW projects, projects in process with the project administrator (PtJ), Letter of Intent, and approved projects.



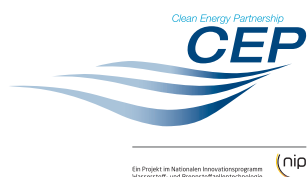
Clean Energy Partnership (CEP)

In 2009, the Clean Energy Partnership (CEP) – the NIP lighthouse of the transport sector – impressively showed that it is indeed a success story. So that additional technical insights can be gathered, the fleet of vehicles in customers' hands from [BMW](#), [Daimler](#), [GM/Opel](#), [Ford](#) and [Volkswagen](#) will continue operation. In August 2009, the Hydrogen4 from GM/Opel broke the 50,000km barrier.

»The energy source of hydrogen and the fuel cell as power drive technology have proven themselves in practice,« says Thorsten Herbert, NOW Programme Manager Transport. Public bus fleets of the [Berliner Verkehrsgesellschaft](#) and [Hamburg Hochbahn](#) were also deployed within the two CEP key regions in 2009. To ensure refuelling of the fleet, the fuelling stations in Berlin and Hamburg – for which the CEP partners [Linde](#), [Shell](#), [Statoil](#), [Total](#) and [Vattenfall](#) are responsible – continued operation.



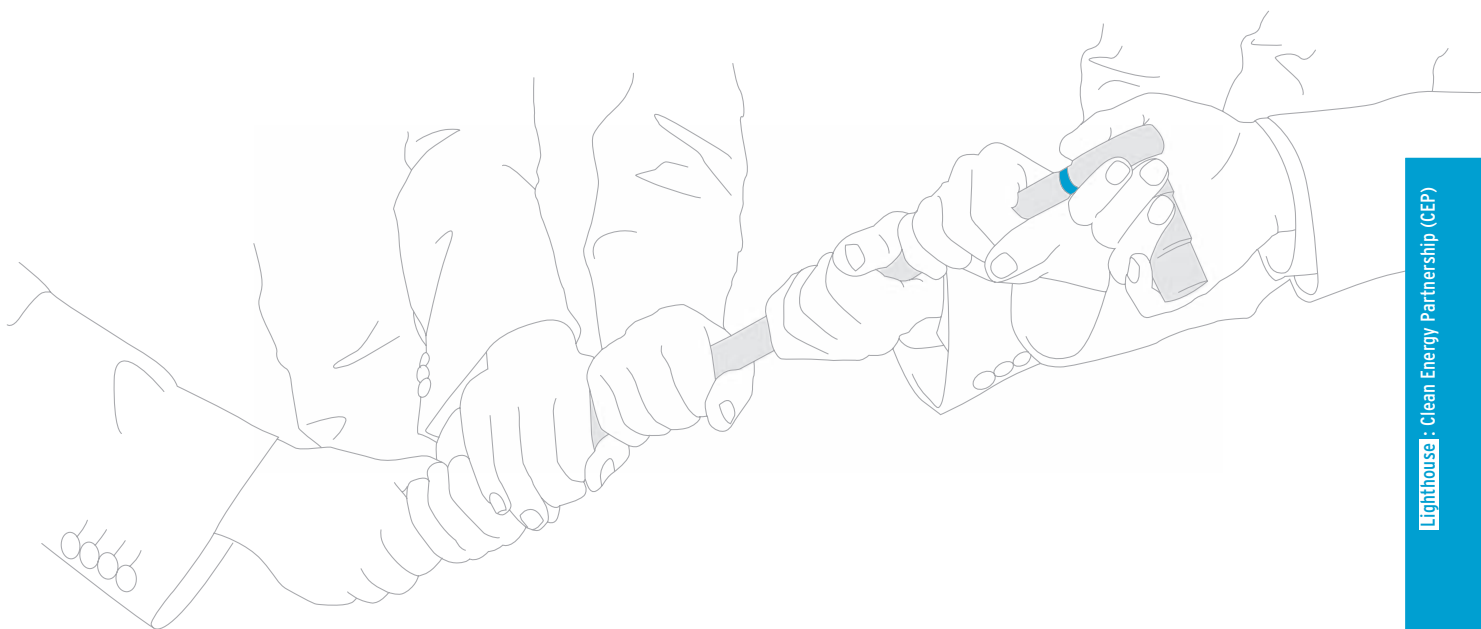
 REGIONS OF ACTIVITY



Phase II duration:
2008-2011
Total budget:
€58,3 million

CEP Partners:

BMW Group, Berliner Verkehrsbetriebe BVG, Daimler, Ford, GM/Opel, Hamburg Hochbahn, Linde, Shell, StatoilHydro, TOTAL, Vattenfall Europe, Volkswagen



Clean Energy Partnership (CEP) – Phase II

The CEP was launched in 2002 as an international corporate partnership. Its aim was to demonstrate the everyday suitability of hydrogen as a fuel for vehicles and to test the infrastructure for refuelling such vehicles. In September 2008, the CEP embarked on its second phase. Since then, 48% of CEP funding contributions comes from the NIP.

Currently, the CEP concentrates on the key regions of Berlin and Hamburg. It is the largest undertaking of its kind in Europe. Roughly 30 passenger cars are in daily use – and the expansion of this fleet to significantly more than 40 vehicles is just around the corner. Furthermore, both cities continue to boast operating fleets of public buses. As these fleets grow, the associated hydrogen infrastructure will mature.

All twelve project partners and NOW work closely together in superordinate modules. These incorporate: coordination and management, project representation, knowledge and information management, public relations plus the work in committees. Vehicle manufacturers, oil companies, energy providers, the gas industry and public transport providers cluster their activities in the superordinate modules to ensure a unified CEP voice. Residing under this framework, individual CEP areas are similarly grouped according to associative applications (e.g. vehicles or fuelling stations).

Milestone: Topping Out Ceremony for Hydrogen Fuelling Station in Berlin

A festive topping out ceremony of the new hydrogen fuelling station in Berlin's Holzmarktstrasse marked an important milestone for the CEP in 2009 on its way to significantly expanding the infrastructure for hydrogen refuelling. Former German Federal Transport Minister, Wolfgang Tiefensee, was on site to witness the installation of the compressor, which is the centrepiece of the fuelling facility. The compressor brings the gaseous hydrogen to a pressure of 1.000 bars and is the central control point for both refuelling and storage.

The hydrogen is brought to its full pressure in two compression steps. First, it is increased from around 30 to 460 bars and stored in underground tanks at the hydrogen fuelling station of TOTAL, Statoil and Linde. A second step raises the pressure to 1,000 bars. Hydrogen-powered vehicles can then refuel using the stored hydrogen.

PROFILES OF PROJECTS APPROVED IN 2009 IN THE AREA OF TRANSPORT (CLEAN ENERGY PARTNERSHIP)

All approved projects can be found at www.now-gmbh.de



NIP: CLEAN ENERGY PARTNERSHIP (CEP) – SUPERORDINATE MODULE

Application:

Superordinate Module

Keyword:

Superordinate Module

Commencement:

1 May 2008

Conclusion:

31 December 2010

Project budget/Subsidy amount:

a) €513,546/€246,502

b) €438,138/€210,306

€951,684/€456,806

Recipients:

a) Statoil ASA

b) Shell Hydrogen BV

PROJECT DESCRIPTION:

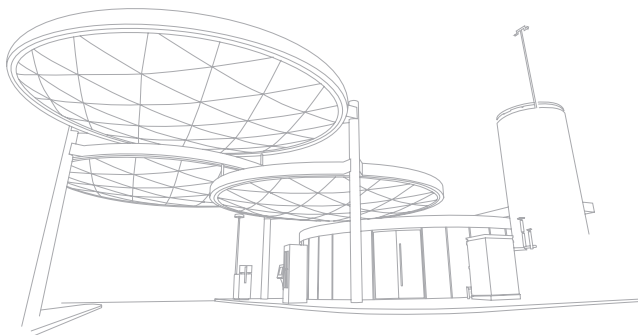
The CEP partners intend to implement measures necessary for continued development. The undertaking has been backed by the German government since 2002 and is a pioneering, lighthouse initiative as it shows the world how hydrogen can be used as a fuel source for vehicles on public roads. The partnership aims to execute the following associated projects within the framework of the superordinate module:

1. Organisational realisation and networking of project modules through establishment of required committees
2. Establishment of a project office in Berlin
3. Project coordination and management of the task as a whole and its individual modules
4. Establishment of an information and knowledge management system

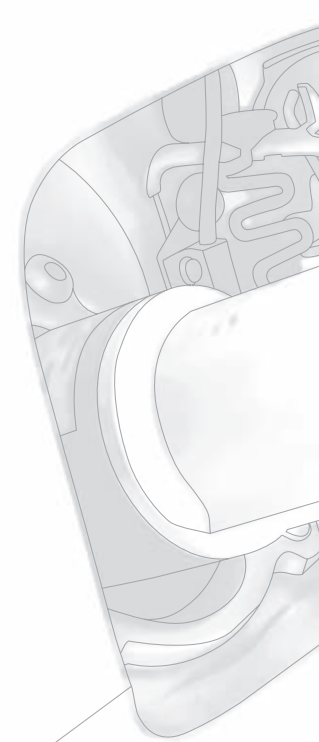
5. Coordination and execution of project communication

The project serves the preindustrial development of hydrogen as a fuel source. It thereby promotes sustainability in two respects:

1. Through the development of an ecologically sustainable (principally CO₂-neutral) fuel source
2. Due to economic sustainability arising from in-house development that is focused on this issue



Lighthouse project





NIP: CLEAN ENERGY PARTNERSHIP (CEP) – RESEARCH FUELLING STATION SACHSENDAMM

Application:

Hydrogen fuelling stations

Keyword:

Sachsendamm

Commencement:

1 August 2008

Conclusion:

31 December 2013

Project budget:

€6,072,699

Subsidy amount:

€2,914,895

Recipient:

Shell Deutschland Oil GmbH

PROJECT DESCRIPTION:

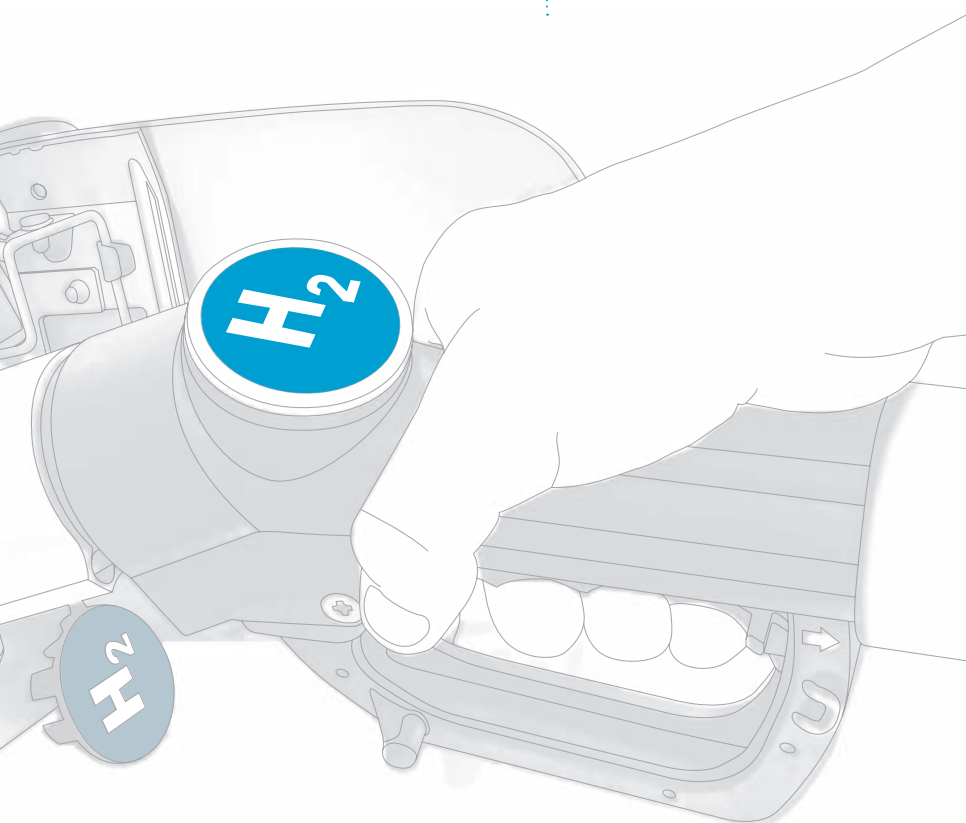
The goal of the project module »Research Fuelling Station Sachsendamm« is the development of an innovative, scalable H₂ fuelling station concept on the basis of LH₂ transfers and a 900 bar cryopump along with large-scale validation.

Through developing a fuelling station concept, the project intends to demonstrate that vehicle manufacturer/OEM demands – such as the »refuelling procedure for 700 bar pressure hydrogen vehicles – Release A« and fast 5kg H₂ refuelling in 3 minutes – can be met. Yet, while the H₂ research fuelling station is being constructed on the basis of the overall project concept, it simultaneously integrates additional innovative components.

These are in particular, the cryopump, temperature management and subterranean installation of plant technology in order to reduce its »footprint«.

Long-term tests will subsequently follow to validate the technology in real life environments. The fuelling station concept itself will be validated on the basis of the three-year test phase. The requisite operational concept will also be developed over the same period. The planned duration of the project is five years.

The project will conclude with the development of requirement specifications, which will form the foundation for future of H₂ fuelling stations.





NIP: CLEAN ENERGY PARTNERSHIP (CEP) – MOBILE FUELLING STATION MARGARETE-SOMMER-STRASSE

Application:

Hydrogen fuelling stations

Keyword:

Margarete-Sommer-Straße

Commencement:

1 May 2009

Conclusion:

31 March 2010

Project budget:

€171,719

Subsidy amount:

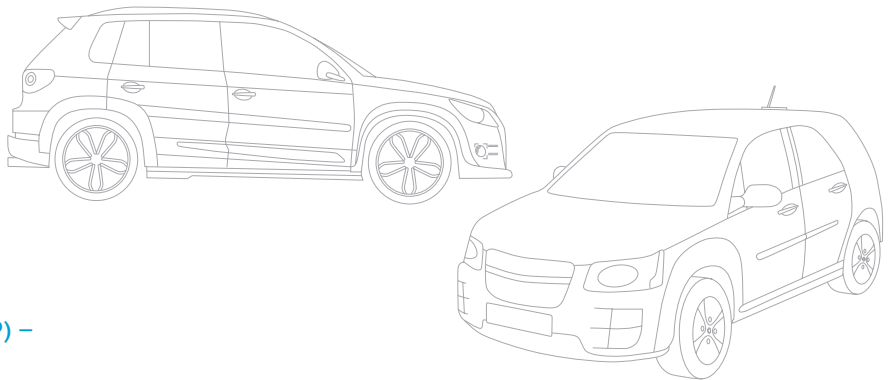
€82,425

Recipient:

TOTAL Deutschland GmbH

PROJECT DESCRIPTION:

NIP: Clean Energy Partnership (CEP) –
Phase II Project Module: Trial continuation
of a mobile 700 bar fuelling facility at the
Margarete-Sommer-Strasse site.



NIP: CLEAN ENERGY PARTNERSHIP (CEP) – SERVICE STATION MESSEDAMM

Application:

Passenger cars

Keyword:

Service station

Commencement:

1 July 2008

Conclusion:

31 January 2011

Project budget/Subsidy amount:

a) €173,410/€83,237

b) €156,292/€75,020

c) €141,861/€68,092

d) €125,960/€60,461

.....
€597,523/€286,810

Recipients:

a) Daimler AG

b) Bayerische Motoren Werke AG

c) Volkswagen AG

d) Ford-Forschungszentrum
Aachen GmbH

PROJECT DESCRIPTION:

The CEP mobility partners intend to
continue and extend operations at the
fuelling stations established in phase I
for hydrogen-powered cars, within the
framework of this project module.

The measures sustainably support
vehicle operation and enable validation
of the technology by customers, which
are a part of individual project modules.
In this particular module, the partnership
intends to undertake following activities:

1. Linking the facility to the infrastructure
provider
2. Continuation of workshop operations
3. Expansion measures

The project serves the preindustrial de-
velopment of hydrogen as a fuel source.
It thereby promotes sustainability in
two respects:

1. Through the development of an
ecologically sustainable (principally
CO₂-neutral) fuel source
2. Due to economic sustainability
arising from in-house development that
is focused on this issue

Application:

Hydrogen fuelling stations

Keyword:

Berlin Gradestraße

Commencement:

1 July 2009

Conclusion:

30 June 2010

Project budget:

€139,690

Subsidy amount:

€67,051

Recipient:

Linde AG

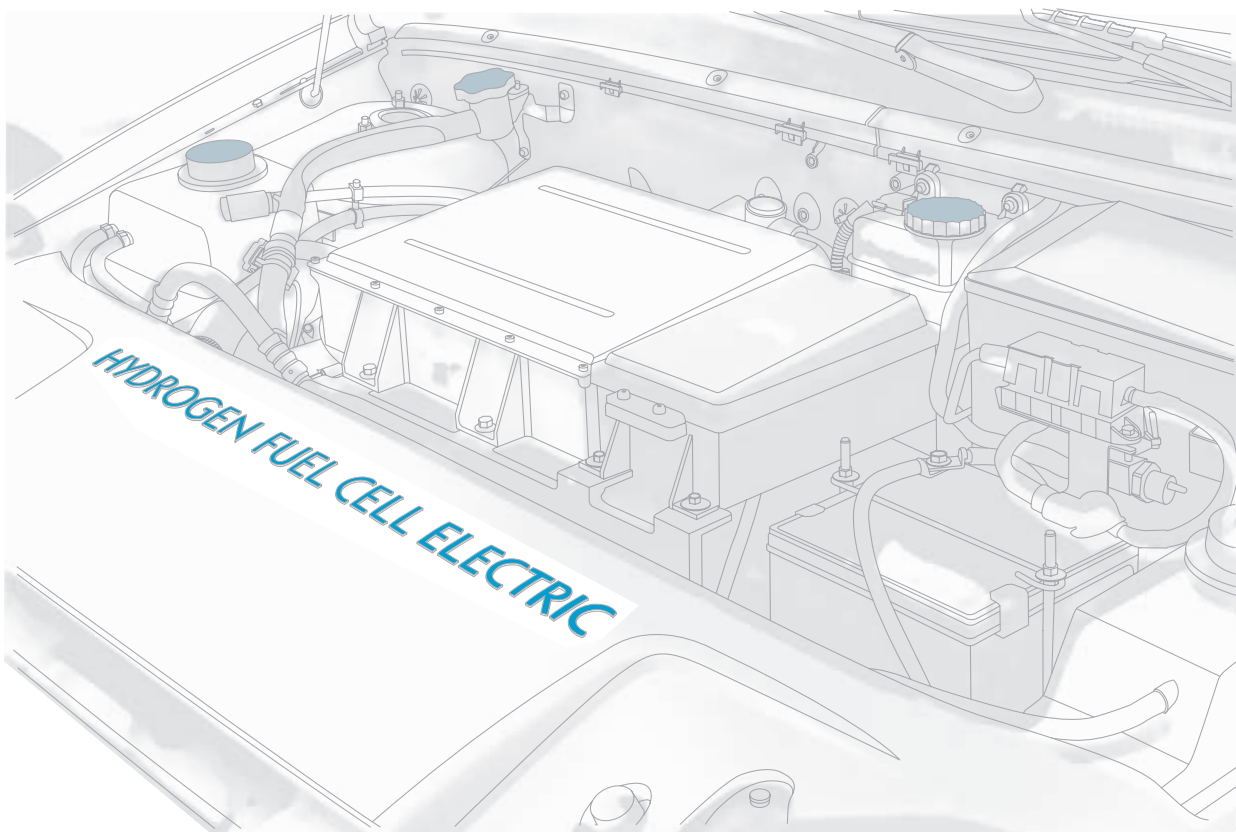
PROJECT DESCRIPTION:

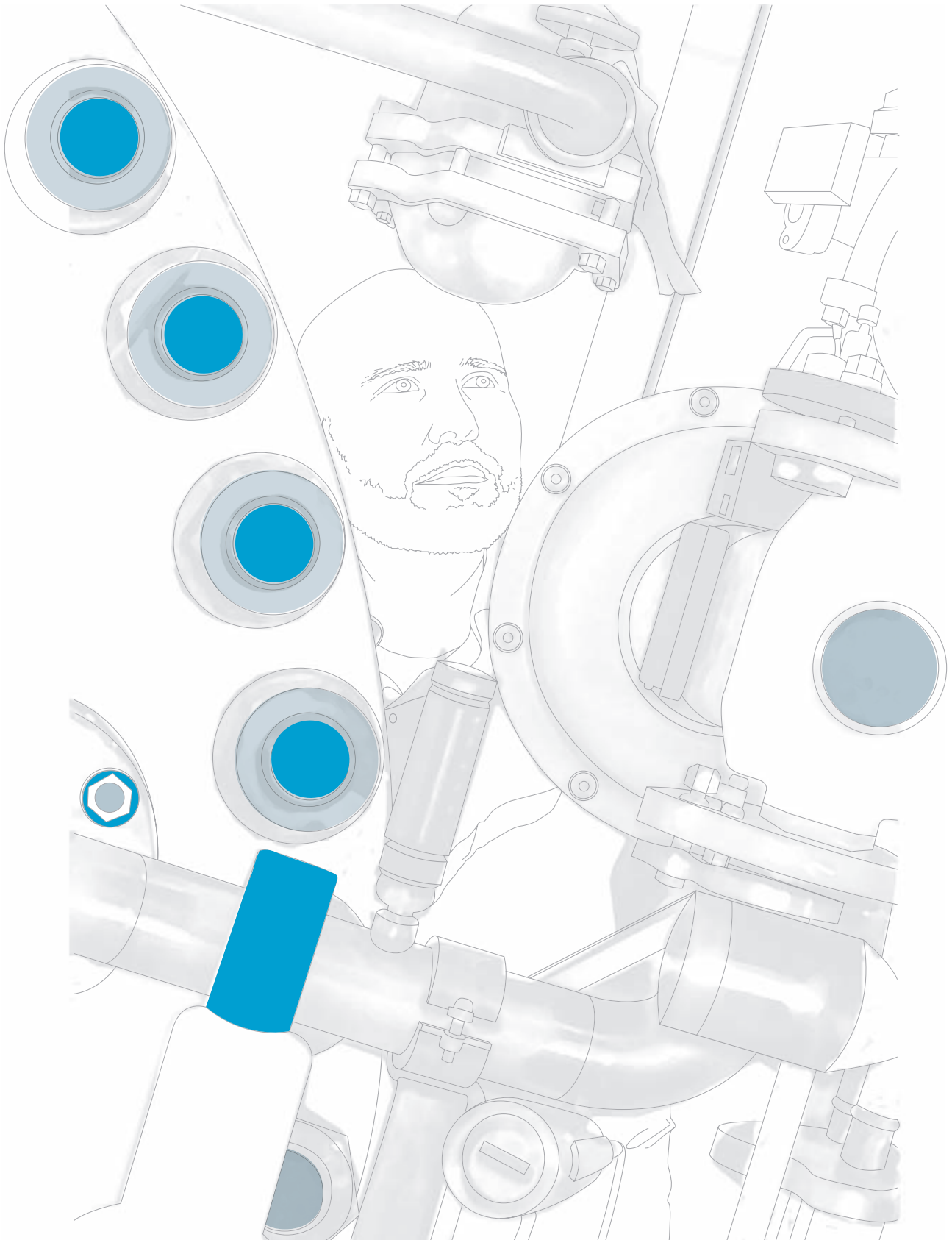
The mobile fuelling facility is an interim measure and will serve as a communication test bed. The IR interface will be simultaneously field-tested here.

The location of the fuelling facility is at the Linde company site on Gradestraße, Berlin. Fuel cell car users will be briefed on fuelling procedures and permitted to individually refuel at specified opening times. The fuelling facility incorporates an H₂ tank that is refilled after approximately 16 cars have refuelled. Refuelling takes place at the BVG site on the Heerstrasse where a H₂ supply is located.

The project serves the preindustrial development of H₂ as a fuel source. It thereby promotes sustainability in two respects:

1. Through the development of an ecologically sustainable (principally CO₂-neutral) fuel source
2. Due to economic sustainability arising from in-house development that is focused on this issue







NIP: CLEAN ENERGY PARTNERSHIP (CEP) – HYDROGEN FUELLING STATION HAFENCITY HAMBURG

Application:

Hydrogen fuelling stations

Keyword:

Hydrogen station Hamburg

Commencement:

1 June 2009

Conclusion:

31 May 2014

Project budget/Subsidy amount:

a) €11,897,115/€5,710,615

b) €1,367,332/€656,319

.....
€13,264,447/€6,366,934

Recipients:

a) Vattenfall Europe AG

b) Shell Deutschland Oil GmbH

PROJECT DESCRIPTION:

A new hydrogen fuelling station is to be constructed in HafenCity Hamburg. The goal is to introduce hydrogen as the energy source of the future. Experience with regard to the necessary infrastructure will be gathered throughout the project. This then can be drawn upon for the establishment of future facilities.

The fuelling station will serve to supply public city buses and private vehicles. It is seen as an initial step to help facilitate the accelerated introduction of hydrogen as a source of energy.

An integral aim of the project is the aspect of evaluation. Research focal points shall be in the areas of refuelling, storage and the handling of hydrogen.

A further focus lies in energy balance optimisation. Incorporation of an innovative compressor and electrolyser aims to ensure this. The use of power from regenerative sources of energy is the guarantee for a sustainable form of individual mobility. The plans envision the construction of a new fuelling station that integrates all infrastructural components. Anticipated completion date is expected to be in 2010.

Continuous evaluation of operations will be undertaken with the support of the Technical University of Hamburg-Harburg. Vattenfall will engage a PhD candidate for this purpose. The priority recipient of the hydrogen produced will be the Hamburg public transport authority, Hamburger Hochbahn. In this way, the company is preparing itself for public transport of the future. It is also anticipated that intensive evaluation regarding vehicle management will take place.

The outcomes of the project will serve as a foundation for the establishment of future fuelling stations. Project partners foresee that the experience gained here will benefit future facilities. The main points of research and evaluation encompass hydrogen production through electrolysis in addition to the logistical and safety issues arising from daily trailer deliveries in quantities not yet tested.



NIP: CLEAN ENERGY PARTNERSHIP (CEP) – DEMONSTRATIVE OPERATION OF VEHICLES WITH HYDROGEN COMBUSTION ENGINES

Application:

Passenger cars

Keyword:

Hydrogen 7

Commencement:

1 July 2009

Conclusion:

30 June 2011

Project budget:

€4,622,005

Subsidy amount:

€2,218,562

Recipient:

Bayerische Motoren Werke
BMW AG

PROJECT DESCRIPTION:

The CEP aims to promote the technological development of hydrogen energy for the transport sector while simultaneously testing its suitability for everyday use and systems integration. Through the operation of vehicles with H₂ combustion engines, broad-ranging information and experience about H₂ vehicles and their technology can be harvested. At the same time, the practical experiences of such vehicles on the road will help facilitate a higher degree of acceptance and better potential uptake for market introduction.

The operation of H₂ vehicles in common everyday situations, serves to validate the developed systems and methods. Vehicle operation occurs in two work packages:

1. Operation of 20 BMW Hydrogen 7 vehicles with bifuel H₂ combustion engines in customer hands

2. Operation of two BMW Hydrogen 7 vehicles with monofuel H₂ combustion engines. (These are test vehicles.)

Through verification of the vehicle's suitability for everyday use and refuelling infrastructure, together with mass supply availability, the project makes a major contribution to preparing the market for accepting hydrogen as fuel. The product development project therefore also boasts the hallmark of economic sustainability.



NIP: CLEAN ENERGY PARTNERSHIP (CEP) – MERCEDES-BENZ B-CLASS F-CELL FLEET IN BERLIN

Application:

Passenger cars

Keyword:

F-CELL Berlin

Commencement:

1 July 2009

Conclusion:

30 July 2013

Project budget:

€20,561,691

Subsidy amount:

€9,581,745

Recipient:

Daimler AG

PROJECT DESCRIPTION:

Daimler plans to operate a fleet of 40 Mercedes-Benz B-Class F-CELL cars to be driven by selected customers within the framework of the CEP. The reliability and competitiveness of these fuel cell vehicles being used under everyday conditions will thereby be demonstrated.

Furthermore, the focused deployment of these vehicles can act as a stimulus for the development of more hydrogen fuelling stations. With a view to mass-producing fuel cell vehicles in the future, this demonstrative undertaking also serves to develop a service infrastructure at the Mercedes-Benz subsidiary and to train technicians in the new technology. In addition it will help

to diminish reservations about fuel cell technology and to sensitise the public on the subject of sustainable mobility using fuel cell vehicles.

Finally, demonstration of the vehicles also sends strong signals to suppliers to invest more readily in future-oriented fuel cell technology.



NIP: CLEAN ENERGY PARTNERSHIP (CEP) – HYMOTION4 FUEL CELL VEHICLE

Application:

Passenger cars

Keyword:

HyMotion4

Commencement:

1 August 2009

Conclusion:

30 September 2011

Project budget:

€2,840,465

Subsidy amount:

€1,363,424

Recipient:

Volkswagen AG

PROJECT DESCRIPTION:

The primary aim of the project is to integrate a fuel cell system – which was also developed within a sponsored programme – into a research vehicle to provide valuable practical experience.

The technological competitiveness is to be validated within the framework of this project. For this purpose, a fuel cell vehicle will be built that doesn't have restrictions in terms of functionality, interior comforts and appointments, or performance when compared to a similar vehicle with a conventional combustion engine. Furthermore, a materials cost analysis is to be undertaken. Besides indicating the actual current expenses, it also enables cost forecasts for the time of mass production to be made as well as

identifying other potentials.

The findings and technologies arising out of this project shall subsequently be used to further promote and mature the development of fuel cell technology in vehicles. The built vehicle is to be operated within the public demonstration programme of the CEP. Practical experiences gathered here will also be transferred and be used as an impetus for further future developments.



NIP: CLEAN ENERGY PARTNERSHIP (CEP) – DEMONSTRATION AND FLEET TEST OF FORD FOCUS FCEV HYBRID FUEL CELL VEHICLES

Application:

Passenger cars

Keyword:

NIP – FCEV

Commencement:

1 March 2009

Conclusion:

31 March 2011

Project budget:

€1,421,565

Subsidy amount:

€651,826

Recipient:

Ford-Forschungszentrum Aachen GmbH

PROJECT DESCRIPTION:

The goal of this undertaking is to prove the suitability of hydrogen for regular, everyday use on the roads through demonstration and fleet test of fuel cell vehicles within the framework of the CEP. Enabling this are three Ford Focus FCEV Hybrid fuel cell vehicles operated by customers. Ford will supervise these from scientific, technological and administrative perspectives. The project is divided into three areas:

- Demonstration and validation of fuel cell technology in vehicles subjected to regular, daily use
- Preparatory market measures for fuel cell technology on the road
- Measures which the CEP project supports and accompanies as a whole

Also incorporated are additional accompanying measures such as the effective public presentation of fuel cell technology in vehicles in order to support the visibility of the CEP.

Besides feeding the knowledge garnered back into this project, it is anticipated that insights gained will be used to support subsequent fuel cell programmes. This specifically means that future R&D activities and programmes as well as thematic technology platforms will also benefit.

PROFILES OF PROJECTS APPROVED IN 2009 IN THE AREA OF TRANSPORT (DEMONSTRATION PREPARATION)

All approved projects can be found at www.now-gmbh.de

11 NIP: OPTIMISATION OF THE GAS DIFFUSION LAYER FOR APPLICATION IN FUEL CELLS FOR PASSENGER CARS (OPTIGAA)

Application:

Components

Keyword:

OptiGAA

Commencement:

1 September 2008

Conclusion:

31 August 2011

Project budget/Subsidy amount:

a) €1,977,221/€949,066

b) €1,892,953/€908,617

.....
€3,870,174 / €1,992,874

Recipients:

a) Freudenberg FCCT KG

b) Daimler AG

PROJECT DESCRIPTION:

Gas diffusion devices will be studied, specified and presented, which due to their mechanical characteristics as well as their functionality meet the requirements of tomorrow's automotive fuel cells.

Based on the characterisation of current gas diffusion devices and with the aid of simulations, decisive parameters will be identified which are pivotal to fuel cell performance. The targets optimised for increased power density will then be put into effect in the prototypes. The characterisation and testing of these gas diffusion devices should then serve as the basis for the subsequent development of a marketable product. To ensure a competitive market introduction of

automotive fuel cell power drives, all required components must fulfil high functionality and low cost demands.

Upon successful project completion, the prototype of a gas diffusion device will be available which will increase the competitiveness of fuel cell power drives. In this way a contribution can be made to the spread of environmentally friendly power drive strategies as well as the creation of jobs in the industries involved.

12 NIP: H₂CPI – HIGH-EFFICIENCY, LOW EMISSION H₂-COMBUSTION ENGINE WITH CRYOGENIC PORT INJECTION AS A HIGH-PERFORMANCE PASSENGER CAR POWER DRIVE

Application:

Components

Keyword:

H₂CPI

Commencement:

1. August 2009

Conclusion:

31 January 2011

Project budget/Subsidy amount:

a) €217,500 / €104,400

b) €64,148 / €30,791

.....
€281,638 / €135,191

Recipients:

a) BMW Forschung und Technik GmbH

b) AFT Atlas Fahrzeugtechnik GmbH

PROJECT DESCRIPTION:

The plan is part of a transnational co-operative project (NIP in Germany and A3plus in Austria), to develop a combustion process for a hydrogen internal combustion engine using cryogenic port injection (CPI). This concept is based on the cryogenic injection of hydrogen into the suction tube of a combustion engine. Through this the air drawn in is rapidly cooled, thereby increasing the overall density of the hydrogen-air mixtures. The result is a higher volumetric mixed heat value.

In this way the power density and efficiency of the engine is substantially improved. In the plan submitted here (the German part of the overall project), special functions for the control of a hydrogen combustion engine with cryogenic injection are to be developed and integrated into a prototype engine control unit.

13 NIP: ENGINEERING PROTOTYPE OF AN ELECTRIC TURBO CHARGER FOR THE CATHODE GAS SUPPLY OF AUTOMOTIVE FUEL CELL SYSTEMS – ELECTRIC TURBO CHARGER (ETC)

Application:

Components

Keyword:

ETC

Commencement:

1 May 2009

Conclusion:

31 August 2011

Projekt budget:

€18,455,294

Subsidy amount:

€8,858,541

Recipient:

Robert Bosch GmbH

PROJECT DESCRIPTION:

The aim of the R&D project is to develop engineering prototypes of an electric turbo charger which are suitable for passenger cars. They should be adapted to guarantee reliable function in fuel cell prototype vehicles and fuel cell testing facilities under real operating conditions. These engineering prototypes are to be made available for testing to automotive manufacturers and universities.

The results of the research and development will be compiled in six main work packages, forming the technological foundation for the engineering prototype of an electric turbo charger (ETC). On this basis, a functional and cost-oriented model (engineering prototype) will be built according to an automotive-oriented concept.

By means of comprehensive testing, the robustness of the engineering prototype and of the overall concept selected for implementation in vehicle prototypes will be demonstrated.

The development of the ETC engineering prototype makes an important contribution to preparing fuel cell vehicles for market entry in a period when the profitability of fuel cell technology is not yet assured from an industry perspective.

Thus the project fulfils the objective of strengthening the competitive position of the German automotive industry by entering into alternative propulsion technology.

The project is purposely designed to include German SMEs as development partners and component suppliers of parts and devices. This can only be achieved if these SMEs are qualified in the area of automotive quality and production standards. SME competitiveness can thus be supported in the context of the international market, and the supply of future production series prepared in advance.

14 NIP: NT PEM FUEL CELL AGGREGATE

Application:

Passenger cars

Keyword:

NT PEM fuel cell unit

Commencement:

1 August 2011

Conclusion:

30 June 2011

Project budget:

€3,969,923

Subsidy amount:

€1,905,563

Recipient:

Volkswagen AG

PROJECT DESCRIPTION:

The project's main aim is the construction and trial of an NT fuel cell aggregate for the propulsion of fuel cell passenger cars.

Implementation involves the testing of components and their applicability. The components are to be integrated and tested in the appropriate sub-systems. This is normally done within the laboratory system, which facilitates extensive analysis because of its accessibility.

Eventually the subsystem aggregate is suitable for a vehicle platform to be con-

structed and for comprehensive testing prior to vehicle operation.

For greater vehicle numbers the fuel cell aggregate is to be optimised with respect to mass, volume and cost.

15 NIP: SUSTAINABLE BUS SYSTEM OF THE FUTURE (NABUZ): ESTABLISHMENT AND OPERATION OF A SMALL FLEET OF FUEL CELL HYBRID BUSES

Application:

Components

Keyword:

NaBuZ prep

Commencement:

1 August 2008

Conclusion:

31 December 2010

Project budget/Subsidy amount:

a) €10,032,412/€4,815,557

b) €7,129,030/€3,421,934

c) €502,682/€241,287

.....
€17,664,124/€8,478,778

Recipients:

a) EvoBus GmbH

b) Daimler AG

c) Hamburger Hochbahn AG

PROJECT DESCRIPTION:

The overarching aim of the NaBuZ project is the establishment and focused operation of a small fleet of fuel cell buses to advance market readiness of fuel cell technology.

NaBuZ prep (first of three modules):

The maturity level of a fuel cell hybrid bus prototype for small batch production is to be improved. In addition the manufacturing facilities for the production of buses and bus shelters will be set up by the bus operators. The partners involved are EvoBus, Daimler and Hamburger Hochbahn.

Exploiting knowledge generated from synergy effects from HyFLEET projects: Further development and test work is to be carried out for CUTE & HyBob, in particular on the topics of licensing, standardisation and certification of H₂fuel cell buses.

The fuel cell bus to be further developed into a pre-series vehicle will be mainly manufactured as part of normal series production at the Mannheim location.

Based on the knowledge gained particularly from fuel cell systems developed for new vehicle applications, another small fleet of ten fuel cell buses is planned for introduction in Hamburg from 2013. This continual and consistent promotion of fuel cell technology contributes to the creation and safeguarding of knowledge and jobs in Germany. In addition the acceptance of the technology will be promoted and the future market for fuel cell vehicles prepared.

16 NIP: VALIDATION OF FUEL CELL SYSTEM DESIGN FOR MARKET LAUNCH OF PASSENGER CARS

Application:

Passenger cars

Keyword:

Fuel cell system design validation

Commencement:

1 October 2008

Conclusion:

31 March 2013

Project budget:

€22,805,928

Subsidy amount:

€9,806,549

Recipient:

NuCellSys GmbH

PROJECT DESCRIPTION:

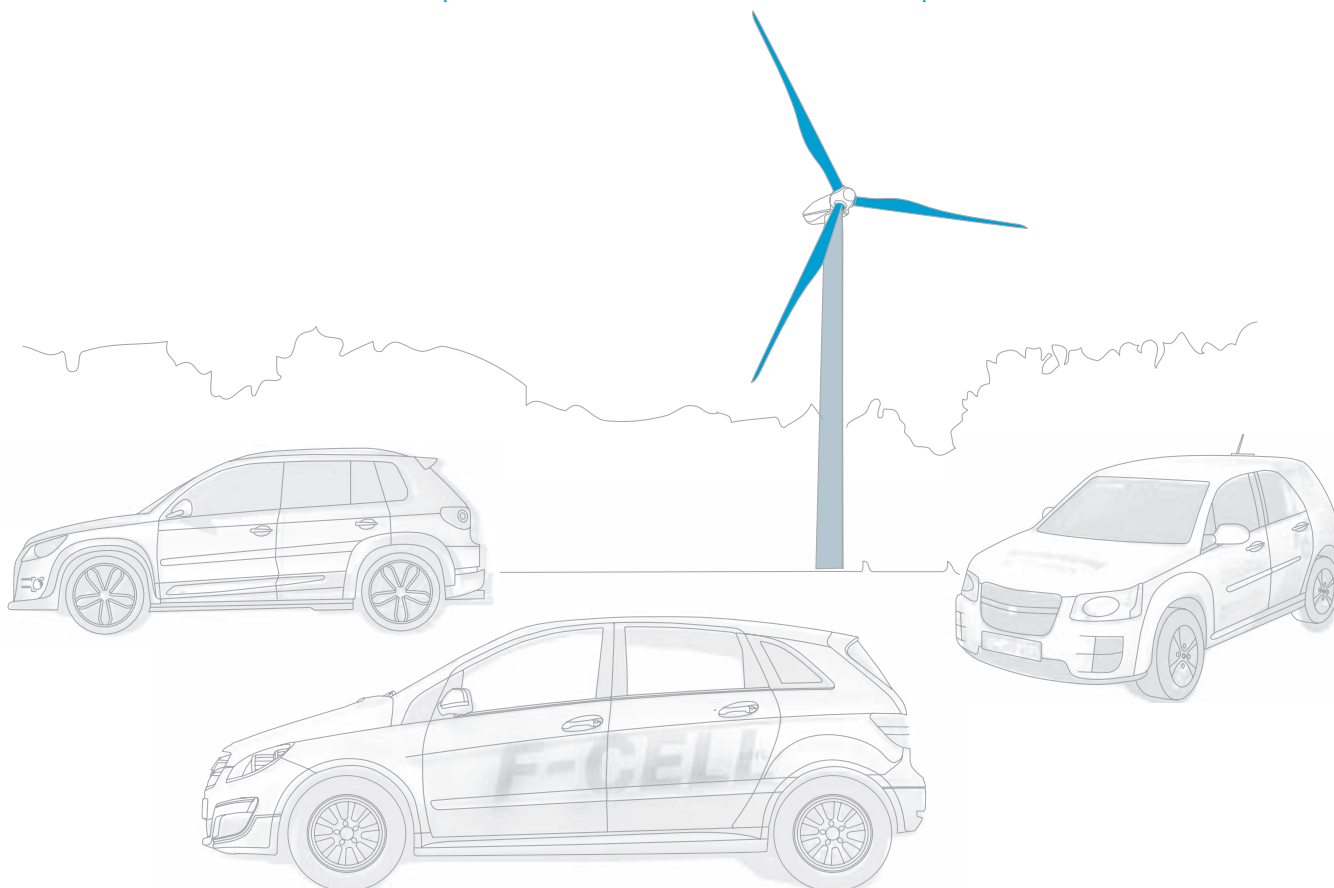
The overall aim of the project is to significantly improve the reliability and life cycle of a developed fuel cell system as well as to accommodate series calculation demands.

The validation of the design of the fuel cell system will be decisively judged on the implementation of a newly defined reliability and robustness process. This process facilitates the identification of errors already in the earliest phase of the project and on the lowest possible integration level, so that immediate troubleshooting measures can be undertaken. The design validation phase procedure is divided into three stages:

1. Determination and coordination of requirements
2. Implementation of validation tests
3. Establishment of maturity level

The results of this project will be fully utilised in the framework of the Daimler passenger car development programme.

The project supports the commercialisation of fuel cell technology through the application of a new methodology with regard to reliability, robustness and requirements of the series.



PROFILES OF PROJECTS APPROVED IN 2009 IN THE AREA OF TRANSPORT (SINGLE PROJECTS)

All approved projects can be found at www.now-gmbh.de

17 NIP: INTRODUCTION OF FUEL CELL MIDIBUSES IN THE UNIVERSITY MEDICAL CENTER HAMBURG-EPPENDORF

Application:

Buses

Keyword:

Midibus

Commencement:

1 July 2009

Conclusion:

31 December 2013

Project budget/ Subsidy amount:

a) €666,845/€320,085

b) €36,483/€17,511

.....
€703,328/€337,596

Recipients:

a) KLE Klinik Logistik Eppendorf GmbH

b) hySOLUTIONS GmbH

PROJECT DESCRIPTION:

The objective of the project is the testing of a midibus with a fuel cell as an efficient and emission-free local power drive system in daily operation on a large clinic premises. The project optimally combines medical care goals and testing of environmentally-friendly power drives, while generating greater public awareness.

The fuel cell system will be examined on the basis of its technical and operating efficiency, so that optimal technical potential can be derived from its real-world operation, which in turn can feed into future market products.

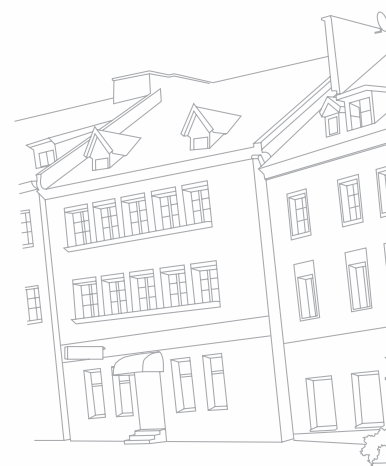
The project is spread over four years in total and will achieve a record-breaking mileage level for this type of vehicle with a planned service of 30,000 km per year.

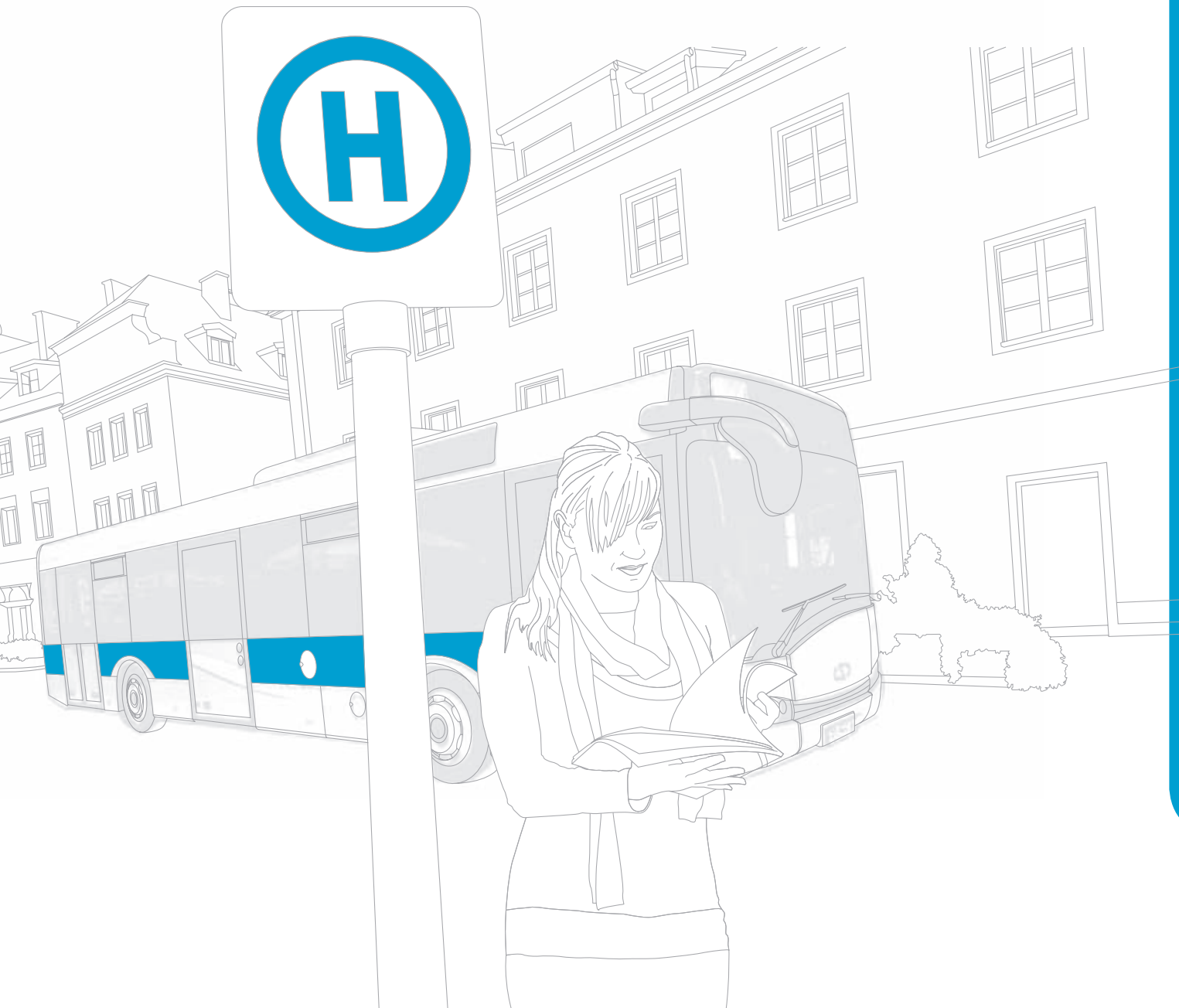
In agreement with the manufacturer (Hydrogenics) the technical performance data will be continually recorded and compared to operational experiences over the course of the project, in order to determine the best service profile for the individual components of the fuel cell hybrid system.

The project also enlarges the circle of users, resulting in increased acceptance on the part of users and the responsible technical experts.

In 2006 there were approximately 750 midibuses of comparable size and efficiency operating within the public transport system in Germany alone. With an average service life of between five and seven years, it will result in a yearly procurement potential of roughly 100 to 120 vehicles per year in this market segment.

Taking midibuses from private bus companies into account, the yearly quota rises to an overall figure of 200 to 250 vehicles. With increasing orientation towards low emission engines, the market potential for fuel cell technology compared to larger service line buses with rather lower procurement costs grows substantially.





PROFILES OF PROJECTS APPROVED IN 2009 IN THE AREA OF TRANSPORT (STUDIES)

All approved projects can be found at www.now-gmbh.de

18 NIP: FUEL CELL DYNAMICS, EXPERIMENTAL STUDIES ON DYNAMIC OPERATION OF PEFC STACKS

Keyword:

Fuel cell dynamics

Commencement:

30 October 2009

Conclusion:

30 September 2012

Project budget:

€851,128

Subsidy amount:

€851,128

Recipient:

Zentrum für Sonnenenergie- und Wasserstoff-Forschung Baden-Württemberg (ZSW)

PROJECT DESCRIPTION:

The service performance of PEFC stacks in highly dynamic applications such as the automotive industry is considerably lower than that of comparable stacks in stationary use or in moderately dynamic applications, and constitutes a decisive barrier on the path to commercialisation.

The focus of the work in this project is the experimental and modelled examination of PEM fuel cells with varying gas diffusion layers and flow field designs in a highly dynamic application and the identification of the transient states caused by dynamics which lead to an accelerated degradation of cells.

The research project consists of four work packages concentrating on parameter definition, experiments, evaluation and modelling as well as validation at the stack level.

19 NIP: DEVELOPMENT, UPSCALING AND TESTING OF NANOCOMPOSITE MATERIALS FOR HYDROGEN STORAGE IN THE CONTEXT OF THE GERMAN-CHINESE SUSTAINABLE FUEL PARTNERSHIP

Keyword:

NIP – GCSFP

Commencement:

1 October 2009

Conclusion:

31 March 2012

Project budget/Subsidy amount:

a) €336,900/€270,000

b) €307,139/€307,139

c) €300,000/€300,000

d) €285,600/€285,600

.....
€1,229,639/€1,162,739

Recipients:

a) GKSS – Forschungszentrum
Geesthacht GmbH

b) Sondervermögen Großforschung
beim Karlsruher Institut für
Technologie (KIT)

c) Fraunhofer-Gesellschaft zur
Förderung der angewandten
Forschung e. V. (FhG)

d) Max-Planck-Institut für Kohlen-
forschung

PROJECT DESCRIPTION:

This initiative is a group project within the framework of the German-Chinese sustainable fuel partnership (GCSFP).

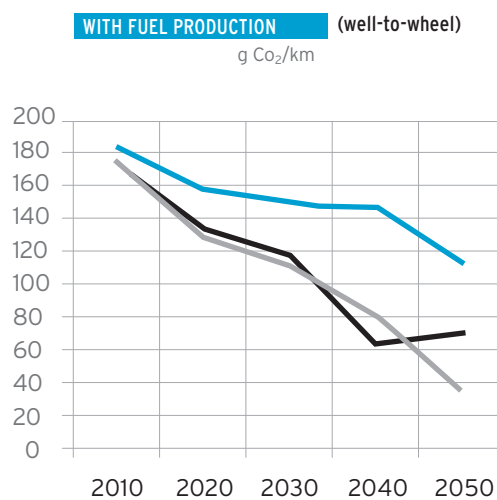
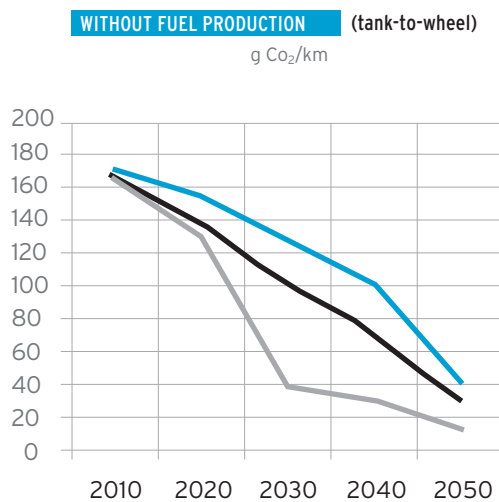
The network consists of subprojects, the results of which are shared for common use. The technological and scientific goal of the project is the development, optimisation and implementation of a high-quality hydrogen storage unit, based on the hydrogen sorption in a nanocomposite storage material.

Besides the development of a suitable storage material, a tank system will also be designed and built, capable of operating in combination with a high temperature PEM fuel cell (operating temperature of up to 200°C).

The German consortium partners possess years of experience and expertise in the development of hydrogen storage material.

Information exchange with Chinese partners is planned and it is agreed that the programmes of both countries should reciprocally support and complement one another.

Work planning: As nanocomposite storage materials, systems based on boranes and amides are selected, which together with magnesium hydride, make nanocomposites, facilitating the reversible storage and delivery of hydrogen. In order to better understand the detailed processes of hydrogen exchange, on-site experiments are planned which will test the transformation behaviour of the material.



Fleet emissions in Germany (passenger cars) ■ Moderate development ■ Scarcity of resources ■ Climate protection

Hydrogen production

Hydrogen production – publication of GermanHy study

Hydrogen is considered to be the energy source of the future. It can be made from countless energy sources, can be easily stored, is highly efficient in the operation of fuel cells and produces virtually no emissions. Its use opens up new perspectives for energy supply. But where will hydrogen in Germany come from between now and 2050? Answers to this and similar questions are provided under the »GermanHy« project in a study of the same name. Funded by the German Federal Ministry of Transport, Building and Urban Development, it was published under the auspices and coordination of NOW in August 2009. Participating partners are the [German Energy Agency](#), the [Karlsruhe Institute of Technology](#), the [Fraunhofer Institute for Systems and Innovation Research ISI](#), [Ludwig-Bölkow-Systemtechnik](#) and the [Wuppertal Institute for Climate, Environment and Energy](#).

Hydrogen roadmap

GermanHy focuses on examining the use of hydrogen in the transport sector. Key questions include the share of hydrogen in future fuel requirements as well as its production, transport and distribution with rising demand. At the same time, the effects on mobility costs, emissions, renewable energies and dependence on energy imports are analysed. »With our comprehensive meta-study building on other key studies, we have developed recommendations for a hydrogen roadmap for Germany up to 2050«, says Dr. Klaus Bonhoff, Managing Director (Chair) of NOW. GermanHy delivers reliable bases for making decisions on fostering activities on hydrogen production and infrastructure in the framework of NIP.

Scientific patterns

For the period between 2000 and 2050 in Germany, experts from GermanHy have identified three different trends by means of a scientific scenario technique: »Moderate development«, »Climate protection« and »Scarcity of resources«. The single scenarios differ from one another primarily in the underlying assumptions derived from accepted analyses. A more conservative »Moderate development« comes from lower pressure as well as only mild increases in energy efficiency and share of renewable energies. The »Climate protection« scenario however, is characterised by stringent regulation on the reduction of greenhouse gases. The severe shortage of fossil resources at extremely high energy prices and inability to increase oil production represents the central assumption of the third scenario called »Scarcity of resources«.

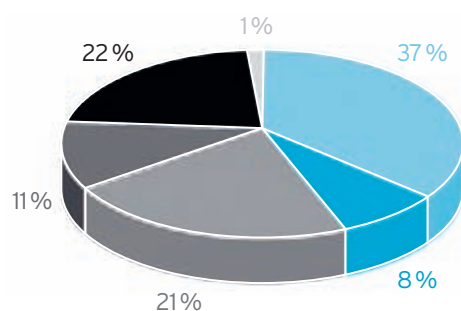
Seeing into the future

All three scenarios show that the efficient use of energy must be increased in each case. Depending on the scenario, hydrogen will be produced via different combinations of output energies and production methods.

In 2050 hydrogen could, depending on the scenario, ultimately cover between 23 % and 40 % of the energy requirements in the transport sector and thereby supply up to 70 % of passenger cars and light commercial vehicles. To generate hydrogen, a mixture of different primary energies will be used, amongst which wind energy is likely to be the most significant long-term option.

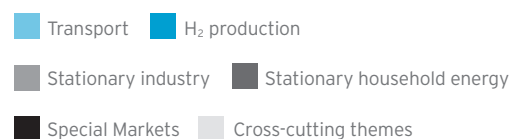
In the longer term, energy-favourable compressed hydrogen pipelines will be relied upon, which will transport approximately 80 % of the total hydrogen required.

»Hydrogen mobility will be possible in the future at current day prices«, says Dr. Oliver Ehret, Programme Manager Hydrogen Infrastructure, summarising the findings of the GermanHy study. Following the launch phase, fuel costs range between 3 and 4 €/t/km. Carbon dioxide emissions from transport will drop by up to 80 % in the longer term, and the share of renewable energies in the production of hydrogen can increase by over 60 % by 2050. If hydrogen technology is adopted as modelled in this study, it will guarantee Germany's future security of energy supply, the fulfilment of EU climate change targets and paves the way for new possibilities in the area of cutting edge technology, innovation, and as a result, competitiveness.

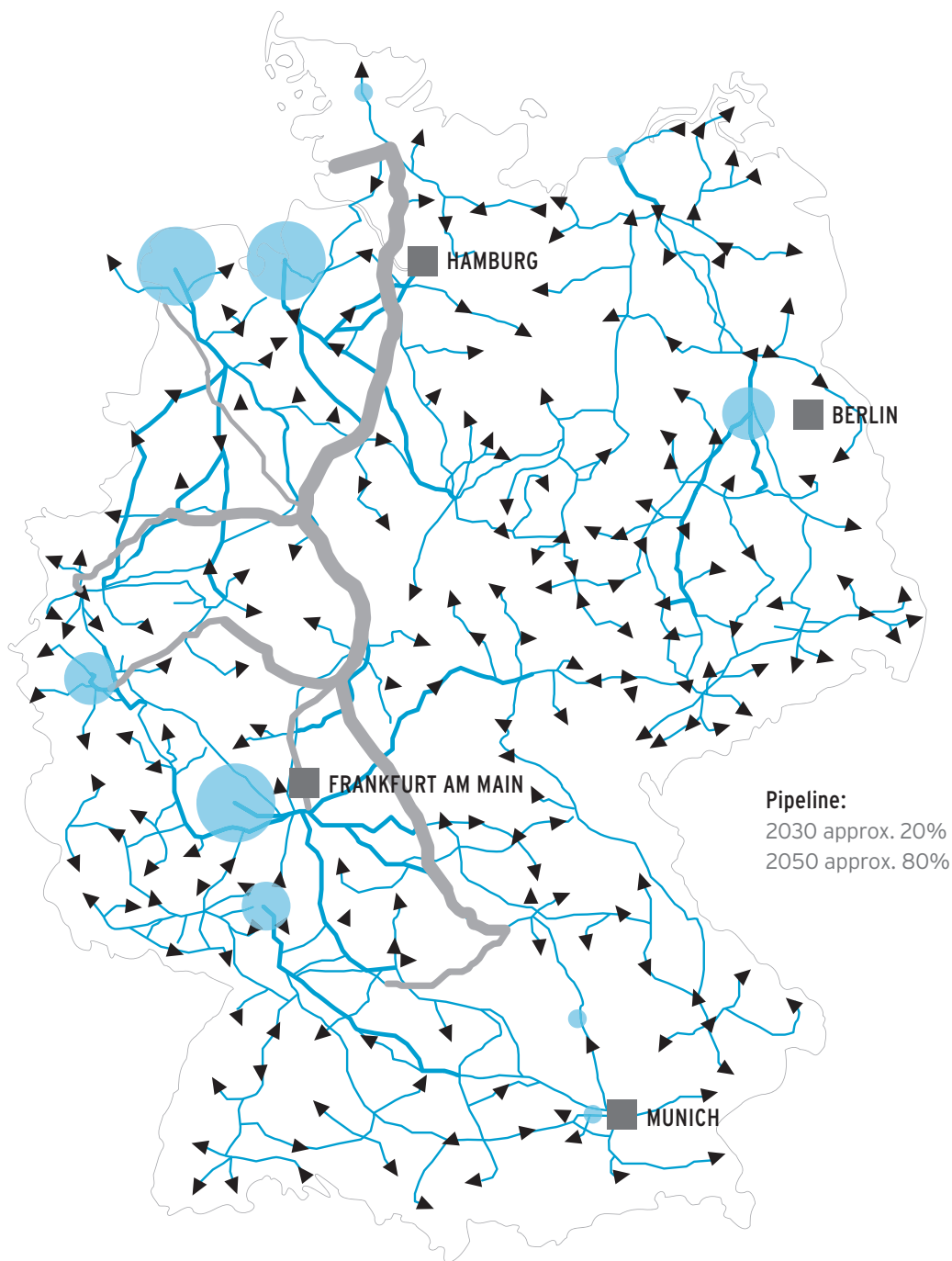


« NIP STATISTIC: APPLICATIONS | AS AT DECEMBER 2009

Share of application sectors in NIP






The diagram comprises planned NOW projects, projects in process with the project administrator (PtJ), Letter of Intent, and approved projects.






»Moderate« Scenario 2030 Source: GermanHy study




LH₂-production

| | | |
|---|----------|-----|
|  | 800-2400 | GWh |
|  | 248-800 | GWh |
|  | 24-248 | GWh |

H₂ liquid transport via trailer

| | | |
|---|----------|-----|
|  | 800-2392 | GWh |
|  | 393-800 | GWh |
|  | <103-393 | GWh |

H₂-pipeline – transport

| | | |
|--|-----------|-----|
|  | 6641-6911 | GWh |
|  | 5947-6640 | GWh |
|  | 5-2310 | GWh |

- » Gradual establishment in metropolitan regions
- » During the entry phase (until 2030) supply of fuelling stations predominantly with liquid hydrogen
- » With rising demand distribution via compressed hydrogen pipelines
- » Regional or on-site production (from natural gas, biomass)
- » Costs of nationwide construction: €1 billion per annum (until 2030)

PROFILES OF PROJECTS APPROVED IN 2009 IN THE HYDROGEN PRODUCTION AREA

All approved projects can be found at www.now-gmbh.de

20 NIP: STATUS AND DEVELOPMENT POTENTIAL OF WATER ELECTROLYSIS FOR THE PRODUCTION OF HYDROGEN FROM REGENERATIVE ENERGIES

Application:

Electrolysis

Keyword:

Water electrolysis

Commencement:

1 November 2009

Conclusion:

31 May 2010

Project budget:

€64,124

Subsidy amount:

€64,124

Recipient:

Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e. V. (FhG)

PROJECT DESCRIPTION:

The overarching goal of the study is to compile a current overview of water electrolysis. According to GermanHy, wind energy will develop into the most significant renewable energy source over the long term. Electrolysis features the major technological components, which must be investigated and further advanced in future projects. In this context, the study evaluates the main methods of electrolysis (AEL, PEMEL, HTEL) and other methods in terms of principles of operation, available technology, costs and future development requirements.

The key German and international players will be observed with regard to their potential positioning in a budding electrolysis market. Linking options of electrolysis with renewable energy sources, in particular wind energy, will be examined.

Future requirements for high performance electrolysis systems will be discussed in detail, from which recommendations for action for NIP projects will be derived.

21 NIP: CHEMERGY – PROVIDING BY-PRODUCT HYDROGEN AND BUILDING A LOCAL HYDROGEN INFRASTRUCTURE

Application:

EP

Keyword:

By-product hydrogen

Commencement:

1 June 2009

Conclusion:

31 May 2010

Project budget:

€1,833,877

Subsidy amount:

€880,261

Recipient:

Stadtwerke Hürth, Technische Betriebe und Einrichtungen, Anstalt des öffentlichen Rechts

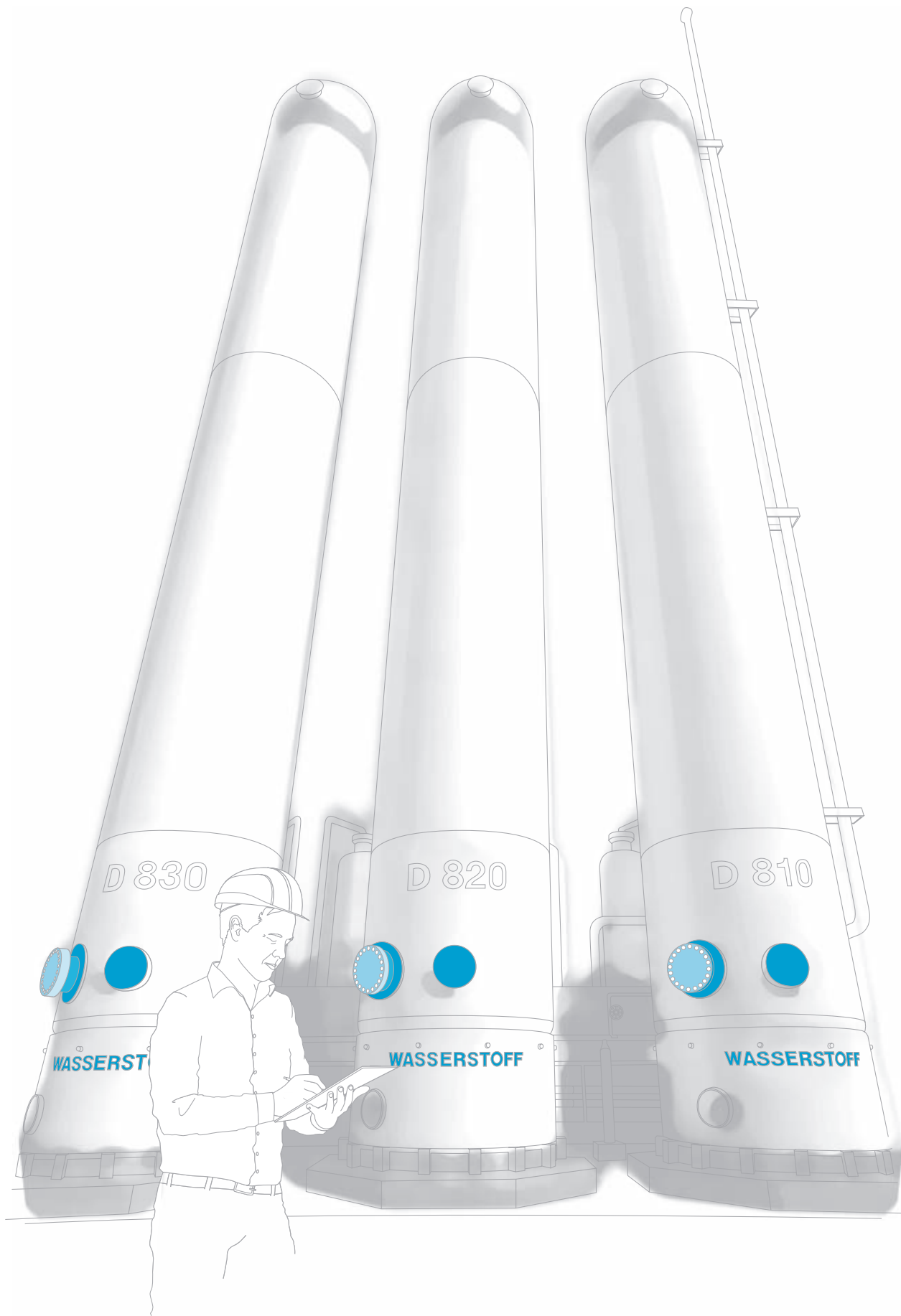
PROJECT DESCRIPTION:

In North Rhine-Westphalia and the Cologne region large amounts of hydrogen are produced as a by-product of the local chemical industry. At present, most of the hydrogen is hardly used. It could however, be used as a low cost and environmentally-friendly transport fuel.

The Chemergy project begins with the exploitation of potential. Hydrogen will be decoupled from a chlorine-electrolysis plant of the chemical industry and prepared, brought via pipeline and trailer to a nearby fuelling station and offered as a transport fuel there. The aim of the project is the appropriation of hydrogen by-product as a fuel:

1. Appropriation of by-product hydrogen for transport
2. Guaranteeing and optimising quality and availability of hydrogen
3. Development of a transmissible technological and business concept
4. Establishment of a basis for operation of hydrogen vehicles
5. Bringing about visibility and raising the profile of hydrogen.

The facilities should be up and running by May 2010, at which point the fuelling station to supply two Dutch-manufactured hydrogen hybrid buses will be used.



Hydrogen fuelling stations for Germany

Becoming more reliable and sinking in cost, fuel cells for use in road transport are becoming more and more appealing. A precondition for this however, is that their energy source hydrogen, can be accessed at anytime. To safeguard tomorrow's availability, [Daimler](#), [EnBW](#), [Linde](#), [OMV](#), [Shell](#), [TOTAL](#), [Vattenfall](#) and [NOW](#) created the initiative »H₂ Mobility« in the form of a memorandum of understanding in September 2009. Its goal is to establish the decisive framework conditions for the development of a nationwide hydrogen infrastructure in Germany.

»This commitment builds on the ongoing National Innovation Programme and represents a meaningful milestone on the road to sustainable and emission free mobility«, highlighted Dr. Klaus Bonhoff, Managing Director (Chair) of NOW. H₂ Mobility accompanies a letter of understanding signed by the global leaders of automotive manufacturing. It heralds the series production and market launch of several hundred thousand hydrogen vehicles starting from 2015. The planned network of hydrogen fuelling stations should fulfil the commercialisation requirement.

Professional business model

During the first phase of H₂ Mobility, stakeholders will examine the different options for building a network of hydrogen fuelling stations. Focus will be put on the development of a common and profitable sustainable business model, also allowing for possible funds via the public sector. So far there are about 30 hydrogen fuelling stations in Germany, of which seven are integrated in public transport. Partners will already present ideas for further fuelling stations over the coming year. The H₂ Mobility initiative will also address overarching issues such as standardisation and cost reduction.

From plan to pump

If the business plan to be drawn up develops favourably, a concrete action plan will follow. As the hydrogen infrastructure should go hand in hand with the planned large-scale production of fuel cell vehicles to ensure sufficient fuelling possibilities, urban centres constitute the starting point. Urban concentrations will gradually become connected through hydrogen corridors along their main transport arteries, enabling nationwide establishment to be successively implemented.

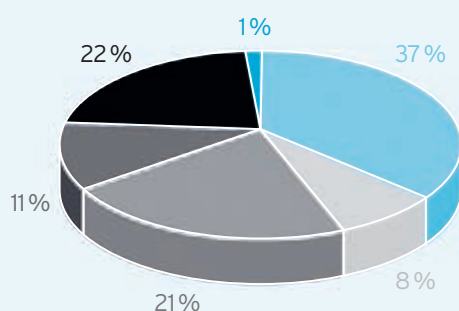
Due to success achieved and continued advances in the development of hydrogen-based technologies, today Germany represents the lead market for emission free mobility. NOW acts as the project control centre for H₂ Mobility activities, so that Germany is best equipped to compete in the field of modern and environmentally friendly mobility technologies, and enable it to further expand its pioneering role in Europe.

NOW'S ACTIVITIES INCLUDE COMMUNICATION AND INTERNATIONAL COOPERATION.

Communication and cooperation: cross-cutting themes

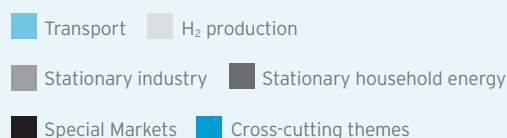
In addition to the implementation and coordination of programmes, NOW is also tasked with communication and international cooperation issues. New technologies must initially campaign for acceptance so that their products will be successfully welcomed onto the market. HyTrust is the socio-scientific accompanying study to NIP. In the framework of HyTrust it will be ascertained among other tasks, how trust in a new technology can be generated within the population.

Technological development in the mobility and energy supply sectors should be seen in a global context. The close collaboration between representatives of industry, science, and politics is therefore essential. It also includes comparison with other demonstration and market preparation projects. Through a comparative study between the NIP and the Multi-Annual Fuel Cell and Hydrogen Joint Undertaking of the European Commission, synergies from both programmes were identified.



« NIP STATISTIC: APPLICATIONS | AS AT DECEMBER 2009

Share of application sectors in NIP



The diagram comprises planned NOW projects, projects in process with the project administrator (PtJ), Letter of Intent, and approved projects.

PROFILES OF PROJECTS APPROVED IN 2009 IN THE AREA OF TRANSPORT (CROSS-CUTTING THEMES)

All approved projects can be found at www.now-gmbh.de

22 NIP: ANALYSIS AND DEVELOPMENT OF PROPOSALS FOR THE UTILISATION OF SYNERGY POTENTIAL BETWEEN NIP AND THE MULTI-ANNUAL IMPLEMENTATION PLAN OF THE JOINT TECHNOLOGY INITIATIVE

Application:

Comparative study

Keyword:

Synergy potential

Commencement:

1 July 2009

Conclusion:

31 October 2009

Project budget:

€39,778

Subsidy amount:

€39,778

Recipient:

André Martin Consulting

PROJECT DESCRIPTION:

The study has the following goals:

- a.) To conduct an analysis of potential synergies between the German programme and the Multi-Annual Implementation Plan of the Fuel Cells and Hydrogen Joint Undertaking and the identification of suitable areas for joint activities
- b.) To develop proposals for such activities, discussion and collaboration with the FCH JU and to determine steps for their implementation

23 NIP: HYTRUST – TOWARDS A HYDROGEN COMMUNITY, SOCIO-SCIENTIFIC STUDY ACCOMPANYING THE NATIONAL DEVELOPMENT PLAN ON THE INNOVATION PROGRAMME FOR HYDROGEN AND FUEL CELL TECHNOLOGY

Application:

Acceptance

Keyword:

HyTrust

Commencement:

1 September 2009

Conclusion:

1 August 2011

Project budget:

€1,420,864

Subsidy amount:

€1,420,864

Recipient:

Unabhängiges Institut für Umweltfragen (UfU) e. V.

PROJECT DESCRIPTION:

The project aims are:

1. Socio-scientific accompaniment to the Innovation Programme for Hydrogen and Fuel Cell Technology
2. Responding to the three primary questions:
 - a) To what extent is hydrogen technology accepted by the public?
 - b) How familiar is the public with the technology and how much confidence do they place in the main hydrogen technology stakeholders?
 - c) How can the technological changeover to hydrogen technology in the mobility sector be implemented from a socio-economic point of view?
3. Analysis of the acceptance environment
4. Conducting and evaluating of processes of confidence-building and knowledge management
5. Developing socially sustainable scenarios
6. Presentation of the report

EFFICIENTLY PRODUCED POWER AND HEAT STATIONARY ENERGY SUPPLY PROGRAMME AREA





»Stable and efficient » 46 » Well-supplied at home » 48
»Project profiles » 50 » On the high seas » 52 » More project profiles » 54

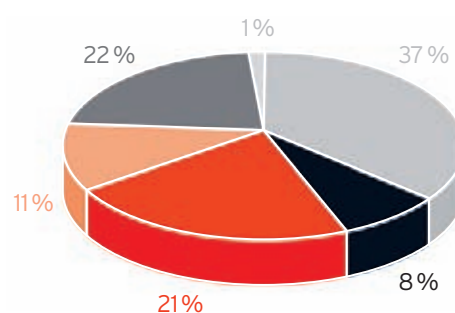
STATIONARY FUEL CELLS HAVE THE POTENTIAL TO SIGNIFICANTLY REDUCE ENERGY CONSUMPTION AND EMISSIONS. »

Kai Klinder,
NOW CFO, Programme Manager
Stationary Fuel Cells,
NOW GmbH «

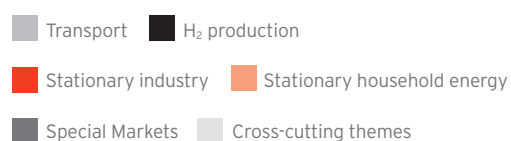
Stable and efficient

Stationary fuel cell systems provide power, heat and refrigeration in residential buildings, on ships, as well as for commerce and industry. They should be ready for widespread use before the decade is out after a further testing phase. New, highly efficient technologies make a significant contribution to climate protection. Around two-thirds of energy is used for power, heating, cooling and hot water. Energy consumption and emissions can be significantly reduced if fuel cells are implemented – particularly in combined heat and power systems. Using biogenic fuels such as biogas, even a virtually CO₂-free energy supply becomes possible.

Within the framework of the National Innovation Programme Hydrogen and Fuel Cell Technology (NIP), NOW GmbH coordinates and controls the »Stationary Energy Supply« programme. The lighthouse projects »Callux«, »NEEDS«, and »e4ships« are central pillars of this programme. Around 36% of the total NIP budget until 2016 is allocated for stationary applications.



« NIP STATISTIC: APPLICATIONS | AS AT DECEMBER 2009
Share of application sectors in NIP



The diagram comprises planned NOW projects, projects in process with the project administrator (PtJ), Letter of Intent, and approved projects.

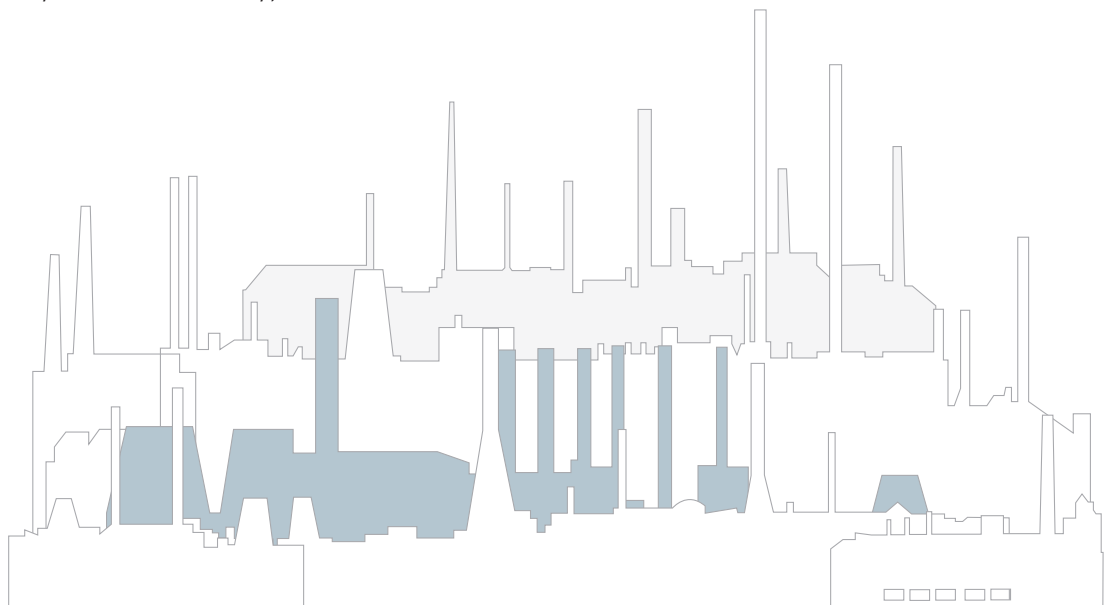
The objective of Callux is the supply of energy to residential buildings with fuel cell heating systems. Through the experience gained during comprehensive field tests with almost 800 installations, the existing technology is to be further developed into reliable systems suitable for general use to enable preparation for market introduction. The total project duration is timetabled for 2008 to 2015 and is divided into several phases that are delineated by uniform objectives and binding assessment criteria for all manufacturers. The field trials predominantly take place in selected private households throughout Germany.

NOW coordinates the activities of the energy firms **EnBW**, **E.ON Ruhrgas**, **EWE**, **MVV Energie** and **VNG Verbundnetz Gas** with the manufacturers of fuel cell heaters **Baxi Innotech**, **Hexis** and **Vaillant**. As an additional partner, the Centre for Solar Energy and Hydrogen Research (Zentrum für Sonnenenergie- und Wasserstoff-Forschung) controls the cooperation on the project level. Callux has a total funding volume of €86 million. Of this, around €45 million are provided by the partners and €41 million are funded by the Federal Ministry of Transport, Building and Urban Development – BMVBS (Bundesministerium für Verkehr, Bau und Stadtentwicklung).

NEEDS stands for »New ecologic energy decentrally supplied« and promotes the production of CO₂-neutral power, heat and refrigeration. In this lighthouse, fuel cell block-type power stations are to supply energy to hospitals, factories, office buildings and indoor pools. The highly efficient plants are powered by gas from sewage works and biogas facilities. Moreover, the extraction of hydrogen-rich fuel gas via pyrolysis units is foreseen, which will enable environmentally friendly conversion of all types of waste.

The e4ships lighthouse aims to prove the suitability of fuel cells as a source of on-board energy on ships. Commenced in 2009 with a planned duration of seven years, it involves dockyards, shipping lines, fuel cell manufacturers and classification societies including: **AIDA Cruises**, **CMT**, **DNV**, **Flensburger Schiffbau-Gesellschaft**, **Lürssen**, **Germanischer Lloyd**, **hySOLUTIONS**, **HAW Hamburg**, **Helmut-Schmidt-Universität**, **Imtech**, **INVEN Engineering**, **MEYER WERFT**, **MTU Onsite Energy**, **Öl-Wärme-Institut (ÖWI)**, **Reederei Rörd Braren**, **Proton Motor**, **ThyssenKrupp MS**, **VSM** and **ZBT**.

The partners will develop fuel cell systems and test their practical application on ships until 2016 under the leadership of NOW. The conditions to pave the way for maritime fuel cells to be accepted as a sustainable energy source will simultaneously be developed. e4ships has a budget of €50 million at its disposal which is equally funded by the parties involved and the BMVBS respectively.





Well-supplied at home

Fuel cell heating systems convert hydrogen to power and heat via an electrochemical process. This makes them ideal for environmentally friendly implementation in buildings. In contrast to conventional systems where mechanical energy is converted to electricity, these innovative small combined heat and power systems are highly efficient. They boast vast effectiveness and guarantee low emissions thanks to their direct conversion of energy. A reformer produces hydrogen from natural gas, directly on site. And thanks to the existing infrastructure, this is easily available – even as biogas.

The lighthouse project Callux sets out to test fuel cell-based combined heat and power systems so that they can be deployed for mass use and application within this decade.

Enlightening field trial

The Latin terms »calor« and »lux« mean »warmth« and »light«. Together they form the expressive name »Callux« chosen for this comprehensive lighthouse project. With the purchasing, installation and operation of up to 800 fuel cell heating systems, the initiative represents Germany's largest field trial for fuel cells in the home. The goal of Callux is to pave the way for the market introduction of natural gas-run fuel cell heating systems, enabling such systems to be reliably implemented in the future for daily use.



REGIONS OF ACTIVITY

The total budget amounts to €86 million, of which 48% is funded by the Federal Ministry of Transport, Building and Urban Development (BMVBS, Bundesministerium für Verkehr, Bau und Stadtentwicklung) – with the remaining 52% financed by the consortium partners. The project kicked off in September 2008 and is timetabled to run for seven years.



Duration:

2008-2015

Total budget:

€86 million

(48% from BMVBS funding, 52% from consortium partners)

Callux partners:

EnBW, E.ON Ruhrgas, EWE, MVV Energie, VNG Verbundnetz Gas, Baxi Innotech, Hexas, Vaillant, Zentrum für Sonnenenergie- und Wasserstoff-Forschung (ZSW)

Callux partners are the energy firms **EnBW**, **E.ON Ruhrgas**, **EWE**, **MVV Energie** and **VNG Verbundnetz Gas**, the system manufacturers **Baxi Innotech**, **Hexis** and **Vaillant** and the **Centre for Solar Energy and Hydrogen Research – ZSW (Zentrum für Sonnenenergie- und Wasserstoff-Forschung)**. ZSW coordinates the cooperation between partners on the project level. »Among NOW's tasks are the selection and evaluation of the individual funding programmes and their coupling in practice,« explains Kai Klinder, NOW CFO and Programme Manager Stationary Fuel Cells. »We handle the aligned knowledge management, manage communication between the parties and pave the way for international cooperation.«

Perfectly installed

The energy supply firms of Callux negotiate long-term contracts with equipment manufacturers independently of one another to examine and test the technology in practice. They procure cutting-edge fuel cell heating equipment, which they put at the disposal of interested households and attend to on site. To be in a position to obtain verifiable, scientific results, the same targets and guidelines apply to all involved. 50 plants – regionally bundled – are already installed across 13 German states.

This number is set to increase to around 800 by the end of 2012, with operations to partly continue until 2015. The fuel cell equipment is especially designed for the basic needs of detached and semi-detached houses. Their thermal performance is rated at 2kW and electrical at approximately 1kW. A natural gas burner ensures coverage during peak demand periods, if required. Meanwhile, a central control unit manages the entire facility. In the future, every house with a natural gas connection will be able to use the highly efficient combined heat and power of fuel cell systems. These installations – which depending on the manufacturer can underlie varying fuel cell technologies – convert the exhaust heat from electricity production into heating for the household. In contrast to electricity production in central (off-site) power plants and the separate production heating in a boiler or furnace, up to 30% of primary energy can be saved and leakages in the electricity grid during delivery are avoided completely.

Market and measures

The Callux partners endeavour to minimise potential barriers to market entry. To achieve this goal, diverse – and in part interdisciplinary – issues must be attended to: market partners and tradesmen in the sanitary-heating-climate field must, for example, be trained in time and be prepped for their future work on the new equipment through continuing, practical education measures.

Joint communications activities by the consortium will ensure the public is informed about the new technologies and interest among potential customers is raised. Simultaneously, market and customer requirements must be clearly defined. For this purpose, the parties will conduct extensive market research from which the obtained data and facts will be validated. Throughout the activities leading to market introduction, Callux partners will continue to work on technical details and mass production solutions. Interfaces must be standardised to enable communication between the fuel cell heating equipment and household energy management systems. A further example is the development of a universal and affordable desulphurisation filter with non-sensitive adsorption materials – which is a small but important aspect, as fuel cells cannot function without natural gas desulphurisation. Here too, logistical aspects, recycling concepts and feasibility analyses will be undertaken from the outset. Thanks to the positive results of the comprehensive field tests, production lines with small runs for fuel cell heating equipment already exist. Through binding orders of large quantities, along with sophisticated concepts for supply structures, delivery chains are to be established and finally costs reduced.

All Callux activities are designed to promote and introduce the new technologies of fuel cell heating equipment as an efficient, climate friendly and cost saving form of energy supply for buildings, promoting added value in Germany.

PROFILES OF PROJECTS APPROVED IN 2009 IN THE AREA OF STATIONARY ENERGY SUPPLY (HOUSEHOLD ENERGY)

All approved projects can be found at www.now-gmbh.de



NIP: FIELD TEST IN PREPARATION FOR THE MARKET INTRODUCTION OF FUEL CELL HEATING SYSTEMS

Application:

Household energy

Keyword:

Field test BZH

Commencement:

1 May 2009

Conclusion:

31 December 2011

Project budget:

€1,172,871

Subsidy amount:

€562,978

Recipient:

VNG-Verbundnetz Gas AG

PROJECT DESCRIPTION:

The aim of the project is, together with the five participating energy firms – EnBW, EWE, MVV, E.ON Ruhrgas and VNG Verbundnetz Gas – to undertake parallel field tests for the installation and operation of fuel cell heating systems with important accompanying measures, to prepare for the market introduction of such systems.

The project is divided into the following six work packages: market partners, market research, infrastructure, communication, scientific monitoring and project coordination. These will generally be undertaken simultaneously throughout the project's duration. The results of the project will be implemented in the subsequent market introduction phase by the participating energy firms and equipment manufacturers alike.

The project makes a significant contribution towards bringing natural gas-run fuel cell heating systems to market maturity. It will help pave the way for widespread implementation and use of this particularly efficient and climate friendly household energy supply.



= Lighthouse project



NIP: INDUSTRY SOLUTION GROUP PROJECT FOR DESULPHURISATION FOR FUEL CELL HEATING SYSTEMS

Application:

Desulphurisation cartridge

Keyword:

Desulphurisation

Commencement:

1 September 2009

Conclusion:

31 August 2012

Project budget/Subsidy amount:

a) €1,048,079/€503,078

b) €561,344/€269,445

c) €414,778/€199,093

d) €384,614/€184,614

e) €234,528/€112,573

f) €188,413/€90,438

g) €143,993/€69,116

h) €129,639/€62,227

i) €125,614/€60,295

j) €99,512/€47,766

.....
€3,330,514/€1,598,645

Recipients:

a) Zentrum für Brennstoffzellen-
Technik GmbH

b) BASF SE

c) DBI Gas- und Umwelttechnik GmbH

d) DVGW Deutsche Vereinigung des
Gas- und Wasserfaches e. V. –
Technischwissenschaftlicher Verein

e) Filter PROFItlich Maschinen-
bau GmbH

f) BAXI INNOTECH GmbH

g) EBZ Entwicklungs- und Vertriebs-
gesellschaft BRENNSTOFFZELLE mbH

h) Donaldson Filtration
Deutschland GmbH

i) Hexis GmbH

j) VAILLANT GmbH

PROJECT DESCRIPTION:

The intention of this group project is the development of a cartridge as an industry-wide solution for the desulphurisation of natural gas for fuel cell heating systems.

Besides the core areas of materials development (to a large extent financed by firms internally) and testing, the schedule of tasks to be undertaken comprises work on the best cartridge system including the aspects of logistics and recycling, along with an assessment of profitability. Furthermore, detailed specifications and a sulphur map of the various gas supply areas will need to be completed.

The results arising from this project will be made available to all manufacturers of fuel cell heating systems involved. In this way, costs can be reduced to a minimum due to desulphurisation in large quantities, with attuned interfaces and maintenance along with uniform sensors, logistics and disposal procedures.

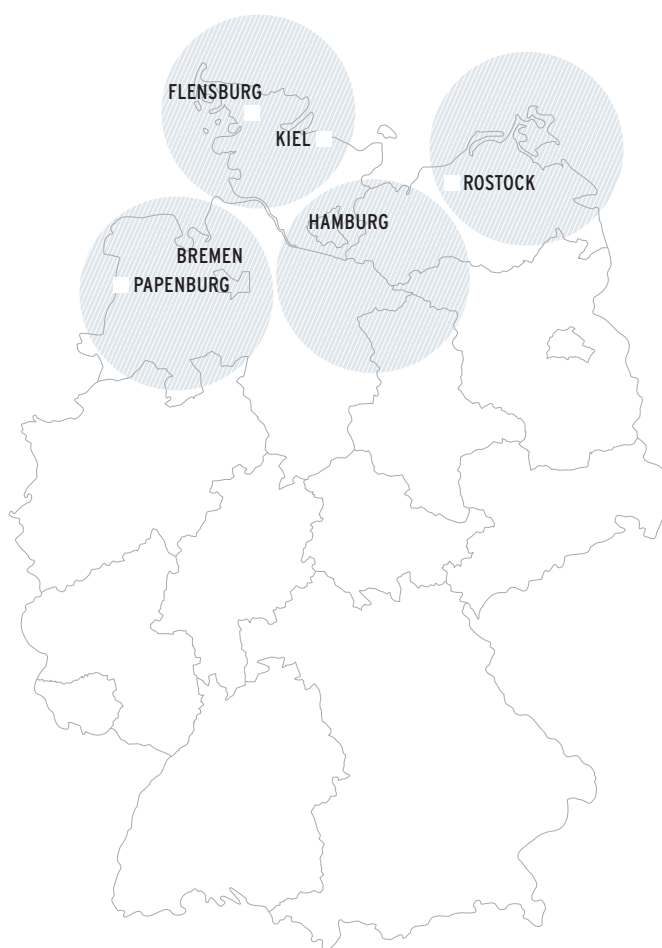
The first samples are already being tested within the framework of the lighthouse project for fuel cell heating systems.



On the high seas

Whether a cruise ship, research craft, merchant vessel, ferry or yacht: in future, highly-efficient, quiet and low emission power and heating will be brought on board through fuel cells. Initiated in July 2009, »e4ships« is the name of this lighthouse project, coordinated by NOW. Until 2016, well-known German dockyards and shipping lines, leading fuel cell manufacturers and classification societies will be testing the functionality of fuel cells as an onboard supply of energy under rugged maritime conditions. Current partners are: **AIDA Cruises, CMT, DNV, Flensburger Schiffbau-Gesellschaft, Lürssen, Germanischer Lloyd GL, hySO-LUTIONS, HAW Hamburg, Helmut-Schmidt-Universität, Imtech, INVEN Engineering, MEYER WERFT, MTU Onsite Energy, Öl-Wärme-Institut (ÖWI), Reederei Rörd Braren, Proton Motor, ThyssenKrupp MS, VSM and ZBT.**

The project budget totals around €50 million and will be funded in equal measure by the project partners and the Federal Ministry of Transport, Building and Urban Development (BMVBS).



REGIONS OF ACTIVITY



Duration:
2009-2016
Total budget:
€50 million

e4ships partners:

AIDA Cruises, CMT, DNV, Flensburger Schiffbau-Gesellschaft, Lürssen, Germanischer Lloyd GL, hySO-LUTIONS, HAW Hamburg, Helmut-Schmidt-Universität, Imtech, INVEN Engineering, MEYER WERFT, MTU Onsite Energy, Öl-Wärme-Institut (ÖWI), Reederei Rörd Braren, Proton Motor, ThyssenKrupp MS, VSM and ZBT

A good climate

»The climate friendly supply of energy on ships while keeping Germany globally competitive: in Germany: That's our goal in the e4ships lighthouse project,« explains Kai Klinder, NOW CFO and Programme Manager Stationary Fuel Cells. In contrast to conventionally used aggregates on ships, fuel cell modules contribute considerably to the reduction of emissions and thereby to climate protection – one of the most important challenges for shipping lines. Fuel cells give these companies the ideal technology to confront the challenge of rising fuel costs, CO₂ loads along with restrictions in particle and sulphur emissions imposed by more stringent environmental regulations.

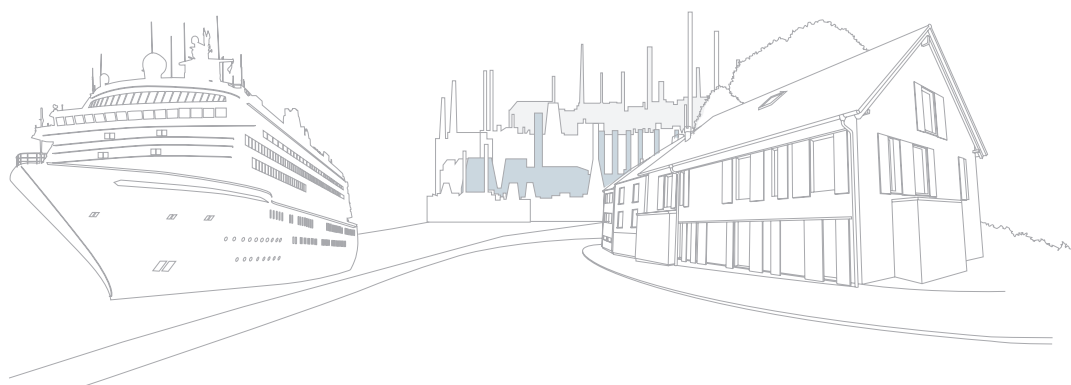
Stationary and on the go

The e4ships initiative is divided into several projects to demonstrate innovative technologies: A high-temperature fuel cell is to be tested on board a cruise ship as a modular energy supply system that is run by natural gas. Following testing – which will initially only be undertaken during supporting operation – the system will be optimised to ensure on the one hand, that the decentralised combined power heat concept is further developed for passenger ships. In another part of the project, consortium partners will work on a fuel cell system that is suitable for use on the high seas – a so-called HotModule, which will be tested at sea over a 10-month period.

To compensate for possible differences in the dynamics of fuel cells and onboard power supply networks, the energy supply will be buffered via a lithium-ion battery. Resource-saving sulphur-free diesel or second-generation synthetic fuels will be used to power the fuel cell equipment.

A sea of answers

Besides purely technical challenges, overarching issues concerning ecological, technical and economic assessments of the application of fuel cells in ships must be addressed by e4ships. Under the auspices of NOW, the involved parties work to uniform technical standards for system variations and performance classes. Furthermore, they are involved in the formulation of rules and regulations. In the near future, the guidelines should not only regulate the use of low emission fuels, but also the approval and installation of fuel cells on ships in particular. As soon as the hurdles on the way to market maturity have been overcome, e4ships will be in the position to make a decisive contribution to the competitiveness of German dockyards and shipping lines through the provision of the necessary innovative and highly efficient technologies.



PROFILES OF PROJECTS APPROVED IN 2009 IN THE AREA OF STATIONARY ENERGY SUPPLY (E4SHIPS)

All approved projects can be found at www.now-gmbh.de



NIP: »PA-X-ELL« – MODULAR ENERGY SUPPLY SYSTEM WITH FUEL CELLS ON PASSENGER SHIPS

Application:

Passenger ships

Keyword:

Pa-X-ell

Commencement:

1 April 2009

Conclusion:

31 May 2014

Project budget:

€6,609,435

Subsidy amount:

€3,172,529

Recipient:

Meyer Werft GmbH

PROJECT DESCRIPTION:

The specific goals of Meyer Werft in this project are not only limited to the integration of fuel cells on board a passenger ship, but also encompass a concept for decentralised thermal and electrical energy.

In particular, the use of waste heat in conjunction with the efficient feeding-in of produced electrical energy will determine Meyer Werft's work. The integration of fuel cells is to be undertaken in two planned implementation steps.

In the first implementation step, preliminary considerations will be employed to define the specifications sheet. The resulting requirements will define the tasks of the technically specific work packages. The second implementation step concerns the simultaneous, decentralised integration of several (2-3) fuel cell modules in developed or existing ship structures. A main focus will be the development of an energy management system that is integrated in the ship's automation system taking the new conditions into account.

Naturally, Meyer Werft will also be involved in work packages encompassing financial and safety issues. In the initial years following successful completion of the project, sales of 30 to 50 fuel cell units can be realistically expected.

Knowledge gained regarding the integration of fuel cells within the Pa-X-ell research project not only enhances know-how in the area of specific thermal and electrical integration as well as decentralised supply structures, but also raises the developmental potential of efficient energy supply solutions on board passenger ships.



= Lighthouse project



NIP: »PA-X-ELL« – MODULAR ENERGY SUPPLY SYSTEM WITH FUEL CELLS ON PASSENGER SHIPS

Application:

Passenger ships

Keyword:

Pa-X-ell

Commencement:

1 April 2009

Conclusion:

30 April 2010

Project budget:

€373,624

Subsidy amount:

€179,340

Recipient:

MTU Onsite Energy GmbH

PROJECT DESCRIPTION:

The overall goal of the funding project »Pa-X-ell« encompasses the conceptualisation, development, production and trial of a fuel cell module comprised of a fuel cell unit and a thermal unit to utilise the waste heat of the fuel cell, in a containerised design for use on seafaring passenger ships.

MTU Onsite Energy will split the overall project in two temporally separate funding applications. This first funding application will incorporate the entire theoretical survey and system modelling. The goal is to develop a clear task profile or design basis in the format of explicit requirement specifications for the implementation of fuel cells on ships.

The aim of the subproject is to establish a basis for the future fuel cell module intended for maritime application. The result of this procedure is the foundation for a needs-based development that adapts current fuel cell systems for use on seafaring vessels right up to full integration in the ship's hull.

The first project phase – for which MTU Onsite Energy has made this application – includes the development of the overall requirement specifications as well as the preliminary theoretical assessment for thermal and electrical integration of fuel cells in ships. Further tasks being undertaken take in examinations of virtual process models and the theoretical analysis and definition of issues relating to safety.



NIP: »PA-X-ELL« – MODULAR ENERGY SUPPLY SYSTEM WITH FUEL CELLS ON PASSENGER SHIPS

Application:

Passenger ships

Keyword:

Pa-X-ell

Commencement:

1 April 2009

Conclusion:

31 March 2014

Project budget:

€870,539

Subsidy amount:

€417,859

Recipient:

DNV Germany GmbH

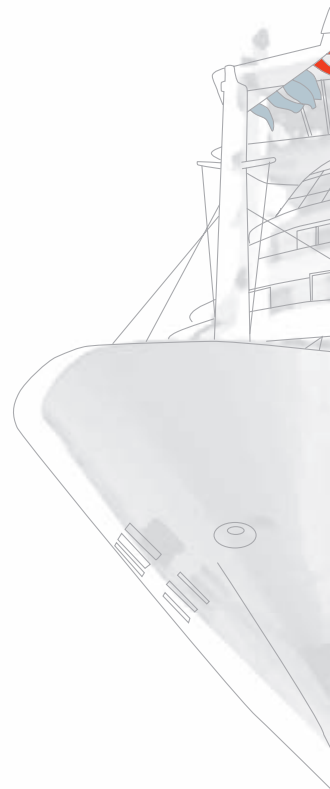
PROJECT DESCRIPTION:

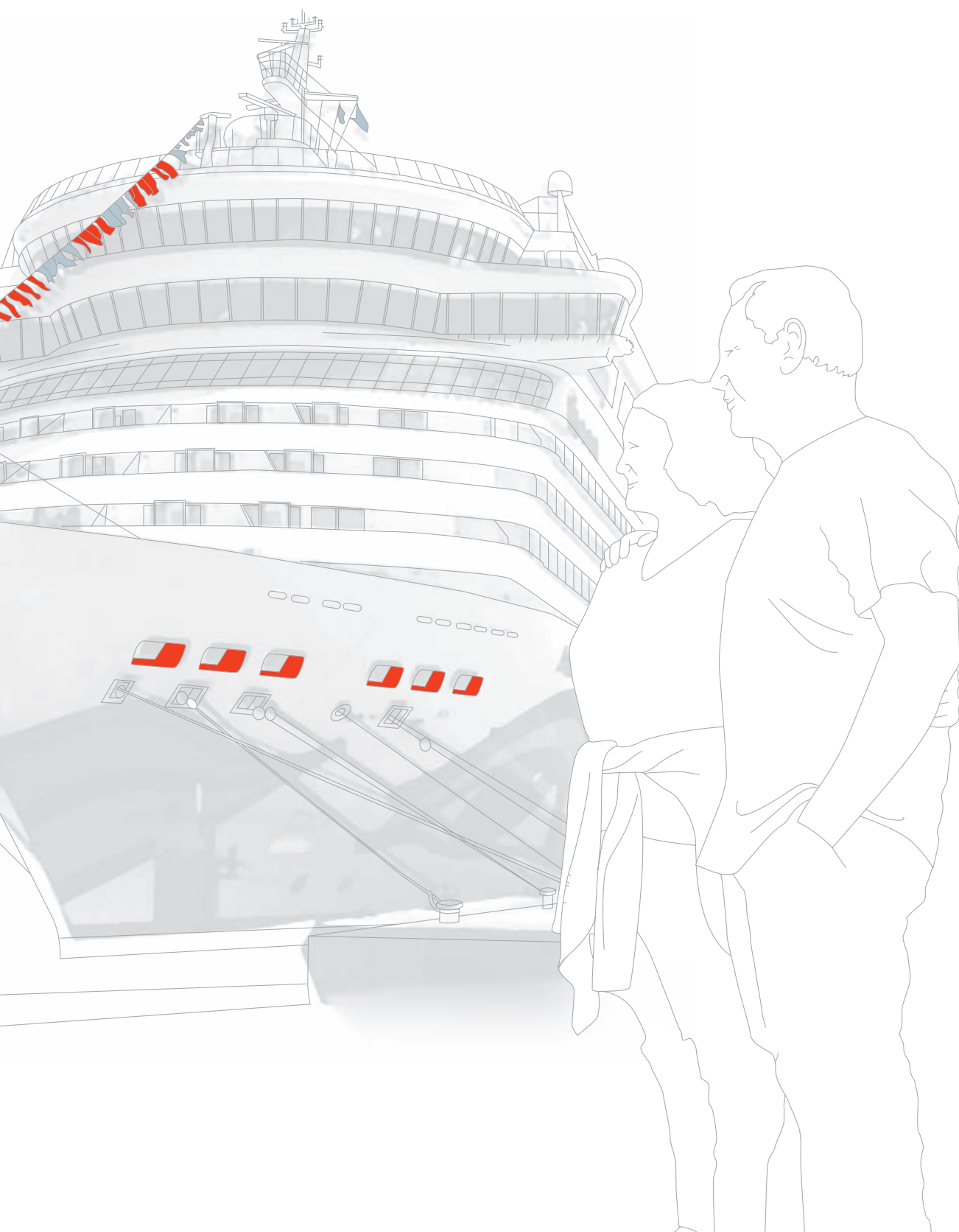
By directly simulating the procedures in the ship's thermal and electrical system on an abstract level, one project aim is to be able to predict system performance under partial loads or transitional conditions. A further goal is the development of a basis for technologically independent rules and standards for the employment of fuel cells on passenger ships.

To achieve the first aim, simulation tools will be further developed on which the quasi-static behaviour of integrated ship systems may be modelled. For the second aim, specific safety demands for passenger ships will be taken into account:

1. Decentralised installation, high-risk potential, complex loading conditions in the fuel cell, complex rules and regulations such as Safe Return to Port.
2. The developments in implementation stages 1 and 2 will be closely monitored. Modern risk management procedures, such as those established for offshore technologies, will be followed.

The results of developments in the »simulation« section will be applied in the early design phase and safety assessment. The results of developments in the »safety« section will be applied in the development of international rules and regulation of the involved classification societies.







NIP: »PA-X-ELL« – MODULAR ENERGY SUPPLY SYSTEM WITH FUEL CELLS ON PASSENGER SHIPS

Application:

Passenger ships

Keyword:

Pa-X-ell

Commencement:

1 April 2009

Conclusion:

31 March 2014

Project budget:

€1,049,145

Subsidy amount:

€503,590

Recipient:

Fr. Lürssen Werft GmbH & Co. KG
(FLW)

PROJECT DESCRIPTION:

The goal is the development of a megayacht design whose base electrical energy supply is achieved by means of fuel cells. The following developmental aims are being pursued: development of a maritime fuel cell module, spatial integration, systems integration, integration into the electrical network, and the integration of an electrical energy storage system. In terms of execution, the project is split in two stages.

The first stage includes development and testing of the fuel cell module. This phase sees the conceptualisation of the ship design and integration of all relevant components. Execution will be carried out by Meyer Werft shipyards and enables validation and, if necessary, fine-tuning of the concepts.

In the second stage, a self-sufficient supply of energy of a firezone is the primary goal, using several fuel cell modules. The Fr. Lürssen Werft shipyards will undertake the task of integrating an energy storage unit in this phase, so that load fluctuations in the electrical network can be compensated for.

The ultimate outcome of this project is the availability of a fuel cell module that is suitable for integration in passenger ships. By gaining all requisite experience for the integration and operation of the module, realisation of the developed concept can commence upon request with manageable risks.



07 NIP: »PA-X-ELL« – MODULAR ENERGY SUPPLY SYSTEM USING FUEL CELLS ON PASSENGER SHIPS

Application:

Passenger ships

Keyword:

Pa-X-ell

Commencement:

1 April 2009

Conclusion:

31 March 2014

Project budget:

€1,832,696

Subsidy amount:

€879,694

Recipient:

Flensburger Schiffbau-Gesellschaft
mbH & Co. KG (FSG)

PROJECT DESCRIPTION:

The goal of FSG with this research project is the conception and development of a fuel cell module, composed of a fuel cell unit and a thermal unit, in order to use waste heat from the fuel cell within a containerised design with an output range of approximately 500kW for RoPax Ferries.

A scheduled approach is planned for different phases of implementation. The first implementation phase comprises the development and testing of the fuel cell module, which consists of a fuel cell unit for the production of electric energy and a thermal unit for the production of heat and refrigeration energy from the fuel cell's waste heat.

The development focus of FSG is the simulation of the module's system behaviour when interacting with the ship's other systems, in order to achieve a reliable and secure module design.

The development towards the concept of decentralised energy and the first partial use on a ship takes place in the second phase of implementation. At this stage also, extensive simulations will be carried out by FSG.

The first phase of implementation will extend over a time period of between 3 and 4 years (ending 2012). The end of implementation phase 2 is foreseen for 2014.

A fuel cell module designed for the ship building industry means that new energy production and distribution concepts can be put into effect on ships.

Aside from the expected reduction in emissions, FGS's priority aim here is to increase the safety and reliability of energy supply in the event of damage, so that the ship's secure return to harbour can be ensured. Another beneficial effect is anticipated through the decentralised distribution of the energy source. The distribution of fuel in itself eliminates any losses which may occur in conventional electric energy distribution.



08 NIP: »PA-X-ELL« – MODULAR ENERGY SUPPLY SYSTEM USING FUEL CELLS ON PASSENGER SHIPS

Application:

Passenger ships

Keyword:

Pa-X-ell

Commencement:

1 April 2009

Conclusion:

31 March 2014

Project budget:

€243,046

Subsidy amount:

€116,662

Recipient:

Germanischer Lloyd AG

PROJECT DESCRIPTION:

Germanischer Lloyd's objective in the context of the Pa-X-ell initiative is the development of safety requirements for modular fuel cell systems and their integration in the energy networks of passenger ships. In a first implementation phase, a modular fuel cell system and the integration of the thermal and electric modules in a passenger ship is developed.

The testing of the entire system takes place in parallel operation to the conventional auxiliary diesel engine.

In the framework of implementation phase 1, Germanischer Lloyd (GL) works out the requirements for modular fuel cell systems and their interfaces with ship systems. For the parallel operation of decentralised energy sources, demands on the network stability will be defined. In a second implementation phase, two fuel cell systems will be deployed in parallel operation for the supply of an autonomous energy network on board the passenger ship.

GL's considerations focus here on general demands on autonomous energy networks on board passenger ships and the demands concerning the availability and redundancies of the energy sources.

The knowledge gained contributes to national and international policy on specific requirements for fuel cell systems on board passenger ships.

The systematic procedures in evaluating the safety requirements of fuel cell systems on passenger ships form the basis for future technical inspections of maritime fuel cell systems.

Thus the conditions for safety evaluations and the secure market introduction of fuel cell systems on passenger ships will be created.



09 NIP: »PA-X-ELL« – MODULAR ENERGY SUPPLY SYSTEM USING FUEL CELLS ON PASSENGER SHIPS

Application:

Passenger ships

Keyword:

Pa-X-ell

Commencement:

1 April 2009

Conclusion:

31 March 2014

Project budget:

€364,088

Subsidy amount:

€174,762

Recipient:

INVEN Absorption GmbH

PROJECT DESCRIPTION:

In the framework of the overall project, the use of waste heat from fuel cells is of key significance. The intended use of this waste heat for refrigeration has two highly beneficial consequences.

Firstly fuel efficiency substantially increases, and secondly onboard energy consumption falls, as absorption-type refrigeration systems partially replace conventional compression assembly.

On the basis of previous initiatives, the goal of this project is to develop an absorption system for onboard use which fulfils safety and reliability requirements. A scheduled project with different phases of implementation is planned.

During the first implementation phase the integration and process engineering issues of interlinking fuel cells will first of all be resolved. In the second implementation phase the development towards a decentralised energy concept in the form of a seaworthy system and first partial use on a ship will take place.

The essential basic components will be tested in the process under real conditions. The first implementation phase will take place over a period of between 3 to 4 years (ending 2012). The end of implementation phase 2 is foreseen for 2014.

Following the conclusion of the project the participating partners will make a product available which, although primarily developed for onboard use, is also suitable for land-based applications.

Aside from civil and military seafaring, the demand for trigeneration (power, heat, refrigeration) systems in containerised designs is rising sharply, particularly in the oil/offshore/mining/large construction (camps) sectors.

The project can in this way provide an essential stimulus to increasing the competitiveness of German business.

PROFILES OF PROJECTS APPROVED IN 2009 IN THE AREA OF STATIONARY ENERGY SUPPLY (INDUSTRY)

All approved projects can be found at www.now-gmbh.de

10 NIP: DELIVERY, REPLACEMENT, STARTUP AND OPERATION OF A HM 301 CELL STACK USING EURO CELLS FOR THE RO 20 FUEL CELL SYSTEM, FESTO ST. INGBERT

Application:

Energy in buildings

Keyword:

Euro cells

Commencement:

1 July 2009

Conclusion:

1 January 2013

Project budget:

€1,729,413

Subsidy amount:

€795,530

Recipient:

Festo AG

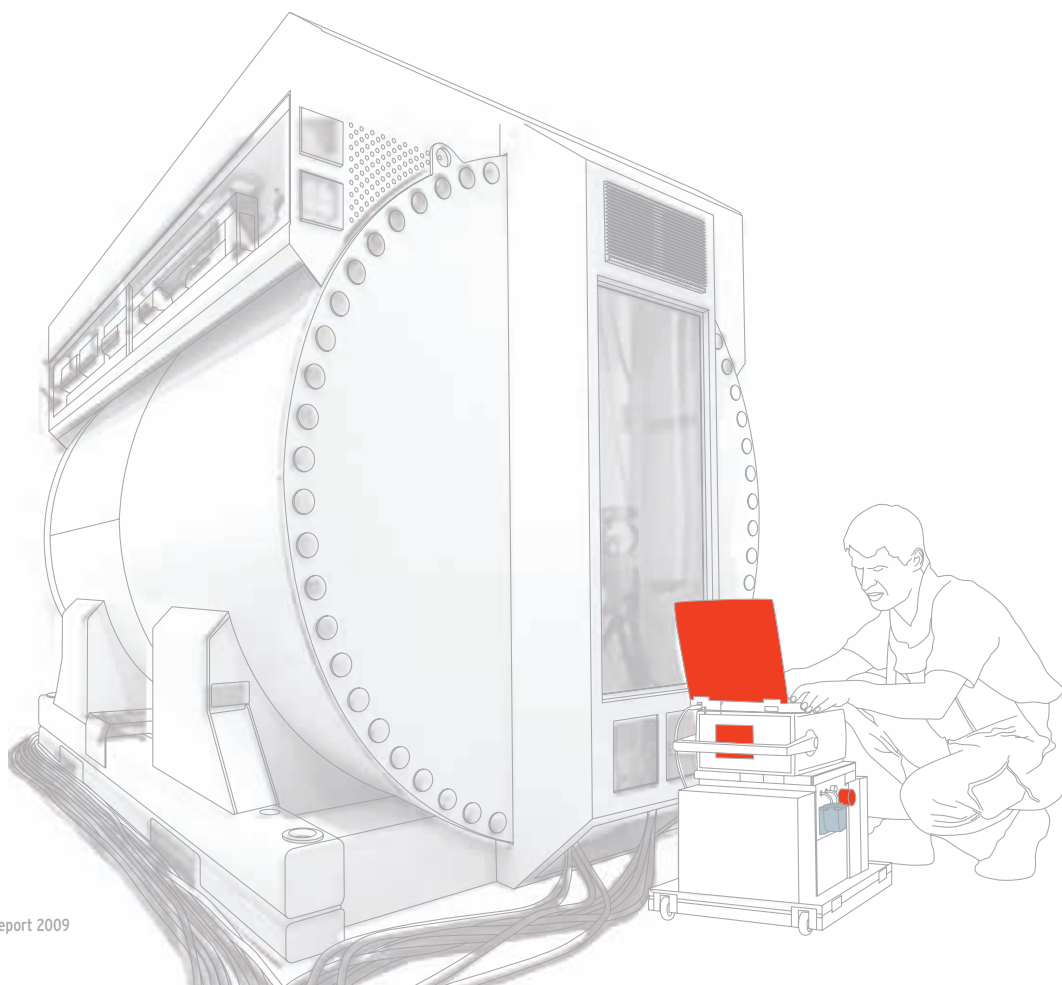
PROJECT DESCRIPTION:

The applicant plans the continued operation of a fuel cell system at the St. Ingbert production location with a new German-made stack (Euro cell model). For this purpose a fuel cell module with a new stack will be exchanged for the existing fuel cell module.

The existing gas utilisation plant will be inspected and reinforced for further operation.



REGION: SAARLAND



11 NIP: INSTALLATION AND OPERATION OF AN INTEGRATED POWER SUPPLY CENTRE AT THE UNIVERSITY CLINIC OF GIESSEN AND MARBURG, GIESSEN LOCATION

Application:

Energy in buildings

Keyword:

Energy centre

Commencement:

1 October 2009

Conclusion:

31 December 2013

Project budget:

€3,601,035

Subsidy amount:

€1,728,495

Recipient:

Energiezentrale Universitätsklinikum
Gießen GmbH

PROJECT DESCRIPTION:

The project's objective is to install a highly efficient and secure power supply centre for the new Giessen University Clinic building, appropriately adapted to the energy requirements of consumer-oriented production of electricity, heat and refrigeration. The facility will be connected to the city's local heat and refrigeration networks.

Because of this connection and the facility's technology, an unprecedented level of natural gas energy efficiency (the primary energy source) should be achieved. The technological concept behind the highly efficient power supply centre of Giessen University clinic foresees several installations for the generation of electricity, heat and refrigeration. A fuel cell system, three gas engines, two absorption refrigerating machines, two exhaust gas heat exchangers, two refrigerator compressor machines and an oil-fired boiler will be installed.

The planned project is an important factor in proving that fuel cell-based Hot-Module small power systems are suitable for use in a highly efficient power supply centre and can play a key role in the modern conception of building energy management.



REGION: HESSE

PROFILES OF PROJECTS APPROVED IN 2009 IN THE AREA OF STATIONARY ENERGY SUPPLY (SINGLE PROJECTS)

All approved projects can be found at www.now-gmbh.de

12 NIP: SERVICE LIFE TEST OF STEAM REFORMERS SUITED FOR SERIES PRODUCTION FOR USE IN STATIONARY FUEL CELL SYSTEMS WITH A POWER RANGE OF BETWEEN 1 AND 5KW

Application:

Steam reformer

Keyword:

LDT

Commencement:

1 January 2009

Conclusion:

31 December 2012

Project budget:

€886,434

Subsidy amount:

€425,488

Recipient:

WS Reformer GmbH

PROJECT DESCRIPTION:

The goal of the project is the further advancement of the FLOX Reformer C1- and C6-HT in order to ready it for series production for household energy use, with a focus on verifying service life by long-term testing over 18,000 hours. In subproject 1 a process-secure initialisation of the CO shift catalyst must firstly be developed and deployed in an automated system. It is established that this procedural step considerably affects the durability of the catalyst.

In subproject 2 automated durability test stands are constructed, test models prepared and reformers run in typical load cycles of up to 18,000 hours.

Regular material testing and performance data will be compiled and evaluated. WS Reformer already now provides prototypes for field tests and various customers worldwide. Market research shows that the demonstrated service life is a key criterion for potential new customers. These include in particular German and European heating companies, that already develop or plan development and market launch of micro combined heat and power systems.



REGION: BADEN-WÜRTTEMBERG

A production-ready reformer module also provides a standard solution to overcoming entry barriers and speeding up launch onto the market.

13 NIP: FIELD TEST AND DEMONSTRATION PROJECT OF PEM FUEL CELL SYSTEM INHOUSE5000 – EFFICIENT ENERGY SUPPLY FOR BUILDINGS WITH COMBINED HEAT AND POWER GENERATION, INHOUSE

Application:

Household energy

Keyword:

INHOUSE

Commencement:

1 August 2009

Conclusion:

31 May 2012

Project budget:

€1,030,330

Subsidy amount:

€484,330

Recipient:

DBI Gastechnologisches Institut
GmbH Freiberg

PROJECT DESCRIPTION:

In the framework of the demonstration project submitted, twelve inhouse5000 fuel cell heating appliances manufactured by RBZ are to be installed in locations with differing requirement structures, operating over a minimum of two heating periods under real conditions.

The objective of the project is the analysis of the systems engineering, peripherals, operational mode and control strategies as well as the integration in the building infrastructure. The resulting potential for optimisation with a view to subsequent market launch will be established and recommendations for series production given to the manufacturer. This demonstration project will validate the inhouse5000 fuel cell heating device technology, collect experience regarding large unit numbers, increase reliability and reproducibility, test the efficiency of combined heat and power generation under various boundary conditions, identify market constraints for commercial application as well as address market preparation.

The work plan is structured in a four-month production period and a test runtime of a minimum of two years depending on the fuel cell system. Twelve systems will be tested during the project.



REGION: SAXONY

The results of each system will be evaluated every three months and made available to project partners in the form of a report.

The overall results of all partners will be presented in the context of workshops, which take place on an annual basis.

CLOSE TO THE MARKET SPECIAL MARKETS PROGRAMME AREA



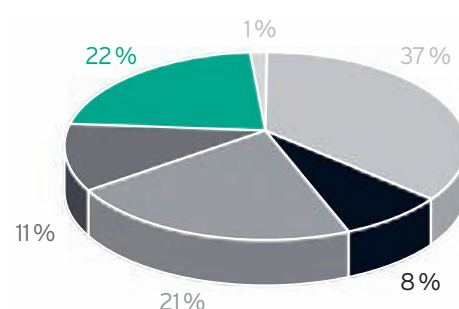


- » Special Markets – paving the way for fuel cells on the mass market » 68
- » The state of Baden-Württemberg promotes NIP BODENSEE lighthouse project » 70
- » Project profiles » 72

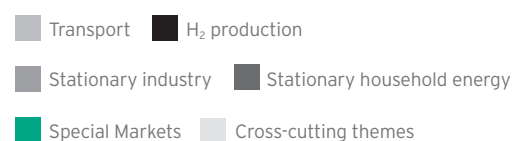
FUEL CELL APPLICATIONS IN SPECIAL MARKETS PARTICULARLY DISTINGUISH THEMSELVES THROUGH:

Special Markets: paving the way for fuel cells on the mass market

Before new technologies capture mass markets, they are often used in special applications that can showcase their merits particularly well. Under the National Innovation Programme Hydrogen and Fuel Cell Technology (NIP), this area is known as »Special Markets«. »Fuel cell applications in »Special Markets« really stand out because of their greater proximity to the market compared to other application areas, their highly diverse applications – from micro fuel cells and critical power supply, to leisure and camping products, as well as a multitude of innovation-focused small to medium sized businesses«, says Wolfgang Axthammer, NOW Programme Manager Special Markets.



« NIP STATISTIC: APPLICATIONS | AS AT DECEMBER 2009
Share of application sectors in NIP



The diagram comprises planned NOW projects, projects in process with the project administrator (PtJ), Letter of Intent, and approved projects.

THEIR HIGHLY DIVERSE APPLICATIONS AND GREATER PROXIMITY TO THE MARKET

compared to other applications areas.

» Wolfgang Axthammer,
NOW Programme Manager Special Markets «

This is why preparing the market with applications for launch in the special markets area paves the way for fuel cell technology towards mass application. Here they demonstrate their reliable operation and technological advantages of a future-oriented, sustainable, and cost conscious technology.

Critical power supply, conveyer technology and vehicles such as forklifts and airport tow tractors, electric light vehicles like cargo bikes and boats, onboard power supply for the leisure and camping market, as well as small applications such as power supply for RFID systems (Radio Frequency Identification in logistics) on the basis of micro fuel cells, are just some of the diverse areas of application.



The state of Baden-Württemberg promotes the NIP BODENSEE lighthouse project

Under the heading »BODENSEE project«, the Baden-Württemberg Ministry for Environment supported the development phase of the NIP BODENSEE lighthouse project. The primary tasks were the identification, initiation, cross-linking and promotion of fuel cell project initiatives in the Bodensee (Lake Constance) region. Under the leadership of the Fuel Cell Education and Training Center Ulm (WBZU, Weiterbildungszentrum Brennstoffzelle Ulm), a team of experts was formed, comprising the Fuel Cell Alliance (Brennstoffzellenallianz) Baden-Württemberg, Esslingen University, the engineering firm Sebastian Wider Engineering Services as well as the Centre for Solar Energy and Hydrogen Research (Zentrum für Sonnenenergie und Wasserstoff-Forschung) Baden-Württemberg. Out of the BODENSEE project began the NIP BODENSEE lighthouse project in February 2010.

As a regional and thematic grouping for leisure applications of fuel cells, the BODENSEE lighthouse project provides ideal conditions for the market preparation of fuel cell technology. By including operators (of boats, light vehicles), the public is offered a hands-on experience of fuel cell technology. Not only will the everyday suitability of sustainable and efficient products be tested with BODENSEE, but public acceptance of new technology will also be strengthened.



REGIONS OF ACTIVITY

That is why the BODENSEE lighthouse project is particularly attractive for tourist-oriented regions, cities and communities, as well as for innovative institutions and businesses from the tourist, environmental and energy industries. Demonstrations will be focused initially in the Bodensee region, in Freiburg im Breisgau, and in the Danube city of Ulm.



Time period:

2008-2011

Overall project budget:

€25.1 million

Lighthouse field test phase 1.1:

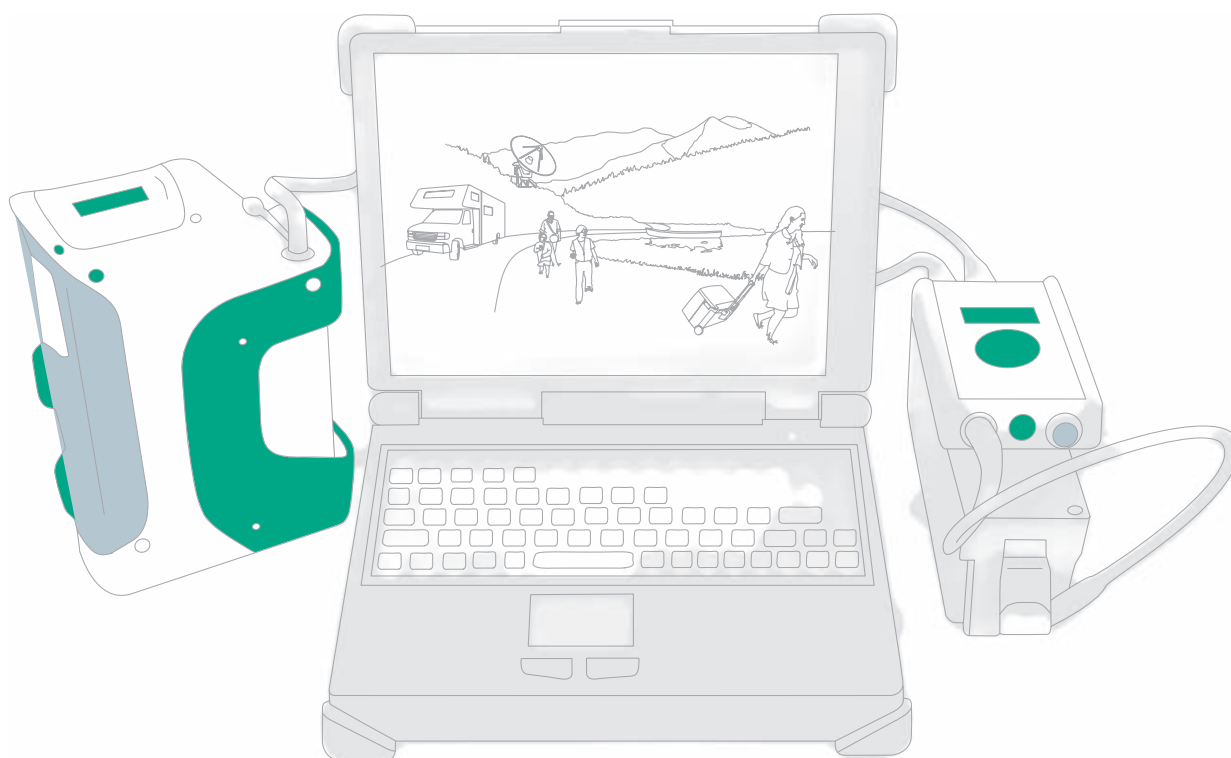
€2.8 million

Accompanying module phase 1:

€26 million

BODENSEE partners:

Elcomax, SFC Smart Fuel Cell, Truma Gerätetechnik, Clean Mobile, EnyMotion, Dometic, Zentrum für Brennstoffzellen-Technik (ZBT)



BODENSEE

Under the BODENSEE project, the onboard power supply of camping vehicles (camper vans, mobile homes) and the power drive of leisure vehicles (boats, light vehicles) using fuel cell systems will be tested. According to the established lighthouse principle, the tests take place under everyday conditions.

The goal here is increased publicity, made especially feasible through fuel cell applications in this sector. The implementation of the BODENSEE lighthouse project is supported for the duration of one year by the state of Baden-Württemberg as a key partner. It finances a business consortium for the management of the project.

The individual initiatives of the BODENSEE lighthouse project: Under the project name »STEP«, [elcomax](#), [SFC Smart Fuel Cell](#) and [Truma Gerätetechnik](#) are developing a new technological generation of membrane electrode assemblies (MEAs), the so-called »heart« of fuel cells. Under this initiative, using considerably more cost-effective MEAs, the next generation of fuel cells for DMFC (direct methanol fuel cells) and HT PEM (polymer electrolyte membrane fuel cells) will be produced.

Within the project: »DMFC systems for light electric vehicles«, project partners [Clean Mobile](#) and [SFC Smart Fuel Cell](#) are developing a DMFC system platform which is tailored to the demands of the LEV (light electric vehicles) market segment. Optimisation and efficiency of the overall system of electric energy supply and systems are at the forefront, as well as the demonstration of various LEV vehicle types in everyday use. A reformer fuel cell system will be further advanced by Truma Gerätetechnik under the »Onboard power supply for leisure vehicles« project. The system will be subjected to a market-oriented practical test and deployed in the mains-independent onboard energy supply (auxiliary power unit) of leisure vehicles. The everyday testing is carried out by selected end customers and vehicle manufacturers in the framework of a two stage field test.

PROFILES OF PROJECTS APPROVED IN 2009 IN THE AREA OF SPECIAL MARKETS (BODENSEE)

All approved projects can be found at www.now-gmbh.de



NIP: STEP – A NEW TECHNOLOGY GENERATION FOR MEAS AND FUEL CELL SYSTEMS

Application:

Onboard energy

Keyword:

STEP

Commencement:

1 July 2008

Conclusion:

30 June 2010

Project budget/Subsidy amount:

a) €9,520,588/€4,569,882

b) €2,750,705/€1,320,338

c) €708,139/€339,907

.....
€12,979,432/€6,230,127

Recipients:

a) elcomax GmbH

b) SFC Smart Fuel Cell AG

c) Truma Gerätetechnik GmbH & Co. KG

PROJECT DESCRIPTION:

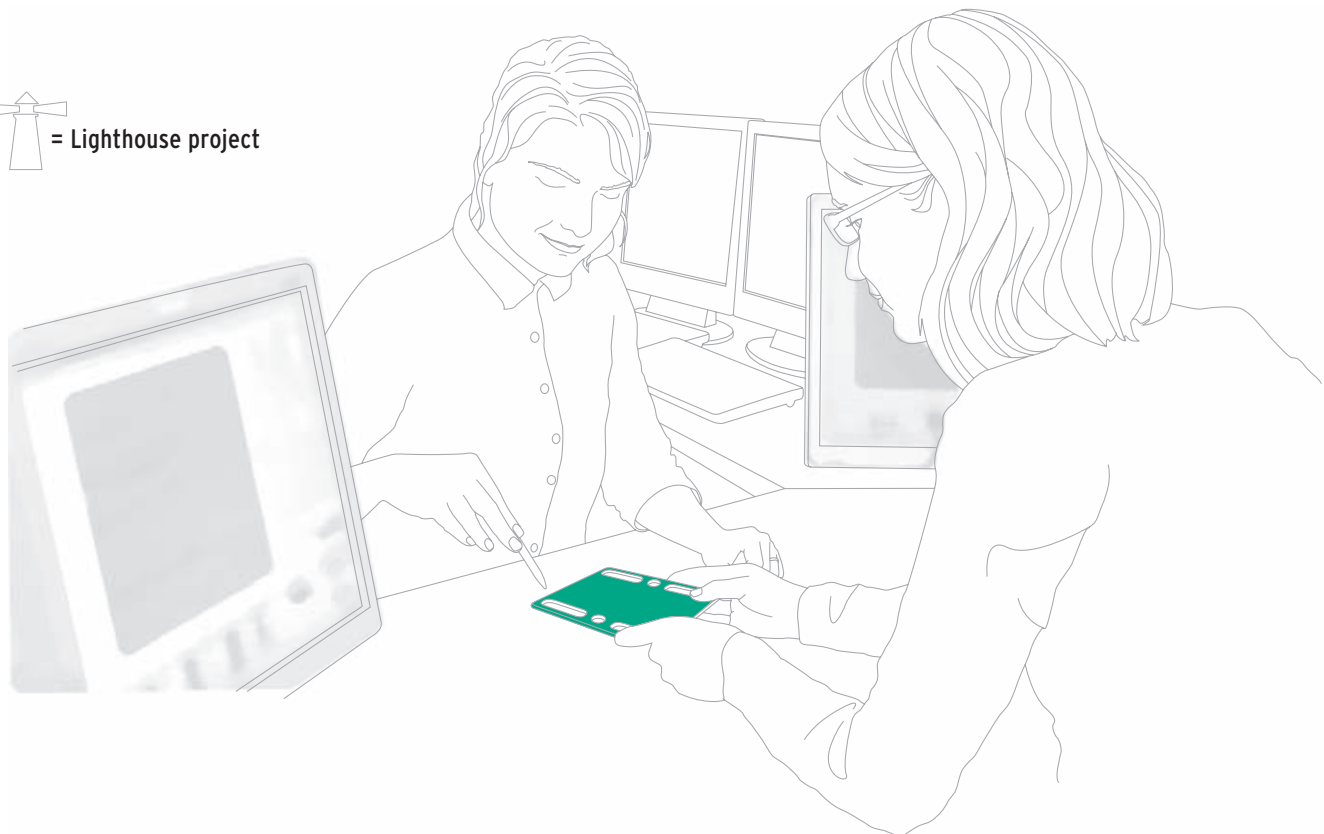
The purpose of the project is to test the new MEAs with an optimised HT PEM stack in the reformer fuel cell APU system developed by Truma. The system offers onboard power supply for leisure vehicles and uses a liquefied gas energy supply, well-established in the caravanning market.

A substantial reduction in cost is essential, and this is where the project comes in. Through radical new technological approaches in the area of MEAs, stack hardware and system peripherals, manufacturing costs for the product will be halved.

At the same time, the project's success will be monitored by successful operation of products in field trials.



= Lighthouse project





NIP: FUEL CELL 4 LEISURE – ENERGY SUPPLY OF BOATS AND CARAVANS IN THE LEISURE SECTOR USING 250 WATT FUEL CELL SYSTEMS IN THE BODENSEE AREA

Application:

Onboard energy

Keyword:

Fuel Cell 4 Leisure

Commencement:

1 June 2009

Conclusion:

29 February 2012

Project budget/Subsidy amount:

a) €938,171/€450,322

b) €388,934/€186,688

c) €149,456/€71,739

.....
€1,476,561/€708,749

Recipients:

a) EnyMotion GmbH

b) Zentrum für Brennstoffzellen-
Technik GmbH

c) Dometic GmbH

PROJECT DESCRIPTION:

A 250 Watt fuel cell system established as a prototype at EnyMotion is to be integrated and tested in various leisure sector applications in the Bodensee area. In the field trial, the specific requirements in camper vans and boats with energy-supplying fuel cell systems, the everyday usability and the reliability of the various systems will be tested in different climatic periods.

The performance of the PEM fuel cell at below freezing temperatures as well as potential operating procedures for this application will be explicitly tested.

The prototype will be integrated and in part further developed with the demands of the vehicle in mind. A port to the onboard battery (energy manager) on the application side will also be created.

A desulphurisation system will also be developed in parallel, which, using a self-secure control system, will guarantee safe, robust operation in leisure applications.

The field trial data will lastly be used for the optimisation of an effective production process.

PROFILES OF PROJECTS APPROVED IN 2009 IN THE AREA OF SPECIAL MARKETS (MICRO FUEL CELL SYSTEMS)

All approved projects can be found at www.now-gmbh.de

03 NIP: μ MEGA – MICRO FUEL CELL SYSTEMS IN INJECTION MOULDING TECHNOLOGY FOR EARLY MASS MARKETS, SYSTEM DEVELOPMENT AND APPLICATION INTEGRATION, DEMONSTRATION OF SYSTEM MANUFACTURING AND TESTING OF MICRO FUEL CELLS IN DIFFERENT APPLICATIONS

Application:

Micro fuel cells

Keyword:

μ Mega

Commencement:

1 July 2009

Conclusion:

30 June 2012

Project budget/Subsidy amount:

- a) €1,553,965/€745,903
- b) €1,422,655/€682,874
- c) €1,145,000/€549,600
- d) €1,119,971/€537,586
- e) €801,660/€384,796
- f) €518,184/€248,728
- g) €306,626/€147,180
- h) €206,942/€99,332
- i) €170,550/€81,864
-
- €7,245,553/€3,477,863

Recipients:

- a) SolviCore GmbH & Co. KG
- b) FWB Kunststofftechnik GmbH
- c) Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e. V. (FhG)
- d) Siemens AG
- e) Freudenberg FCCT KG
- f) VDE Prüf- und Zertifizierungsinstitut GmbH
- g) EPSa-Elektronik & Präzisionsbau Saalfeld GmbH
- h) Bartels Mikrotechnik GmbH
- i) Fachhochschule Trier

PROJECT DESCRIPTION:

The consortium is developing a planar micro fuel cell (DMFC) in injection moulding technology with a passive air supply and partially active methanol distribution. With a performance ranging from 0.1 to 10W, the power system is characterised by the following factors:

A hybrid system composed of fuel cells and lithium-ion batteries is being built. Through different battery capacities and performances, a broad spectrum of applications can be covered without changing the fuel cell module.

The goal is to achieve an electrical system efficiency of 20%. The system volume without methanol cartridges amounts to approx. 0.3l at a power output of 0.5W, and approx. 0.5l at an output of 1W. The project consortium covers the entire value chain from material manufacture (TICONA), component preparation (SOLVICORE, FFCCT, BARTELS) and system manufacture (FWB), to application (ILLE, EPSA, Siemens).

The project's objective is the development and production of prototypes suitable for approval and their testing in field trial inspections, and the construction of a qualification and production concept for fuel cell stacks and systems for partially automated assembly.

1. Optimisation of existing stack design
2. System configuration to prototypes
3. System testing
4. Application integration
5. Production technology and stack and system assembly

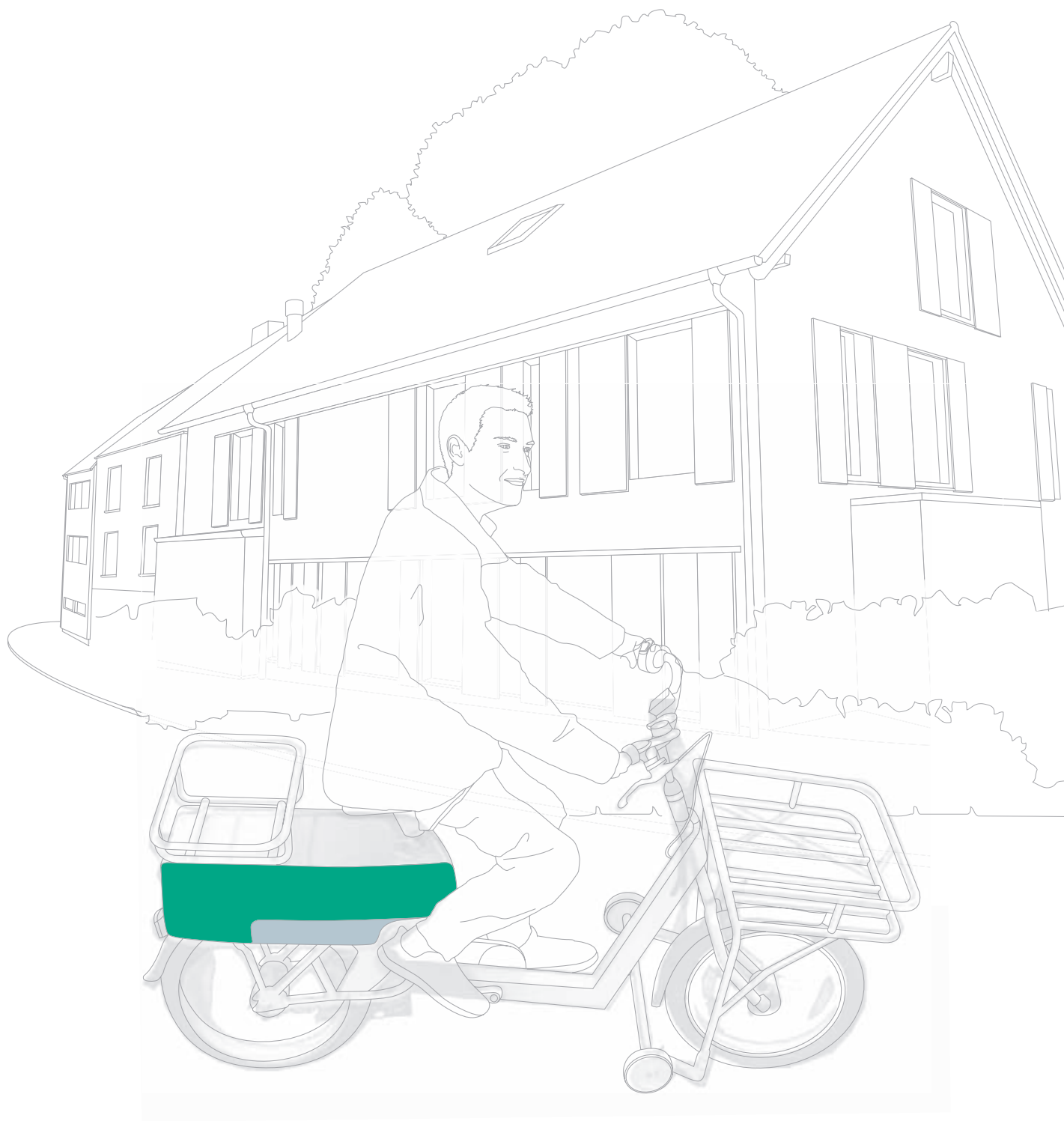


REGION: RHINELAND-PALATINATE, BERLIN, NORTH RHINE-WESTPHALIA, THURINGIA, BADEN-WÜRTTEMBERG, HESSE

6. Equipping and maintenance of manufactured demonstrators in field trials
7. Approval issues and project administration

The results acquired should, after successful testing and further development towards customer-specific products, be commercialised following certification. The marketing of the stacks as a subsystem for other integrators is conceivable at a later stage.

Through partially automated production, the challenging target costs of industrial customers are achievable and facilitate a competitive market launch.



PROFILES OF PROJECTS APPROVED IN 2009 IN THE AREA OF SPECIAL MARKETS (CRITICAL POWER SUPPLY)

All approved projects can be found at www.now-gmbh.de

04 NIP: EUSKAB – CREATION AND ANALYSIS OF A MODULAR SCALABLE FUEL CELL SYSTEM WITH AN OUTPUT POWER RANGE OF 1-10KW

Application:

Telecommunications

Keyword:

EUSKAB

Commencement:

1 June 2009

Conclusion:

30 June 2011

Project budget:

€457,698

Subsidy amount:

€219,695

Recipient:

Rittal GmbH & Co. KG

PROJECT DESCRIPTION:

The aim of the proposed project is the establishment and testing, in terms of operability and availability, of a modular and scalable fuel cell system. In the framework of the project the system is to undergo field tests and be tested and optimised. Basic practical experience and technological competence in working with the fuel cell system will be compiled over the project's duration.

As a first step the planned project intends to establish a demonstrator, which comprises an operable modular fuel cell system including both casing and equipment.

Following the initial tests, there will subsequently be an optimisation phase, in which the demonstrator will be re-engineered and improved.

Finally the demonstrator will be tested during a field trial over the course of the duration of the fuel cell service life.

05 NIP: DEVELOPMENT OF SOLUTIONS IN THE AREA OF UNINTERRUPTIBLE POWER SUPPLIES USING FUEL CELLS

Application:

Telecommunications

Keyword:

USV

Commencement:

1 April 2009

Conclusion:

31 March 2011

Project budget:

€2,445,343

Subsidy amount:

€1,173,764

Recipient:

b+w Electronic Systems GmbH & Co. KG

PROJECT DESCRIPTION:

The point of reference is the 2.1 version of the National Development Plan dated 30 April 2007 on the Innovation Programme for Hydrogen and Fuel Cell Technology. Article 6, the development plan for special markets for fuel cells, in this case fuel cell emergency power supply for telecommunications (Tetra), is the application for the envisaged developments. The account illustrates the technical advantages of fuel cell technology in this area.

The businesses and partners involved in development such as TerraCon each bring their own company-specific knowledge to the project.

In addition b+w will guarantee the training and service for b+w and end customers/Herten. Further goals include the development and production of outdoor housings and complete systems, system integration of fuel cells in production facilities in NRW, as well as training, service, spare parts management and installation of fuel cells.

06 NIP: SAFEGUARDING AVAILABILITY FOR TELECOMMUNICATIONS NETWORKS, FUEL CELL SYSTEMS IN THE TELECOM FIXED NETWORK

Application:

Telecommunications

Keyword:

Safeguarding availability

Commencement:

1 March 2009

Conclusion:

31 December 2012

Project budget:

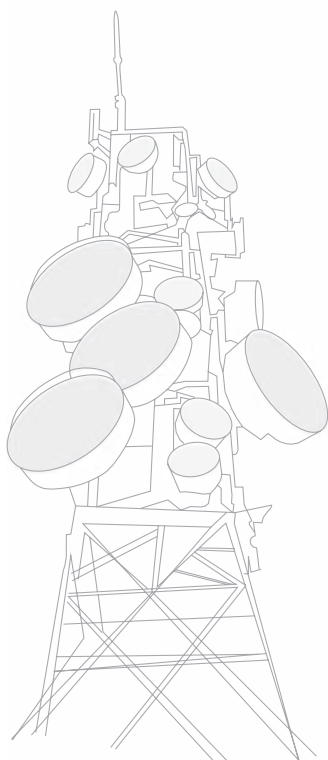
€8,038,491

Subsidy amount:

€3,858,475

Recipient:

PASM Power and Air Condition
Solution Management
GmbH & Co. KG München



PROJECT DESCRIPTION:

To safeguard the availability of telecommunication networks, a new fuel cell system technology will be deployed within the framework of a demonstration project, which can replace existing rectifiers and lead batteries. This technology will in addition, be integrated in a virtual control power plant for the production of minutes reserves, and be used to lower peak loads.

Taking all synergy effects into account, a higher level of efficiency with regard to the use of batteries is expected over the longer term. Another goal is to provide an integrated overall solution for uninterruptible power supply (UPS) systems in telecommunication networks. Yet another aim is the integration of individual components and the optimisation of the overall system.

Following determination of the location for the individual systems, detailed preliminary planning is necessary, which is required for approval by the responsible authorities in order to implement fuel cell system technology at the assembly locations. After permission is granted, the individual work packages should be dealt with accordingly (tendering, evaluation, awarding, contracting and building of infrastructure incl. facility approval, system component assembly, delivery and installation at the assembly location, functional testing, start of operation, test phase, optimisation of individual components, recording of results, evaluation, optimisation of the entire system and final report).



REGION: BAVARIA

Following the completion of pilot phases 1 and 2 of the demonstration project, the findings of all project participants will be made accessible.

The results from the operation of PASM with the virtual control power plant for minutes reserves and the peak load reduction could feed into the design of future virtual power plants and decentralised energy generation systems.

The use of the virtual control power plant for minutes reserves increases the efficiency of energy supply. Upon successful completion, the new fuel cell system technology will be implemented nationwide.

PROFILES OF PROJECTS APPROVED IN 2009 IN THE AREA OF SPECIAL MARKETS (MATERIAL HANDLING)

All approved projects can be found at www.now-gmbh.de

07 NIP: DEVELOPMENT OF FUEL CELL/BATTERY HYBRID ENERGY SUPPLY SYSTEMS FOR MATERIAL HANDLING EQUIPMENT BASED ON NICKEL-METAL HYDRIDE (NIMH) AND LITHIUM-ION TECHNOLOGY

Application:

Storage technology vehicles

Keyword:

BBH-MH II

Commencement:

1 March 2009

Conclusion:

29 February 2012

Project budget:

€2,032,678

Subsidy amount:

€975,685

Recipient:

HOPPECKE Advanced Battery Technology GmbH

PROJECT DESCRIPTION:

Hybrid concepts, comprising of a battery to cover peak loads in combination with a base load coverage by a fuel cell, represent a key technology which clearly reduces system costs, raises the dynamics of the overall system, lengthens the service life of the fuel cell in the system and can pave the way for the launch of the hydrogen industry.

The goal of the project is the development of fuel cells/battery hybrid energy supply systems for material handling equipment based on advanced battery technologies such as nickel-metal hydride (NIMH) and lithium-ion.

Goals and content:

1. Design and development of fuel cell-battery hybrid systems integrating the latest in NIMH and lithium-ion battery technologies
2. Increase in system availability and system performance
3. Reduction in production costs by modular design, particularly in terms of maintainability
4. Communication of development results in lighthouse projects especially by KION and Linde AG. There are three development phases of hybrid systems planned within the project.

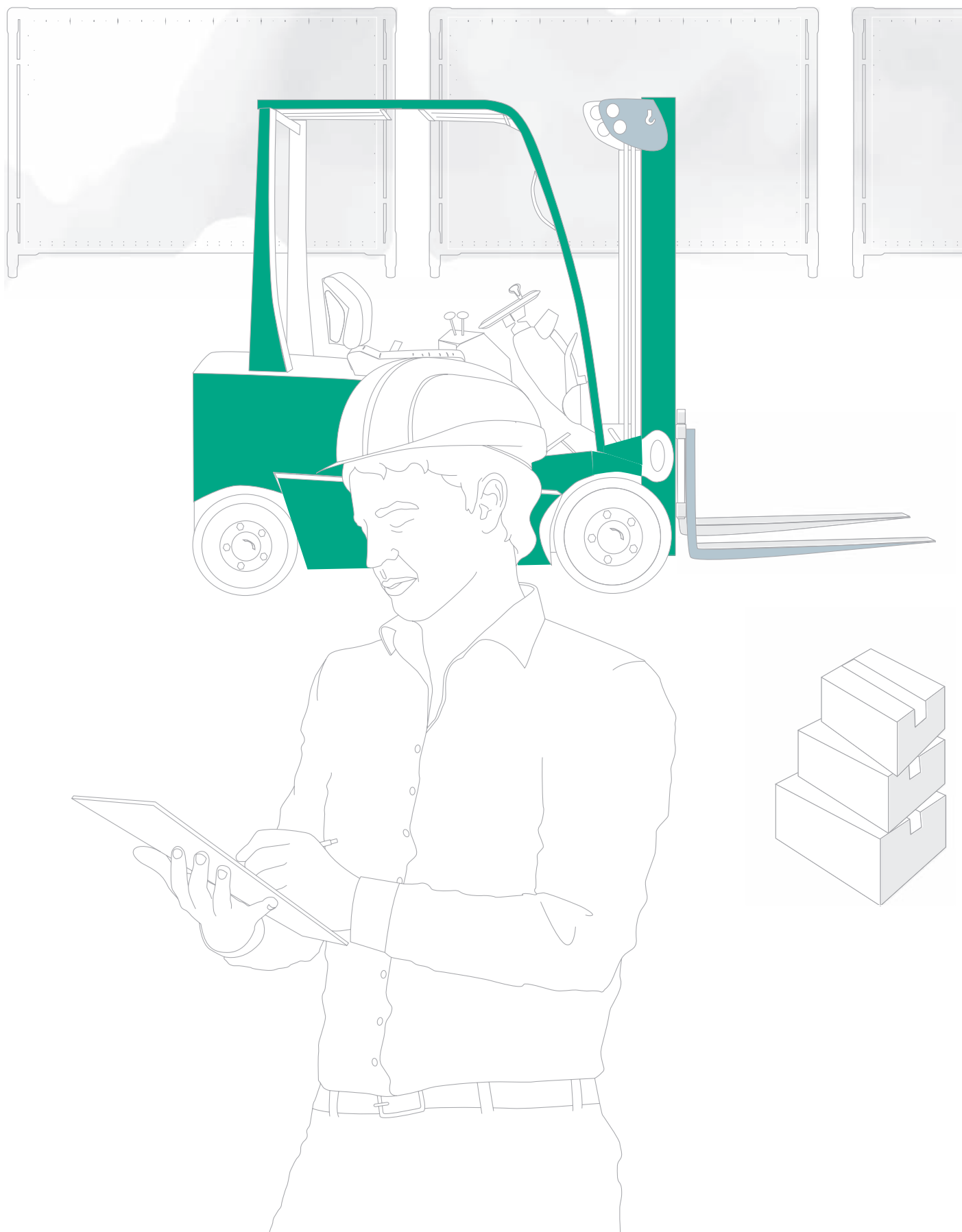
The first development stage includes a rebuild of the entire system integrating all individual components in the battery tray (direct exchange of batteries for hybrid systems is thus a possible upgrade).



REGION: SAXONY

The second development phase integrates an NIMH battery with greater energy power density. The third development phase features the most powerful system with a lithium battery for peak load coverage (increased H₂ quantity in the system lengthens the operating time).

In the fourth implementation phase, project findings are directly transferred into demonstration projects for early markets. The findings will be exploited and requirements for potential series production and market entry established. In corridor supply vehicles in the hybrid system, application of lithium battery technology (high capacities) will be demonstrated.



PROFILES OF PROJECTS APPROVED IN 2009 IN THE AREA OF SPECIAL MARKETS (HYSPORT)

All approved projects can be found at www.now-gmbh.de

08 NIP: HYSPORT – DEVELOPMENT AND DEMONSTRATION OF ALTITUDE TRAINING EQUIPMENT BASED ON FUEL CELL TECHNOLOGY

Application:

Special application

Keyword:

HySport

Commencement:

1 October 2009

Conclusion:

31 December 2010

Project budget/Subsidy amount:

a) €342,858/€164,572

b) €193,738/€92,994

c) €87,976/€42,228

d) €68,800/€33,024

€693,372/€332,818

Recipients:

a) Zentrum für Brennstoffzellen-Technik GmbH

b) N2telligence GmbH

c) Air Products GmbH

d) HyCologne – Wasserstoff Region Rheinland e. V.

PROJECT DESCRIPTION:

The goal of the current HySport project is the application-oriented further development and demonstration of an aggregate, which provides conditioned and oxygen-reduced respiratory air for sports applications (altitude training). Fuel cell technology will be used to generate power, in addition to producing oxygen-reduced respiratory air.

These devices will be initially supplied via a new type of hydrogen cylinder of of the Integra variety, which through the application of a low pressure valve, allows the use of hydrogen as an energy source, thereby making H₂ tangible for the layman.

In the framework of this project up to ten systems are to be created and tested in field trials. The work packages from N2telligence are as follows:

- 1.) Development of overall system with regard to construction, materials, method of assembly, ergonomics, safety, etc.
- 2.) Improvement of energy consumption in terms of performance and control concept of the system
- 3.) Air analysis
- 4.) Preparation, construction, verification, execution, and overall assessment of field tests.

The Centre for Fuel Cell Technology (ZBT) is assuming responsibility for the adaptation of the fuel cell system to expected user requirements as well as to applicable safety standards. An evaluation of applied standards and norms and a system safety analysis will be carried out and a notified body engaged for approval.



REGION: HAMBURG, NORTH RHINE-WESTPHALIA

The task of HyCologne as set out in this project is its active involvement in the following project steps:

1. Preparation of the field tests: appropriate partners must be chosen for the active implementation of the field tests and prior to the presentation of the system, local conditions must be assessed and technical implementation planned.
2. The field test concept is to be verified.

PROFILES OF PROJECTS APPROVED IN 2009 IN THE AREA OF SPECIAL MARKETS (STUDIES)

All approved projects can be found at www.now-gmbh.de

09 NIP: DEVELOPMENT OF A MARKET LAUNCH PROGRAMME FOR FUEL CELLS IN SPECIAL MARKETS – PREPARATION OF A STUDY

Application:

Market launch

Keyword:

Analysis of market obstacles

Commencement:

1 September 2009

Conclusion:

31 March 2010

Project budget:

€81,406

Subsidy amount:

€81,406

Recipient:

VDI Technologiezentrum GmbH

PROJECT DESCRIPTION:

The project is designed to identify suitable promotional instruments by which

1) the market launch of fuel cells in the application segment of »Special Markets« can be advanced, and which 2) are conducive to expanding German technological leadership in an international context.

Another objective is the assessment of potential promotional instruments in view of energy, climate as well as economic aims. The project is subdivided into four work packages (APs). In AP1 a portfolio analysis for the German fuel cell industry is constructed. Another basis for information is a commissioned fuel cell market study and the analysis of the German fuel cell company landscape on the basis of data provided by the VDMA Fuel Cell Working Group (VDMA Arbeitsgemeinschaft Brennstoffzelle) and of the VDI Fuel Cell Technical Committee (VDI Fachausschusses Brennstoffzelle).

With the help of the portfolio analysis the market segments with particularly high growth potential will be identified, in which German industry is especially well positioned. Further analysis of the study focuses on these key markets. In AP2 obstacles to market introduction and possible measures to overcome them are identified with the aid of in-depth interviews. On the basis of these interviews a fuel cell workshop brought together stakeholders from both the supply and purchase sides as well as political and administrative organisations.



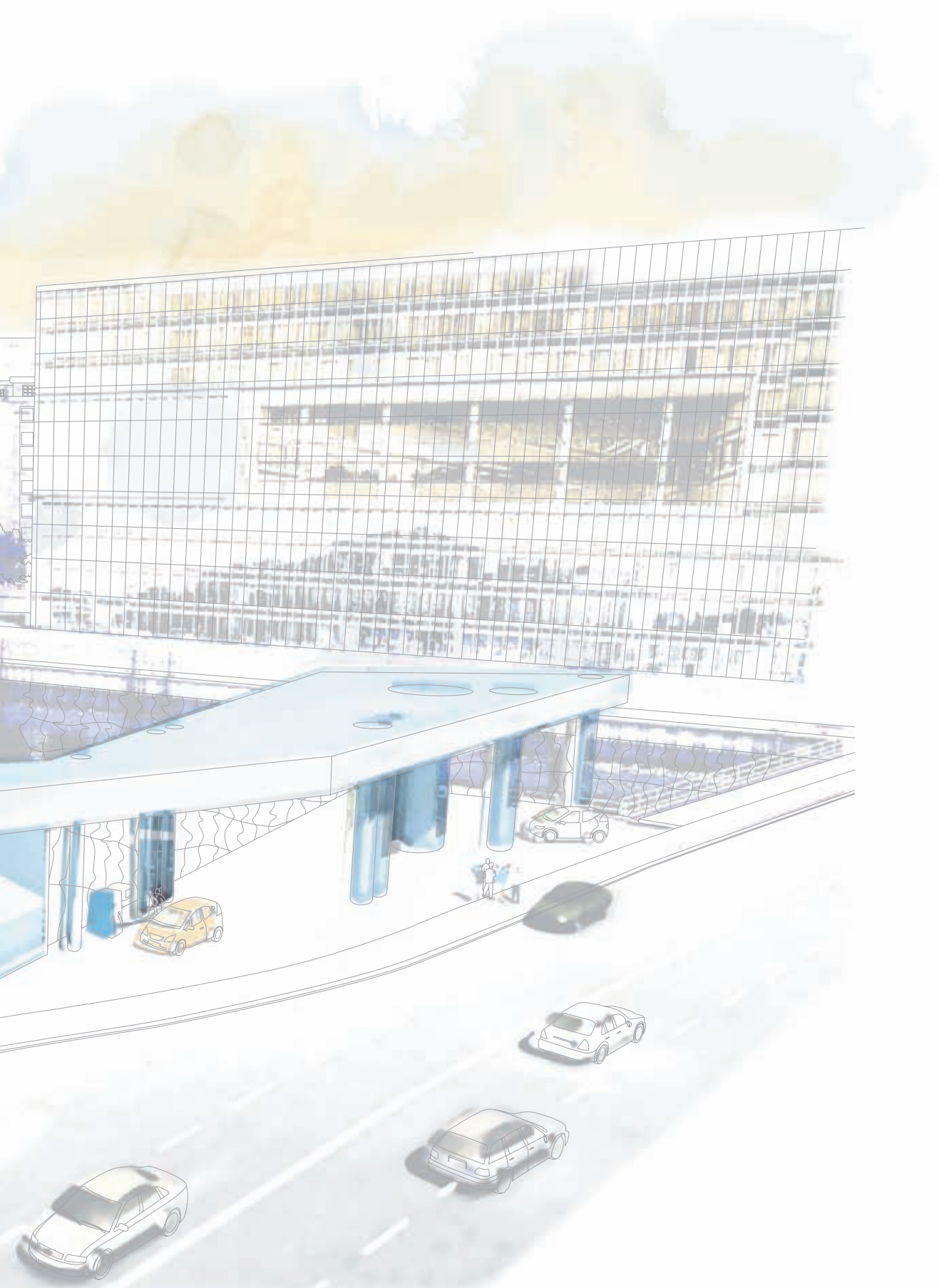
REGION: NORTH RHINE-WESTPHALIA

At the workshop for all relevant market segments, action points included:

- 1) a SWOT analysis
- 2) identification of measures to support market entry, and
- 3) development of scenarios for the future development of each market segment. Development of market entry programme on the basis of the workshop's findings (AP3). In addition, examination of market entry measures discussed at the workshop according to plausibility and with regard to energy, climate and economic goals.
- 4) The fourth work package consists of the preparation of the final report.

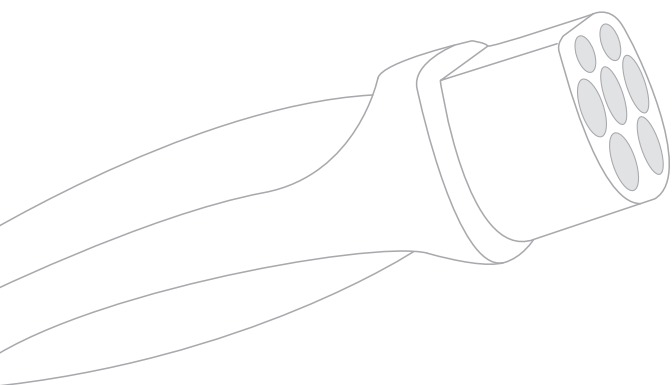
EVERYDAY MOBILITY IN THE CITIES OF TOMORROW ELECTROMOBILITY MODEL REGIONS





ELECTRIC VEHICLES ARE OF A FUTURE-ORIENTED SYSTEM AND SUSTAINABLE

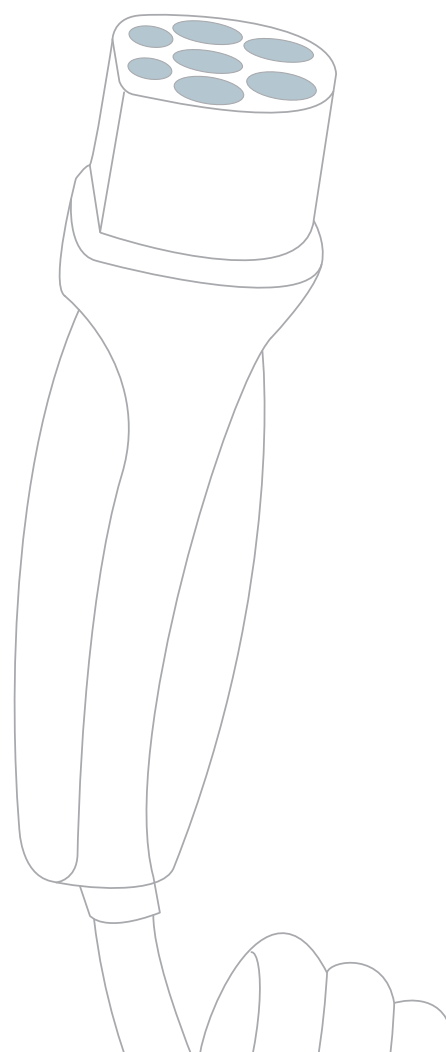
» Andre Metzner,
Programme Manager Electromobility, BMVBS «



Electromobility Model Regions

Electric vehicles are an essential part of a future-oriented transport system and sustainable mobility. Through their use, CO₂ emissions as well as dependence on oil-based fuels can be considerably reduced. Furthermore electromobility promotes the development of renewable energies and contributes to achieving global climate targets.

The funding programme Electromobility Model Regions supports this development. It aims at using the funding budget of 115 million euro (2009-2011, Economic Stimulus Package II) to promote the research and development, market preparation and introduction of battery electric vehicles in Germany. The programme has been adopted in August 2009 by the Federal Ministry of Transport, Building and Urban Development.



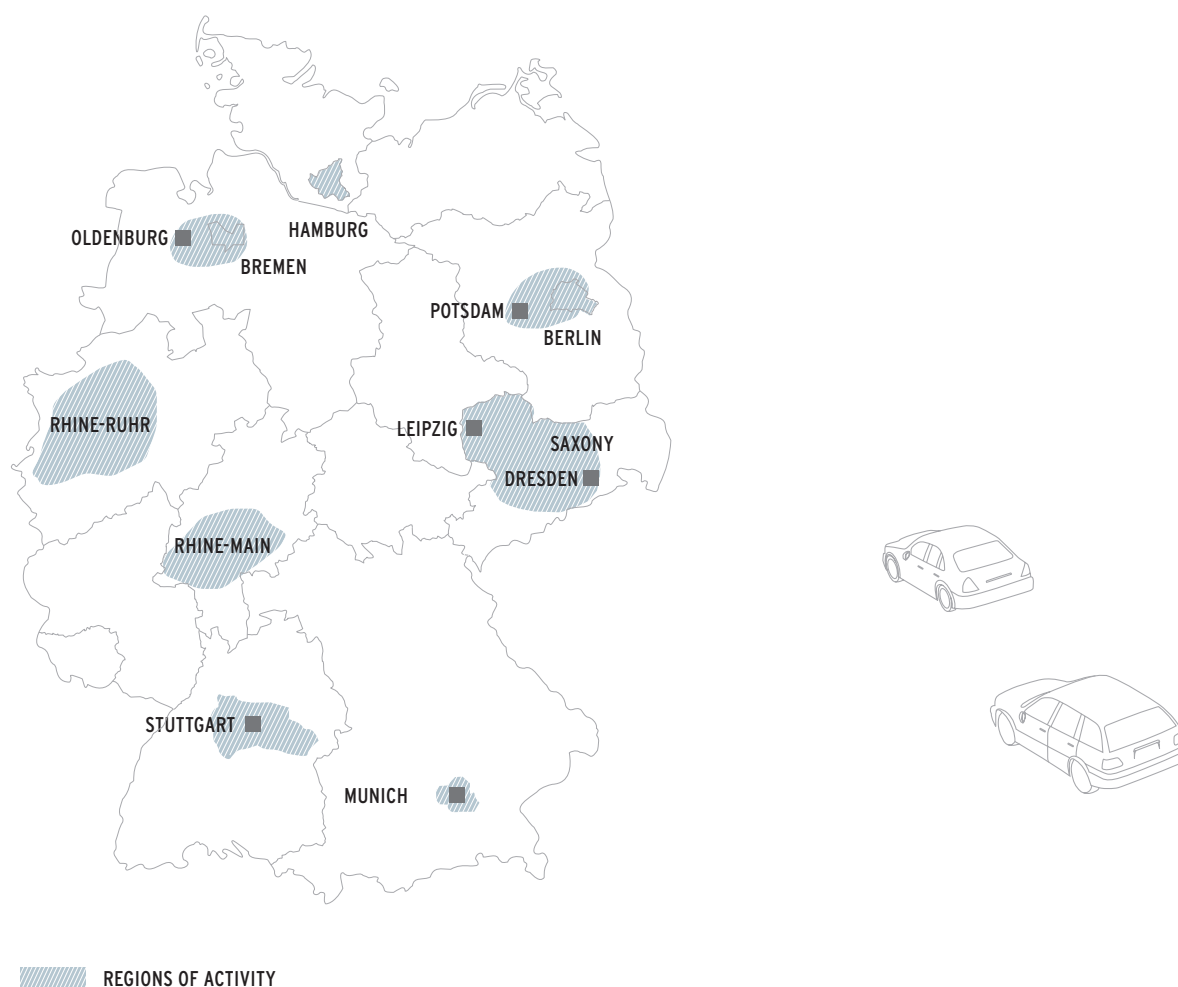
BE AN ESSENTIAL PART OF TRANSPORT AND MOBILITY

Eight model regions are supported

From almost 130 submissions, eight model regions were selected for the programme: the metropolitan regions of Berlin/Potsdam, Bremen/Oldenburg, Hamburg, Munich, Rhine-Main, Rhine-Ruhr, Saxony and Stuttgart. In these regions key players from science, industry and participating local authorities are working closely together – taking regional features into account – in order to integrate electric vehicles into everyday operation.

Aside from the operation of electric vehicles, the installation of an infrastructure as well as the establishment of electromobility in the public eye is the focus here. In addition new mobility concepts, the integration of different transport options and future-oriented business models are to be conceived, implemented and evaluated. Last but not least, user behaviour and acceptance will be examined by means of a widely diverse, scientific accompanying study.

Ongoing and enlarged demonstration projects in the electromobility sector via the second economic stimulus package are embedded in the model regions. All model regions adopt the overarching approach of demonstrating electromobility in everyday life. In the individual regions however, different project aspects will be applied. This will guarantee that all relevant thematic fields are taken into account.



Regional approach

The programme enables application-oriented research and development issues to be implemented in demonstration projects and everyday applications within individual or group projects. As a result, attention is turning to a regional approach, in order to facilitate the development of electromobility from certain clusters. Through cooperation of industry, the energy sector, science and individual regional authorities, competences and activities can be grouped together and the different building blocks of electromobility can be created in a targeted way.

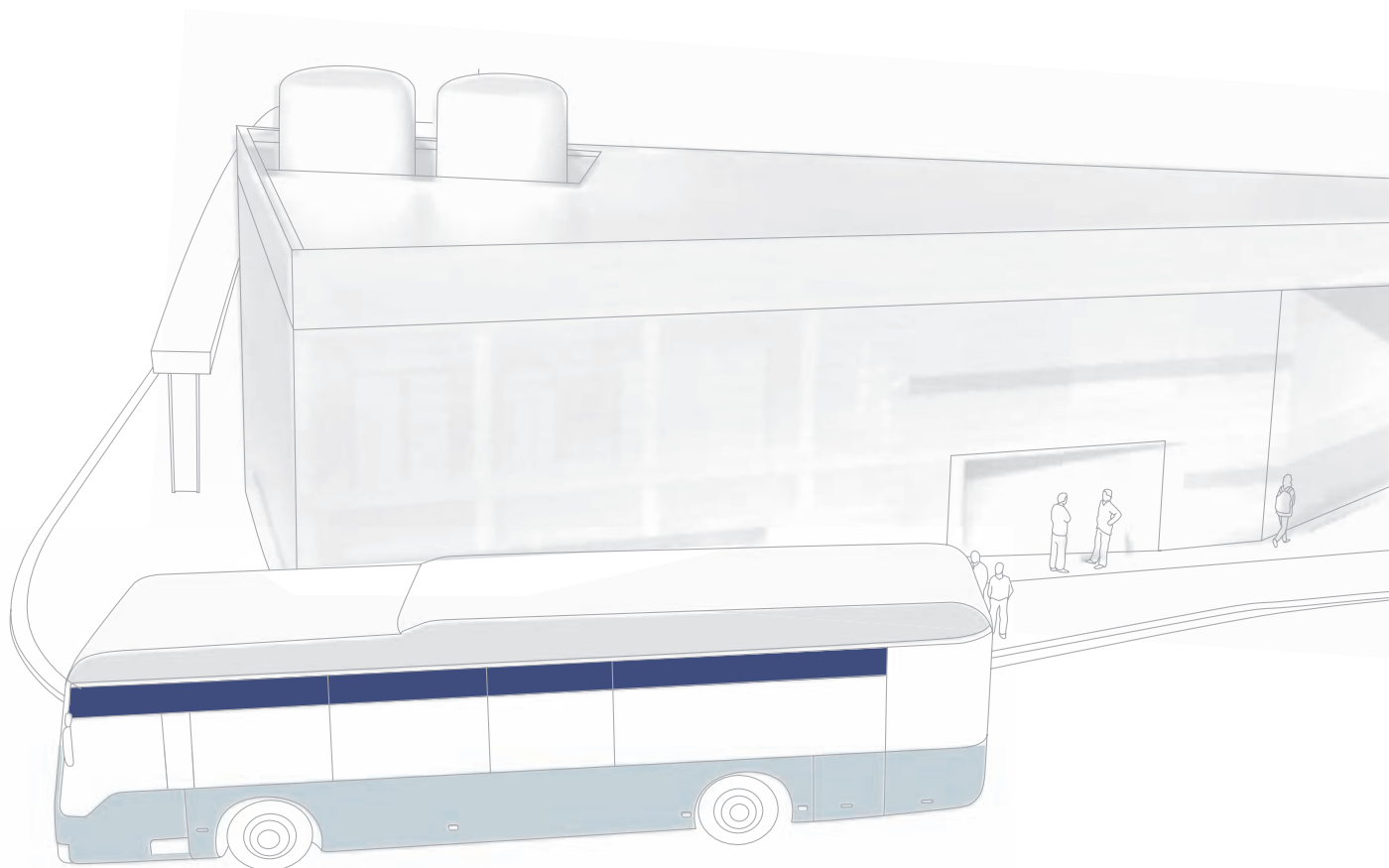
The next step will see the development from the regions to nationwide electromobility. The programme therefore serves first and foremost as a catalyst for further expansion of electromobility in Germany.

Electric vehicles and charging stations

Vehicles in addition to electric cars is also coming into operation in different performance classes (light to medium), such as commercial vehicles, city buses, railed vehicles, motorcycles and bicycles with auxiliary motors (so-called pedelecs).

An appropriate public charging infrastructure must be built for operation of these vehicles. The development of this network and charging infrastructure is an essential prerequisite for the success of nationwide electromobility.

Public and non-discriminatory access to charging stations will generate acceptance by the public and expands the radius of mobility. Parallel to this accounting and pricing models for users and operators will be tested. Questions regarding the generation of charging current from renewable energies and demand-based supply are a part of the function of the programme.



Part of the overall strategy of the federal government

The Electromobility Model Regions Programme is part of the federal government's National Electromobility Development Plan. Within the plan the stated objective is to bring one million electric vehicles onto German roads by 2020 and to evolve the country into the leading market for electromobility.

To this end the government is making €500 million available from the second economic stimulus package. Aside from the successfully launched National Innovation Programme Hydrogen and Fuel Cell Technology (NIP), developments in the area of energy storage technology, battery electric power drives as well as the setting up of a power charging infrastructure will be pursued with the National Electromobility Development Plan.

Battery and fuel cell technology are complementary technologies, both of which must be further advanced in equal measure.

Organisation and coordination

Each of the eight model regions is supervised from a central project headquarters, forming the interface between the projects of a model region and the NOW GmbH National Organisation Hydrogen and Fuel Cell Technology.

The project headquarters' main tasks are to secure binding standards and monitor implementation of objectives. NOW is responsible for the monitoring of the content, coordination and implementation of the entire support programme.

The project administrator Jülich (PtJ) is responsible for the handling of subsidies as well as administrative support. Depending on the project's orientation towards application, the model region project partners will be supported by up to 100%. The remaining financing for the project is raised through the participating project partners' own contributions.

Due to its location and size, Bremen-Oldenburg offers ideal conditions for a model region for the implementation of electromobility. Its catchment area encompasses maximum distances of around 150 to 200km. The cities of Bremen/Bremerhaven and Oldenburg comprise its centre, in what is a rather rural region with a multitude of mobility requirements.

The main focus is on traffic between the larger cities. Furthermore, the high volume of commuters from the surrounding communities heading into the cities is a factor.

The aim of the model region is to bring vehicles on the road and develop holistic and sustainable transportation concepts as well as providing solutions for the car of the future. Further goals are the reduction of fossil fuel usage in the transport sector and the promotion of regenerative energy.

FOCUS:

The model region focuses its attention on the intelligent step-by-step integration of electric vehicles in new and existing types of mobility services to enable efficient, environmentally friendly inner-city and commuter transport.

Furthermore, the connection of the extended city centre – in particular to local public transport and to Bremen Airport and main-line railway stations – is to be taken into account. Individual mobility is hereby given a high level of importance.

The introduction of electromobility allows all commuters to be involved and offers them the use of public transport or an electric vehicle as well as easily accessible charging facilities, as required. Laying the foundation for this is the funding programme.

The model region is also distinguished by the close involvement of local research facilities in the area of electromobility.

ACTIVITIES IN THE MODEL REGION:

Applications were made for a total of four project modules with a combined volume of around €9.5 million. 90 electric cars in diverse performance categories are planned for the vehicle fleet. Moreover, 30 electric two-wheelers and 5 light commercial vehicles will become operational during the course of the project.

The range of applications encompasses personal usage as well as integration of vehicles in the existing public transport network and car-sharing fleets or commercial transport fleets. Currently available electric vehicles will be used for this purpose along with new vehicle concepts arising from ongoing development projects.

The business model will also take into account the build-up of the charging infrastructure. Electric charging stations will be installed in public locations as well as on company grounds and in private households.

The region's local research institutes and higher education facilities will accompany the project from a scientific perspective and evaluate results. These will be coordinated and pooled by the Personal Mobility Center (PMC), which was founded for this purpose.



MODEL REGION: BREMEN/OLDENBURG

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Personal Mobility Center
Bremen-Oldenburg

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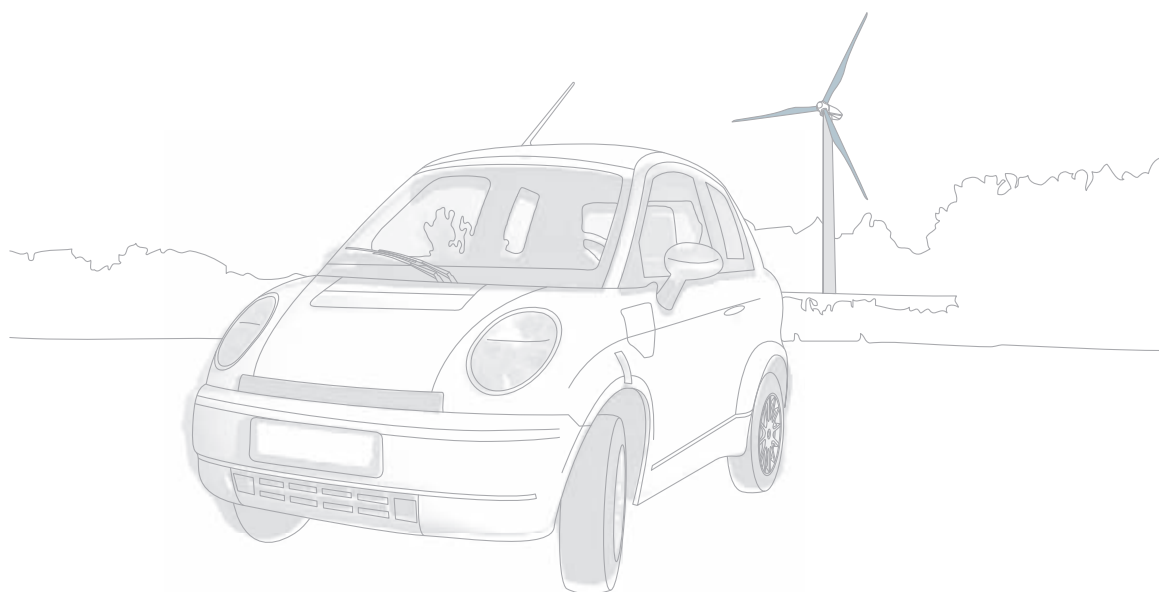
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02 ELECTROMOBILITY MODEL REGION: RHINE-MAIN

The Rhine-Main region counts as one of Germany's economically strongest metropolitan areas. Domestically and internationally, it is also a significant hub for road, rail and air transport.

Its central location in Germany and its diversity make the region an ideal site for new technological developments, including electromobility. Besides its large metropolitan area, this strong growth area is also home to expansive rural regions. The model region thereby fulfils the whole spectrum of mobility demands. This diversity is also noticeable in the involved partners.

Besides a number of local authorities and regional energy supply firms, small and medium-sized companies as well as large corporations are involved in the projects. In addition, regional research institutes and higher education facilities provide scientific support.

FOCUS:



MODEL REGION: RHINE-MAIN

A main focal point of the model region is the implementation of a modular concept that demonstrates the deployability of electromobility solutions in the German state of Hesse. Electric vehicles (cars, pedelecs, buses, commercial vehicles) for varying uses will be included in existing mobility chains.

This integrated mobility concept incorporates both private and public transport as well as inner-city freight and other special traffic. An essential element is the development of a suitable recharging infrastructure.

ACTIVITIES IN THE MODEL REGION:

The model region plans to undertake projects in the amount of €7 million. The projects cover a wide spectrum of electromobile application fields. The development of an innovative infrastructure, the integration of electromobility in established structures, the incorporation of electromobility in public transport as well as in local government waste management enterprises and in inner-city delivery transport, constitute a large part of the project.

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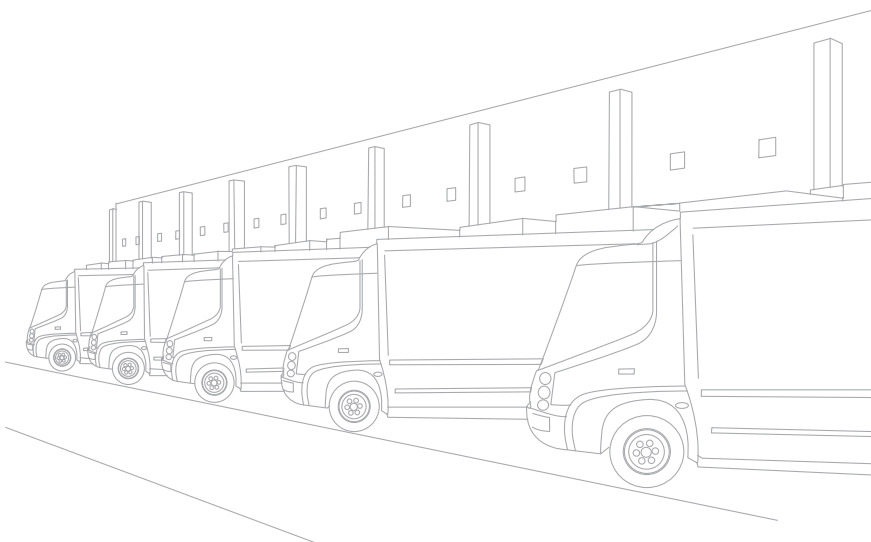
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Of the eight electromobility model regions, Rhine-Ruhr, with its population of over ten million is Germany's most populous and densely populated region. Due to the region's existing economic structures, know-how and competencies for the introduction of electromobility are on hand.

Economic life is characterised by many small and medium-sized firms from all sectors and by the automotive and energy sectors. The region is home to many renowned universities and research institutions. The value-added chain of electromobility can therefore be seen as a significant business opportunity for the region. To take appropriate advantage of this, the German state of North Rhine-Westphalia has supplemented federal funding with its own state funds. Both funding programmes are connected with respect to content.

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FOCUS:

The projects of the Rhine-Ruhr model region cover four main areas. On the one hand, this deals with the implementation of electric vehicles for various applications.

Electric cars and two-wheelers are used privately and also by public authorities. Experience is being gathered in city traffic through the use of hybrid garbage trucks and buses by local authorities and transportation companies.

An additional focus is the development of a charging infrastructure. User-friendly charging stations are to be installed at numerous locations. A third main focus sees the development of new business models that will be examined and assessed throughout the programme.

Scientific monitoring of the projects, with an emphasis on user behaviour and vehicle acceptance, as well as the initial and further training of required skilled workers comprise the fourth main area of focus.

ACTIVITIES IN THE MODEL REGION:**MODEL REGION: RHINE-RUHR**

So far, a total of eight projects with a combined value of around €20 million have been applied for. A total of about 400 vehicles will be operated in cities such as Cologne, Düsseldorf, Wuppertal, Dortmund, Essen, Mülheim and Aachen, within the framework of these projects. Among this number are 23 commercial vehicles for inner-city delivery use, along with 25 hybrid buses that are earmarked for use in public transport services. In addition, 150 electric scooters and bicycles plus various special vehicles will be demonstrated in the participating cities and communities.

The infrastructure required to support this is being built up under the leadership of the involved energy suppliers. And rounding out the programme is the development of targeted training courses for operators and users.

The electromobility model region of Saxony boasts a 100-year tradition in automobile manufacturing and thereby represents an excellent location for the development of an electromobility vehicle manufacturing and supply industry.

The region is already a significant production site for lithium-ion batteries and several industry-related research institutes reside here too. Moreover, existing industrial and scientific know-how and competencies relevant to both the automotive and electro industries today already offer a capable infrastructure and a strong business environment for the implementation of electromobility.

On a political level, the environmental and economic strategy of Saxony is integrated. This targets a considerable reduction in CO₂ emissions over the coming years, paired with the development of regenerative energies.

FOCUS:

At the centre of activities in the model region of Saxony is the integration and demonstration of low emission, hybrid buses in regularly scheduled public transport services. Besides the buses, additional electric vehicles (cars, light commercial vehicles and two-wheelers) will be procured and deployed within the framework of fleet tests under everyday conditions.

Integration of the charging stations into the existing electricity grid will be monitored on both a technical and scientific basis. The model region also has as a goal, to establish the entire value-added chain for lithium-ion batteries within the state, attracting the relevant firms to Saxony. The main centres for the execution of the projects are Leipzig and Dresden.

ACTIVITIES IN THE MODEL REGION:

The public transport authorities of Leipzig and Dresden have developed a joint concept for fast-charging hybrid buses to be procured and tested throughout the project. Ten buses will operate in each city, thereby sustainably reducing inner-city fuel consumption and CO₂ emissions. In the area of private transport, both cities will also have a fleet of 40 electric vehicles comprising cars, light commercial vehicles and scooters, which will be operated by various users. Another part of the project concerns the establishment of the necessary charging service stations.

The development of industrial production processes and technologies for energy storage systems with a key focus on mobility forms the third regional funding project.



MODEL REGION: SAXONY

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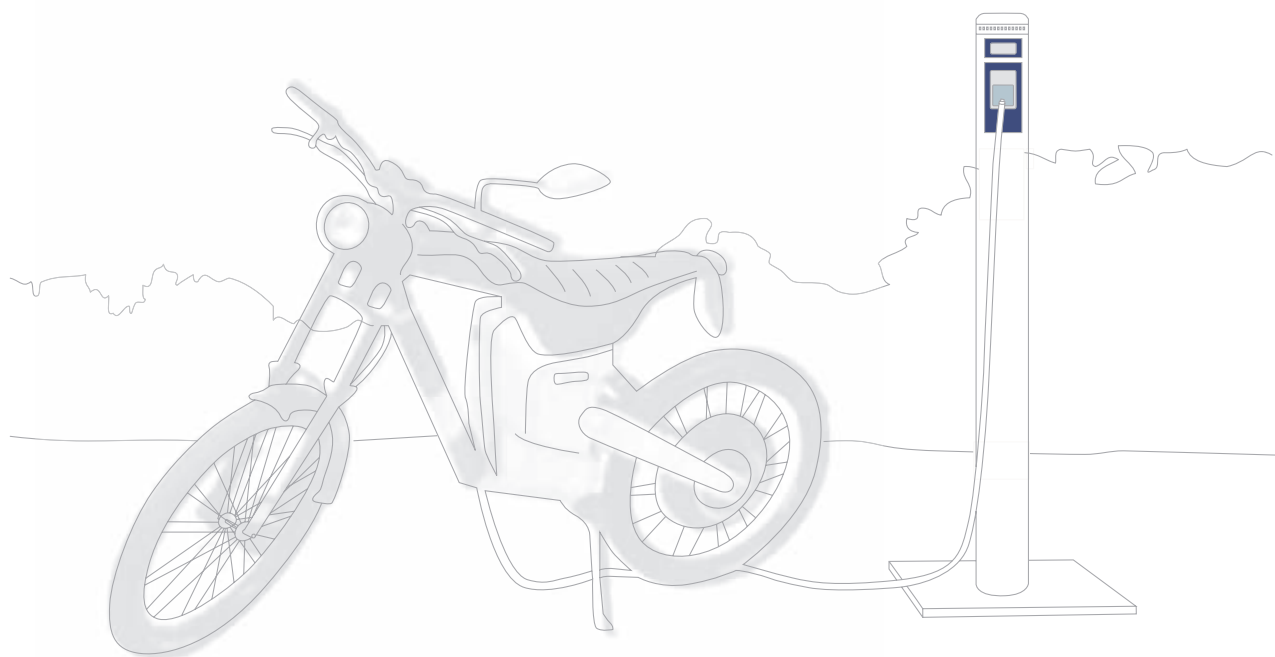
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With Berlin as the capital of Germany and the adjacent Potsdam in the southwest, this model region enjoys exceptional possibilities to highlight the potential of electromobility. The activities will serve to clarify what level of acceptance or what obstacles are to be expected during the introduction of electromobility as well as what regulatory framework is required and how the infrastructure can be integrated in the urban plan. The introduction of electromobility also helps to establish the demands that will be placed on the supply of energy in terms of electricity production and delivery.

The testing of new mobility services and business models are just as much an issue for project participants as is the strengthening of the region of Berlin/Brandenburg as a hub for business and science.

FOCUS:

The model region of Berlin/Potsdam focuses on several fields of activities within the funding programme. The emphasis is put on the integration of various types of electric vehicles within the traditional range of options for local public transport, tourism, mobility and domestic services as well as inner-city delivery transport.

The establishment of charging stations, along with corresponding accounting and billing modalities is an integral component of the demonstration project. Scientific monitoring will accompany all projects. The results will be evaluated according to political and economic viewpoints and will give insights about a future, broad introduction of electromobility within the region.

ACTIVITIES IN THE MODEL REGION:

Projects totalling around €5 million have so far been applied for in the model region within the federal government's second economic stimulus package. The coming months will see the first electric cars and bicycles as well as electric transport vehicles deployed in city traffic.

Besides contemporary car-sharing models for Berlin residents, tourists are also to profit from new mobility possibilities in Berlin and Potsdam. Public transport season ticket holders will be able to use the provided electric vehicles at reduced rates.

In large housing estates of selected town districts, innovative mobility concepts are being implemented and user acceptance monitored. Not least is the aim to sustainably relieve traffic in the busy inner city by introducing environmentally friendly supply vehicles and new types of logistical concepts.



MODEL REGION: BERLIN/POTSDAM

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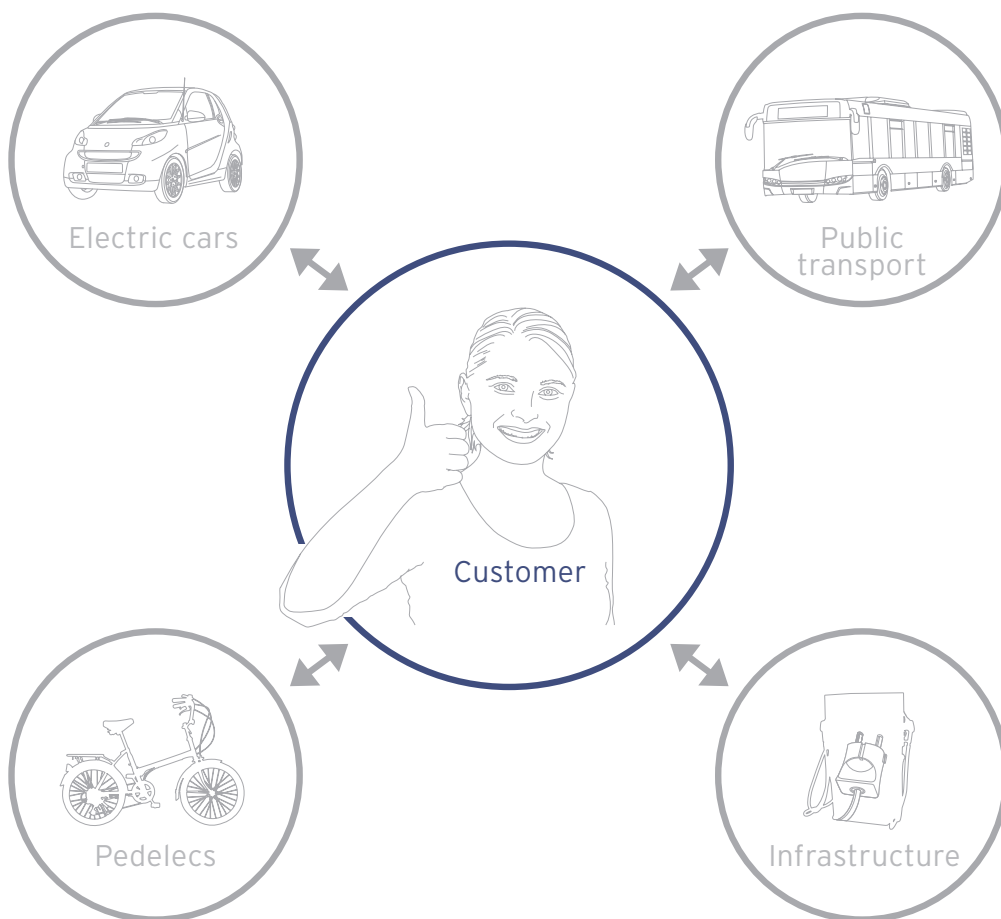
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Large cities are increasingly being assessed in terms of how successfully aspects such as quality of life, economic development, technological innovation, sustainability and environmental friendliness are put into practice. Hamburg has been setting international standards in this respect for many years.

The Hamburg Senate's highly regarded climate protection concept already encompasses some 360 projects and aims to reduce the annual total amount of CO₂ emissions by two million tonnes by 2012, as well as a decrease of 40% by 2020. Ambitious standards and important change processes have also been initiated in many other fields of activities in urban development and economic policy.

It is against this backdrop that the European Commission has named Hamburg the »European Green Capital 2011«. As such, the introduction of electromobility obtains a further degree of location-specific significance.

The climate-friendly orientation of inner city mobility has an exceptionally high priority in the city of Hamburg, which is characterised by industry, trade and services.

FOCUS:

The model region of Hamburg is determined to fundamentally contribute to the ongoing change to low emission vehicles and send out a clear signal for the greater use of regenerative energy sources in the transport sector. Electromobility is an important component in reaching this goal. Both public transportation and private motorised transport is integrated in this concept.

The operation of the charging infrastructure will be equally split between state-run and private providers. Power produced through regenerative sources will be used exclusively. Charging stations will feature a cityscape-compatible design. Furthermore, handling regulatory issues is an integral component of the Hamburg approach.

The concept in Hamburg extends far beyond a demonstration of electrically powered vehicles. It is also a long-term regional development plan for electromobility.

ACTIVITIES IN THE MODEL REGION:

To implement activities, Hamburg has so far applied for funding of around €8 million.

Ten diesel-hybrid buses will be deployed for scheduled inner-city public transport. Fuel cell-powered hydrogen buses can already be seen on the streets of Hamburg. At least another 50 vehicles will be made available for fleet operators and private use.

Simultaneously, vehicles for commercial use will be deployed. These will be allocated to fleet owners or car-sharing organisations on the basis of agreed user/usage profiles.

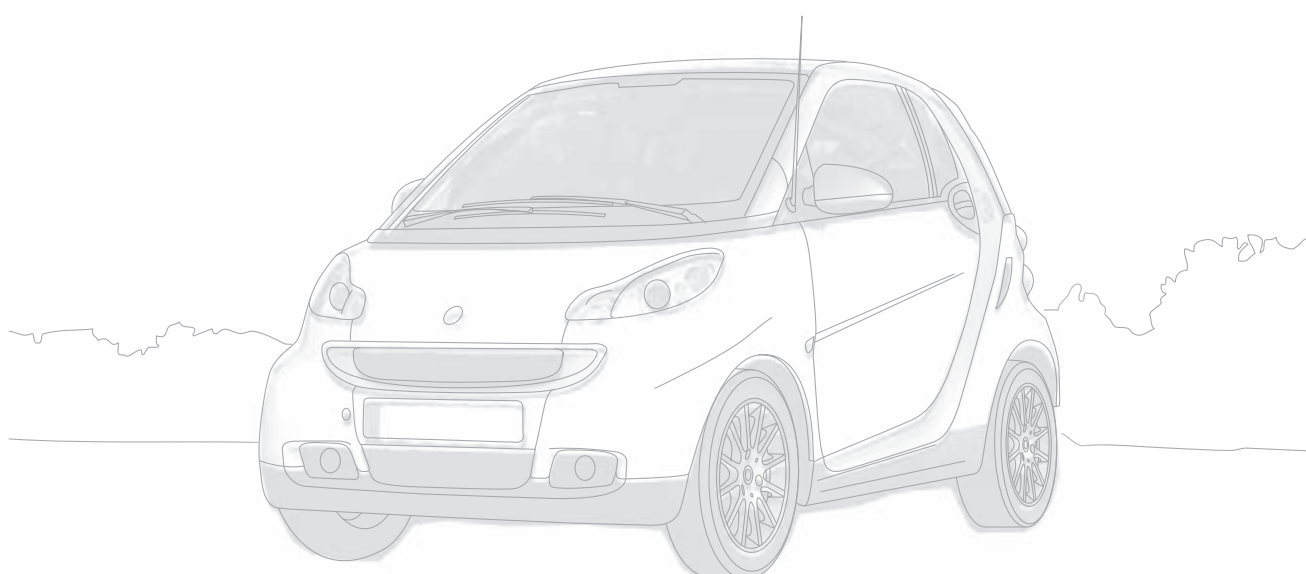
The successive construction of the necessary charging infrastructure will extend to up to 100 charging points in public places in addition to further points that are publically accessible or on private grounds.



MODEL REGION: HAMBURG

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The region of Stuttgart is regarded as the birthplace of the automobile and is today Europe's most important automobile region.

The automotive industry is the economic driving force and with around 180,000 jobs one of the most important employers in the region. Current energy supply and climate protection policies demand comprehensive changes in the transport sector and consequently also in the automotive industry.

Against this backdrop, the region of Stuttgart is without doubt an ideal model for an electromobility funding programme. The key players of the model region – including automobile manufacturers and their suppliers, local transport authorities, the local communities themselves, trade associations, as well as research institutes and higher education facilities – will work together to accelerate the introduction of electrically powered vehicles and the associated development of a charging infrastructure.

FOCUS:

The model region aims to make electromobility visible to the public, test various pathways to blanket electromobility coverage, and promote the market introduction of electric vehicles.

As such, one of four focal areas is the demonstration of various electric vehicles (buses, light commercial vehicles, cars and two-wheelers) for diverse mobility concepts. A charging infrastructure integrated in public spaces will be simultaneously established.

The results of all projects will be collated in an electromobility centre of competence and are part of a roadmap extending beyond the life of the project. The model region Stuttgart also aims to establish an electromobility round table where project partners can discuss joint intermodal mobility concepts and implement them as part of the regional and town plan.

ACTIVITIES IN THE MODEL REGION:

Well over 1,000 electric vehicles will be deployed for the daily use of varying groups of users. In a first step, five diesel hybrid buses will be deployed for use in local public transport. 700 specially developed electric scooters and 450 electric bicycles will also go into operation.

The early gathering of information concerning user behaviour and changes to mobility patterns is planned – particularly regarding the experience with bicycles. Various firms will test 50 electric vans for delivery traffic in the model region. Finally, 25 battery electric cars supplement the complete fleet of vehicles.

In a second step, further innovative mobility concepts will be realised in several cities within the Stuttgart region.



MODEL REGION: REGION STUTTART

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Cluster Automotive Region
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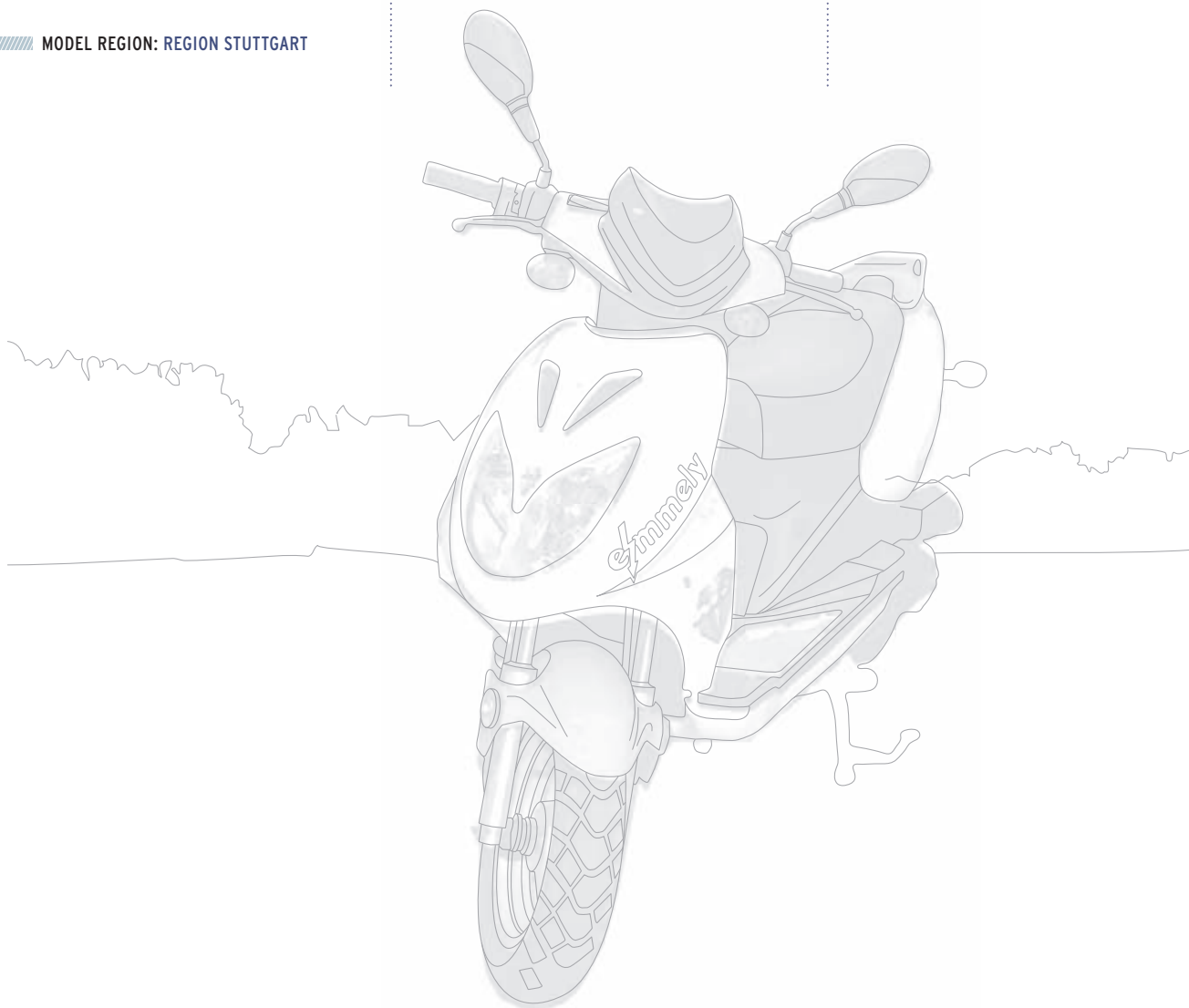
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As the Bavarian capital and one of southeast Germany's economic hubs, Munich is striving to assume a pioneering role in the important issues of the future: climate protection and sustainable mobility. The city has therefore set as one of its goals the reduction of CO₂ emissions by 50% per head based on the period from 1990 to 2030.

The deployment of electric vehicles in the transport sector can make an important contribution to achieving this goal. The competitiveness of the resident automotive industry is thereby simultaneously enhanced.

Electromobility developments and associated needs for action were incorporated into the traffic development and public transport plans at an early stage by the model region. In addition, the topic of electromobility is also being closely followed within the framework of the European Metropolitan Region Munich (Europäische Metropolregion München).

FOCUS:

Three fields of action have been earmarked by the Munich model region that will form the centre of activities. Besides the development of an overall municipal electromobility concept with accompanying scientific studies, the implementation of commercial and delivery vehicles fleets for business use also stands at the forefront.

The deployment of hybrid buses in local public transport and use of electric vehicles for private and fleet use comprise further priorities.

Development of a charging infrastructure to meet anticipated demands for sustainable energy supply is an essential component of the overall concept. The additional power required as a result of electromobility is to be completely covered through sources of regenerative energy.

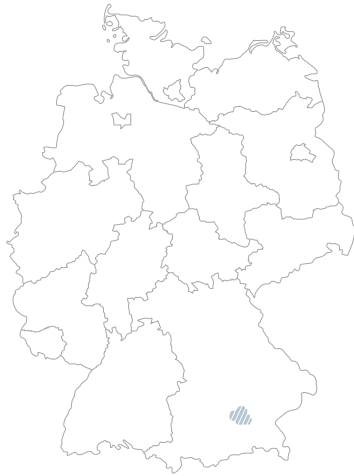
ACTIVITIES IN THE MODEL REGION:

So far, four projects have been submitted. Integrating local public transport into the concept of sustainable electromobility, the development and practical trials of hybrid buses are being supported.

Hereby various hybrid concepts are being compared to one another and evaluated. For the applications in commercial and delivery vehicles, a fleet of specially developed electric vans is being built.

A demand-oriented network of approximately 100 electric charging stations is being established over the course of the project. The involved research facilities will compile a holistic and sustainable electromobility concept that also incorporates energy supply aspect.

The analyses planned for this consider all currently relevant electric vehicles and their applications as well as the applicable legal framework. Further projects of the Munich model region involve the continued development of the charging infrastructure (fast recharging tests, development of next-generation charge points taking location and cost-optimisation aspects into account, etc.) and the deployment of electric cars for diverse user situations.



MODEL REGION: MUNICH

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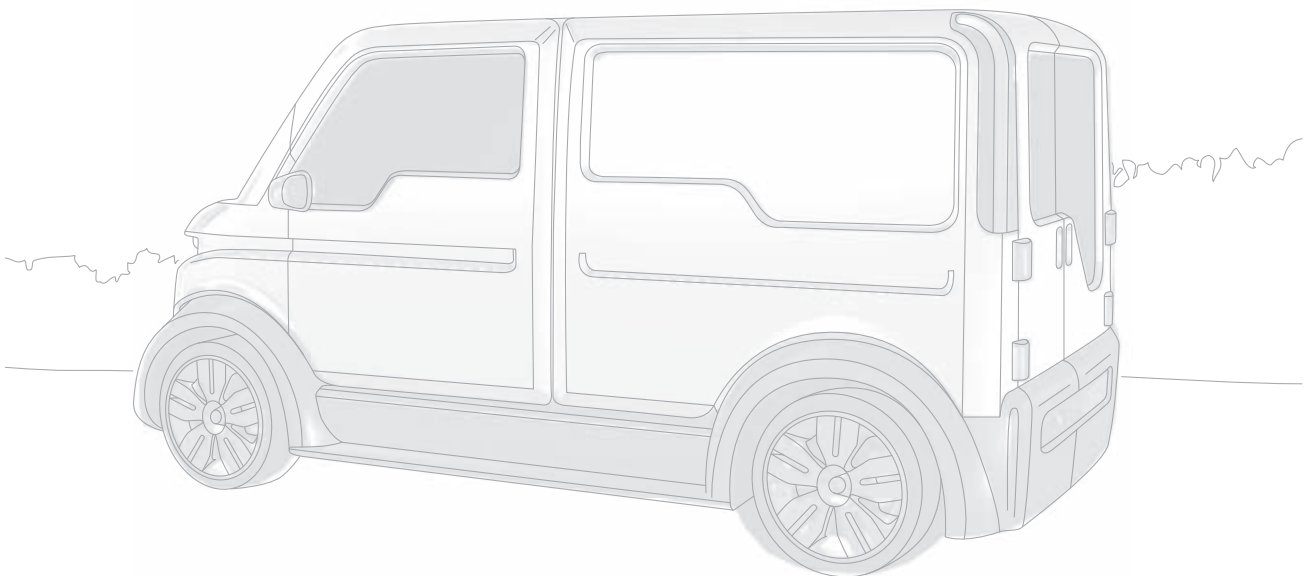
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EVENTS



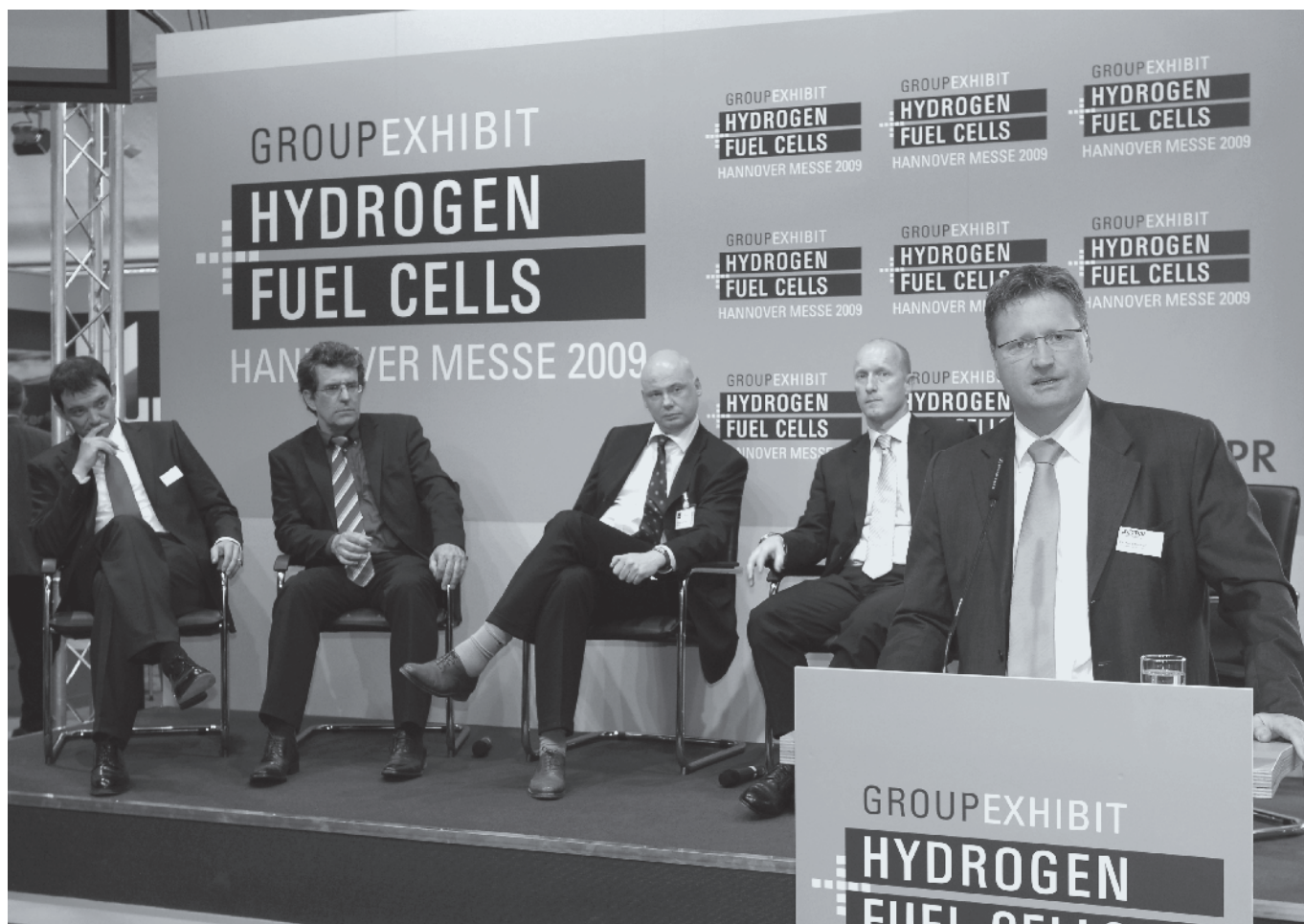
- » Topping out ceremony of hydrogen fuelling station in Holzmarktstrasse, Berlin » 104/105
- » Hanover Fair » 106/107
- » Meeting of Electromobility Model Regions » 108/109
- » Technology journalist forum » 110
- » Federal symposium of the CDU Economic Council » 111
- » Innovation dialogue »Urban Transport 2020« » 111
- » e4ships launch event » 112/113
- » H₂ Mobility » 114/115
- » Operation launch of MTU Onsite Energy fuel cell » 116/117





» Topping out ceremony of a hydrogen fuelling station in Holzmarktstrasse, Berlin, August 2009, with former Federal Transport Minister Wolfgang Tiefensee

» (right) Following the opening topping out address, the foreman symbolically hands over the key of the fuelling station to the Federal Minister of Transport.



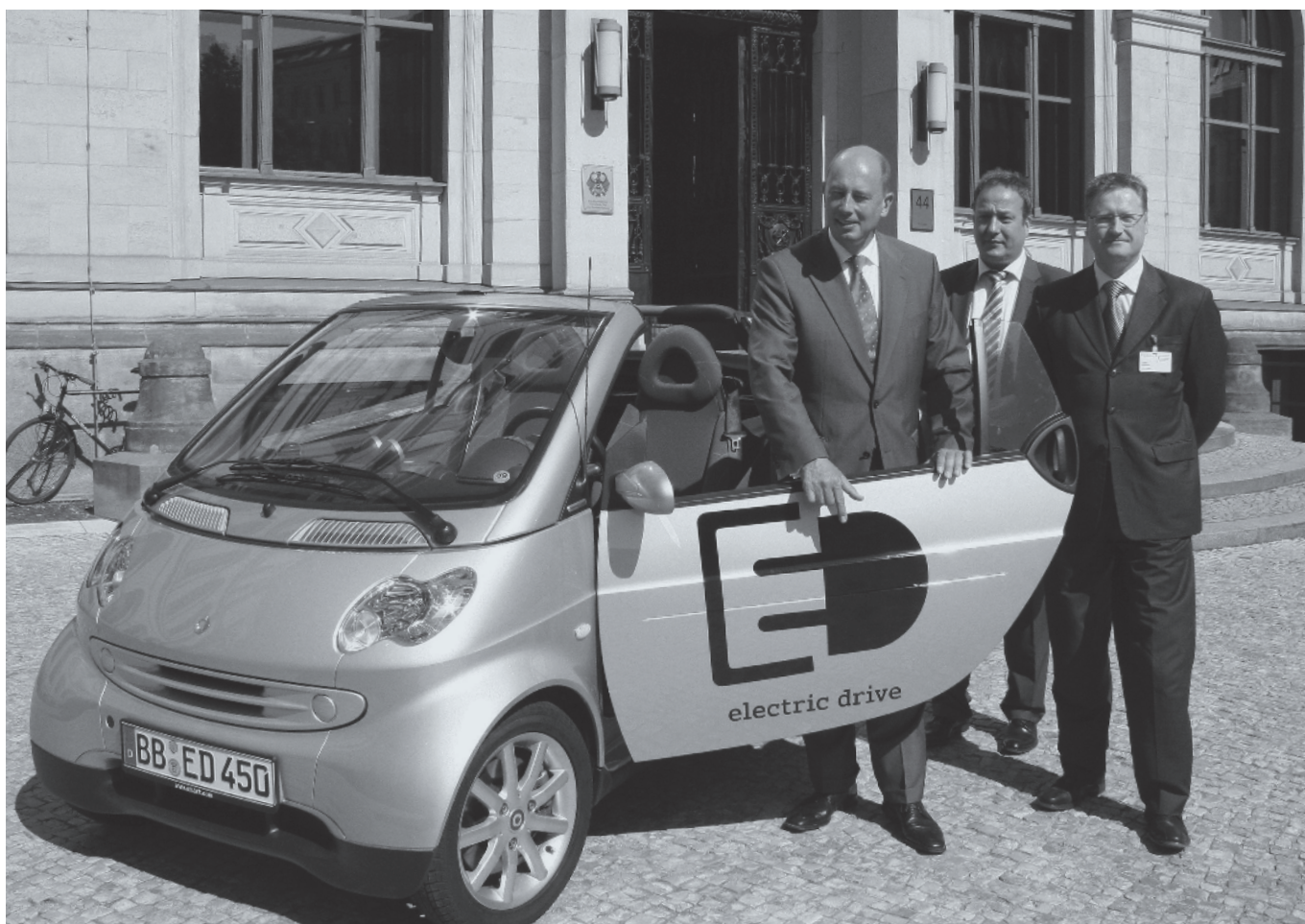
» Impressions of the Hanover Fair, April 2009

» Dr. Klaus Bonhoff, Managing Director (Chair), at the press conference of the group exhibit hydrogen and fuel cells.



» (above left) Axel Gedaschko (Senator for Economic and Labour Affairs, Hamburg), (above right) Wolfgang Tiefensee (former Federal Minister of Transport, Building and Urban Development) and (below) Jens Baganz (State Secretary for Economic Affairs and Energy of the State of North Rhine-Westphalia) inform themselves about the newest developments in hydrogen and fuel cell technology.





» First working meeting of the Electromobility Model Regions, August 2009

» (left) Former Federal Minister of Transport Wolfgang Tiefensee

» (right, l-r) Former Federal Transport Minister Wolfgang Tiefensee, Michael Adam, Daimler, and Dr. Klaus Bonhoff, Managing Director (Chair), NOW.



» Technology Journalism Forum, November 2009

» Together with Freudenberg, IFOK and the Frankfurter Allgemeine Zeitung, NOW invited correspondents from specialist and key media as well as young journalists to the Hydrogen and Fuel Cell workshop in Weinheim.



» Federal symposium of the CDU Economic Council, November 2009

»(top row above): NOW and CEP participated in the event with an information stand and ride and drive facility.

» Innovation dialogue »Urban Transport 2020«, November 2009

»(bottom row above): Podium discussion with representatives from politics, science and industry.



» e4ships launch event, July 2009

» (left) Launch event – the NIP Lighthouse e4ships was launched in a festive atmosphere on board the Aida Luna.

» (right) Kai Klinder, CFO, Programme Manager Stationary Fuel Cells.





» H₂ Mobility – September 2009

- » Coordinated by NOW, industry leaders sign a memorandum of understanding for the creation of a hydrogen infrastructure in Germany.
- » (top row above, l-r) Dr. Peter Blauwhoff, CEO Deutsche Shell Holding GmbH, Michel Mallet, former CEO of Total Deutschland GmbH, Udo Bekker, Member of the Board, Vattenfall Europe AG, Prof. Dr. W. Reitzle, Chairman of the Executive Board, Linde AG, Dr. Dieter Zetsche, Chairman of Daimler AG and head of Mercedes Benz cars, Wolfgang Tiefensee, former Federal Minister of Transport, Building and Urban Development, Hans-Peter Villis, CEO EnBW Energie Baden-Württemberg AG, Dr. Dieter Tuppinger, Managing Director OMV Deutschland GmbH, Dr. Klaus Bonhoff, Managing Director (Chair) NOW GmbH National Organisation Fuel Cell and Hydrogen Technology.





» Operation launch of MTU Onsite Energy fuel cell, June 2009

» Together with Erdinger brewery chief Werner Brombach, former Federal Minister for Economics and Technology Karl-Theodor zu Guttenberg launches the first fuel cell operation used in a brewery.

Photo credits

- p. 104/105: Clean Energy Partnership (CEP)
- p. 106/107: Tobias Rentz FAIR PR
- p. 108/109: NOW GmbH
- p. 110: Freudenberg FCCT KG
- p. 111: (top row) Clean Energy Partnership (CEP)
- p. 111: (bottom row) NOW GmbH
- p. 112/113: e4ships
- p. 114/115: H₂ Mobility
- p. 116/117: MTU Onsite Energy

Notes

CEP partners

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Callux partners

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e4ships partners

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|  |  |  |  | ThyssenKrupp Marine Systems  |  |  |

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