Federal Ministry
for Economic Affairs
and Energy

ICT FOR ELECTRIC MOBILITY

ICT for Electric Mobility II

Smart Car – Smart Grid – Smart Traffic

Imprint

Publisher
Federal Ministry for Economic Affairs and Energy (BMWi)
Public Relations
D - 11019 Berlin
www.bmwi.de

Text and edited by
Deutsches Dialog Institut GmbH, Frankfurt am Main
Loesch*Hund*Liepold Kommunikation GmbH, Berlin
VDE Verband der Elektrotechnik Elektronik
Informationstechnik e. V., Frankfurt am Main

Design and production
Loesch*Hund*Liepold Kommunikation GmbH, Berlin

Status
April 2014

Printed by
Silber Druck oHG, Niesetal

Photos courtesy of
Cover page: ICT für Electric Mobility II
P. 5: BMWi, P. 6: acatech/D. Ausserhofer, P. 7: Petair - Fotolia,
P. 8: Jurgen Ziewe - Shutterstock, P. 10: Deutsches Dialog Institut,
P. 12: RWE Effizienz GmbH, P. 22: Siemens AG (RACE), P. 23: SecMobil,
P. 24: 1996-2011 Deere & Company, P. 28: B. Wylezich - Fotolia,
P. 14, 15, 16, 17, 18, 19, 20, 21, 25, 26, 27: BMWi/Hornischer GbR

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Federal Ministry for Economic Affairs and Energy
Public Relations
E-Mail: publikationen@bundesregierung.de
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Central Ordering Service:
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Contents

Foreword

Information and communication technologies (ICT) are a decisive driving force behind tomorrow's mobility. This is particularly evident when it comes to electric mobility as this calls for a high degree of networking between electrically driven vehicles and the environment surrounding them. Electric vehicles, for instance, need a direct interface with the power grid in order to "fill up". Advanced ICT ensure direct communication between the vehicle and the grid and control the charging process so that safe grid operation is ensured. In the future, electric vehicles will also be closely integrated into the traffic scene. Modern ICT can help to optimise the range of today's electric vehicles and to improve the flow of traffic. Moreover, modern electrics and electronics in the vehicle itself are the most important innovation drivers. They will ensure that electric cars will become lighter, more efficient and more powerful.

The foundation for effective interaction between vehicle systems, energy and traffic infrastructure is being laid in the "ICT for Electric Mobility II: Smart Car – Smart Grid – Smart Traffic" programme which is backed by the Federal Ministry for Economic Affairs and Energy. More than 100 companies and research institutions are working on suitable solutions here in a total of 18 consortiums.

This brochure provides an overview of the current projects supported. These focus on electric mobility applications that have not been tried and tested up to now, for instance, in transport, in closed logistics systems, in agriculture, in taxi operations, or when it comes to the use of vehicle fleets by several companies.

I hope you find this brochure to be a thoroughly good read.

Yours

The Future is Bright for Electric Mobility

by Prof. Dr. Henning Kagermann

The future is bright for electric mobility. It has huge economic and ecological potential for Germany.

I believe that the break-through for electric mobility depends heavily on cooperation between various sectors of the economy which have traditionally had very little to do with each other.

The technology programme presented in this brochure, ICT for Electric Mobility II, is helping this young cooperation to gain momentum. The cross-cutting character of ICT as "enabling technologies" and the broad range of applications and stakeholders ensure that the technology programme covers almost all aspects of electric mobility while bringing together the relevant sectors.

ICT ensure that vehicles do not just stop at being complex mechanical and electrical machines, but that they become smart with the ability to communicate. This also applies to electricity grids and traffic infrastructures. Based on this, ICT transform smart vehicles, electricity distribution grids and traffic infrastructures into more than just the sum of their individual possibilities. They create added value while acting as a driving force. Besides enabling technological innovation, ICT form the technological foundation for innovation in services in conjunction with electric mobility. By cleverly networking the areas of vehicle, power and traffic, ICT are paving the way for tomorrow's mobility.

The National Platform for Electric Mobility (NPE) is also increasingly addressing ICT topics. This applies to all of its working groups – powertrain and battery technology, charging infrastructure and grid integration, standardisation, materials and recycling, education and qualification as well as regulatory frameworks.

Another, more far-reaching NPE working group is examining the challenges facing electric mobility from a systemic perspective. It is here and in many other areas that the ICT for Electric Mobility II technology programme can serve as a valuable partner. I am looking forward to seeing beneficial input in both directions.

Although each of the projects presented in this brochure is already exciting in its own right, it is the synergies between these projects and all other electric mobility activities in Germany – not least the NPE – which make the ICT for Electric Mobility II technology programme so important for Germany as a centre of innovation.

ICT for Electric Mobility II

Information and communication technologies (ICT) are central to the future competitiveness of business and industry in Germany. In the ICT for Electric Mobility II technology programme, the Federal Ministry for Economic Affairs and Energy is in total supporting 18 projects which are developing new ideas and technologies for interaction between smart vehicle systems in the electric car (Smart Car), smart power supply (Smart Grid) and smart mobility concepts (Smart Traffic) based on state-of-the-art information and communication technology. Around €80m have been earmarked for this purpose while the overall budget totals about €170m. During the term of the programme, other projects may also be supported.

When it comes to the Smart Car, ICT are enabling, for instance, advanced control and communication systems (so-called bus) in electric vehicles which can also be used to control the powertrain, brakes and steering, as well as infotainment functions. The electric vehicle can also communicate with the charging infrastructure and traffic management systems. When it comes to the Smart Grid, new charging concepts and the grid-compatible integration of electric vehicles are being explored. In the case of Smart Traffic, the focus is on intermodal mobility concepts, fleet management solutions and individual traffic management for drivers. In the ICT for Electric Mobility II programme, information and communication technologies are also the key to new and comprehensive system approaches in electric mobility.

The scientific support provided under the ICT for Electric Mobility II programme helps the projects to identify and overcome innovation barriers, during cross-cutting collaboration with other partners and during the transfer of findings. The specialist groups: “application scenarios and innovation environment”, “regulation” and “interoperability and standardisation” have been set up to promote exchange on cross-cutting topics between the projects. Through offers such as the “Electric Mobility in Dialogue” cross-sector online platform and events with electric mobility experts and decision-makers, activities in Germany are being bundled at the interface between Smart Car, Smart Grid and Smart Traffic. In addition to creating visibility and acceptance for project results, this approach also enables a joint understanding for the measures that aim to strengthen Germany‘s innovative ability in this innovation field.

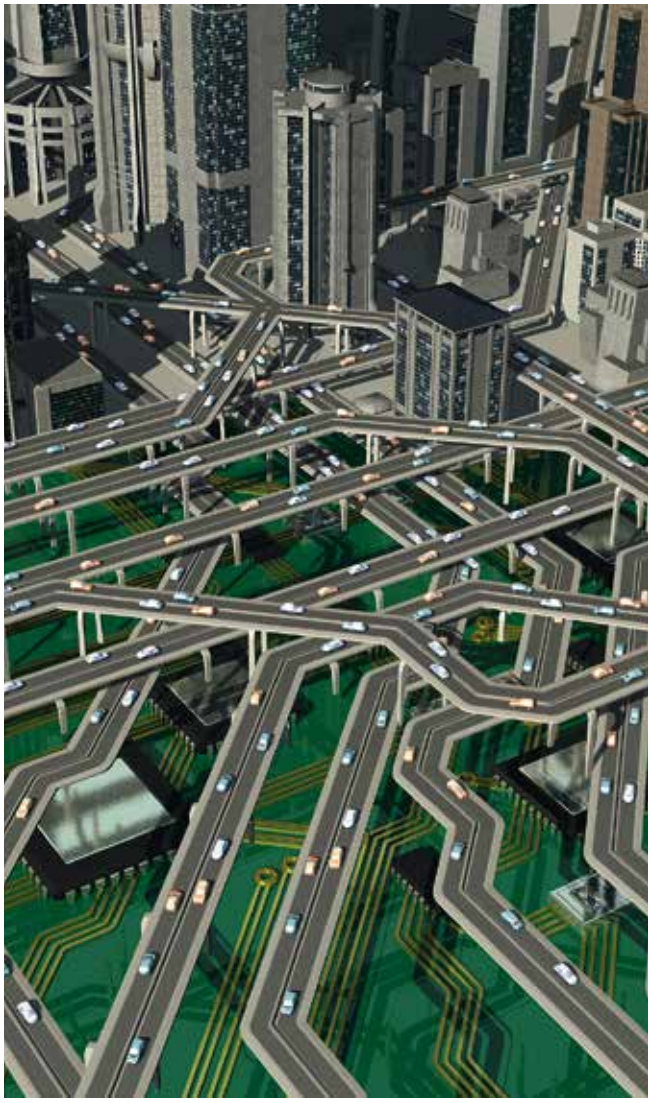
One important aim of the supporting research measures for the ICT for Electric Mobility II programme is to identify key topics, to create synergies and to help overcome innovation barriers. Three topics have been identified which are of paramount importance for all of the projects:

- Intelligent vehicle systems
- Intelligent energy systems
- Intelligent traffic systems

This collaboration is what makes the ICT for Electric Mobility II programme much more than just the sum of its 18 individual projects. It delivers new, future-oriented systemic approaches and solutions and is of paramount importance for the successful innovation work by German companies in this key future market. Together with the “Electric Mobility Showcases”, which were added in 2013, the programme is going a long way towards establishing Germany as the leading market for electric mobility.

Smart Car – Smart Grid – Smart Traffic

Information and Communication Technologies for Future-oriented Solutions



In terms of sales, the automotive industry is Germany‘s most important sector by far. It provides jobs to approx. 750,000 people and is the world‘s third-largest car producer. Resource conservation and climate protection through lower carbon emissions and fine particulate air pollution are societal goals that call for ever-more efficient vehicles and even new vehicle concepts. These are the challenges facing Germany‘s car industry in global competition.

Driven by new climate protection goals, Germany and other countries are breaking new ground, also where the generation of electrical energy is concerned. The conversion from central power stations and other large-scale power plants to distributed power generated from sun and wind means that there is a suitably designed electricity grid in the future. Fluctuations in energy from renewable sources require new concepts for grid control, energy storage and for controlling energy consumers.

Demand for mobility is growing the world over, and this is leading to huge burdens in conurbation areas. Between 2006 and 2010, congestion in West European cities, for instance, doubled. The picture is pretty much the same when it comes to the more than 40 million registered vehicles on German motorways. At the same time, however, there is a decline in society‘s willingness and hence financial possibilities to invest in road construction. State-of-the-art traffic management systems, which control inner-city and outer-city traffic, will enable more efficient use of existing roads.

In each of the sectors named above, information and communication technologies (ICT) have a key role to play. They are the engine that drives the development of system solutions and what makes it possible to tailor products and services to the user. They also enable cross-domain solutions which, for instance, as part of electric mobility, can lead to entirely new mobility concepts. ICT will become a driving factor in the development of future vehicles and the solution to the main challenges that individual traffic will face in the future. Electrically driven vehicles and the infrastructure they require will serve as catalysts and will accelerate this process even more.

Today, ICT in the form of electrics and electronics in cars are already a unique selling proposition for Germany‘s car industry. They are part of active and passive safety and improve efficiency and comfort; examples of this include braking systems, airbags, electronic engine control units

and parking assist systems. In today's vehicles with combustion engines, the share of electric, electronic and IT components ranges between 20 and 35 percent, depending on the vehicle classification. In electric vehicles, this figure will rise to up to 70 percent. When it comes to improving traffic infrastructure, ICT are already making valuable contributions and many haulage companies already use ICT to control their fleets. They form the basis for navigation systems and this marks the first step towards modern traffic management.

With the end of the combustion engine as the drive motor and the implementation of distributed drives (e.g. wheel hub motors), electric mobility is opening the door for completely new vehicle concepts. Together with new ICT architectures in the vehicle, functional innovations, such as "Drive by Wire" and "Brake by Wire", which have already been successfully established in aircraft design, can now be introduced faster. Combined with advanced sensors, future concepts for autonomous driving and additional comfort functions, such as automatic parking, will be particularly easy to implement.

The further expansion of our road network is increasingly meeting with opposition in society and is becoming more difficult to finance out of public coffers. This is where ICT come up with new solutions. Future vehicles will be fitted with standardised interfaces with smart traffic systems. If, for instance, 10 to 12 percent of the vehicle condition of all vehicles on long-distance roads are known in realtime, traffic situations can then be identified precisely to the location and to the time. Information for motorists and intervention in the driving situation could then help to decongest the traffic situation significantly. In inner-city districts, the flow of traffic could be improved by controlling speed and traffic lights based on the given traffic situation. This will also lessen the burden on residents.

This type of decongestion in inner-city and outer-city areas can result in a significant increase in range for electric vehicles. It is also important for these vehicles to have information on the availability and outfit of (semi-)public charging stations and the condition of the route to these stations. This information can be picked up and processed by on-board systems in order to provide the motorist with suggestions for the best-possible routes. There are also new possibilities for smart and controlled charging which take into account the electricity rate, the charging status of the battery and local grid conditions.

This means that ICT systems will help to solve the urgent challenges facing resources, the environment and mobility in the years to come. This is one of the reasons why in its intermediate report in 2011 the National Platform for Electromobility identified the "ICT and Infrastructure" beacon project as a research field that is vital for the success of electric mobility. The ICT for Electric Mobility II support programme by the Federal Ministry for Economic Affairs and Energy (BMWi) is a key pillar in the implementation of this strategy. Its research work is centred around state-of-the-art ICT as the factor crucial for the success of electric mobility.

The cross-cutting implementation of ICT systems in the automotive, energy, electrical and IT sectors is a particularly demanding challenge. These sectors see ICT as important key technologies, but due to their boundaries and particular interests, they are faced with difficulties when it comes to quickly establishing cross-cutting systems. The integration of ICT into innovation processes, i.e. to form the starting basis for innovation, however, also calls for a fundamental change in perspective, away from the current "add-on" view of ICT. There is now a risk that this change in perspective will not be sufficient or that its importance will be underestimated, especially by the established automotive industry in Germany. It will also offer other industries, which are not necessarily located in Germany, an opportunity for lateral entry. Just recently, an US computer manufacturer in the established music and player industry provided an example of this in the case of another application. What there is to do is to highlight the likelihood of such a scenario, even in other established industries, along with the opportunities for the economy and private business as well as the risks of shifting the importance of ICT. The new BMWi funding programme will also have an important role to play here.

The Key Topics Facing the ICT for Electric Mobility II Programme

As part of the funding measure, 18 projects are being promoted in the fields of Smart Car, Smart Grid and Smart Traffic. The many research approaches in these projects have been used to identify global core research areas which have been bundled in eight comprehensive key topics. These key topics are connected and mutually influence each other.

Fig. 1 Topic pyramid

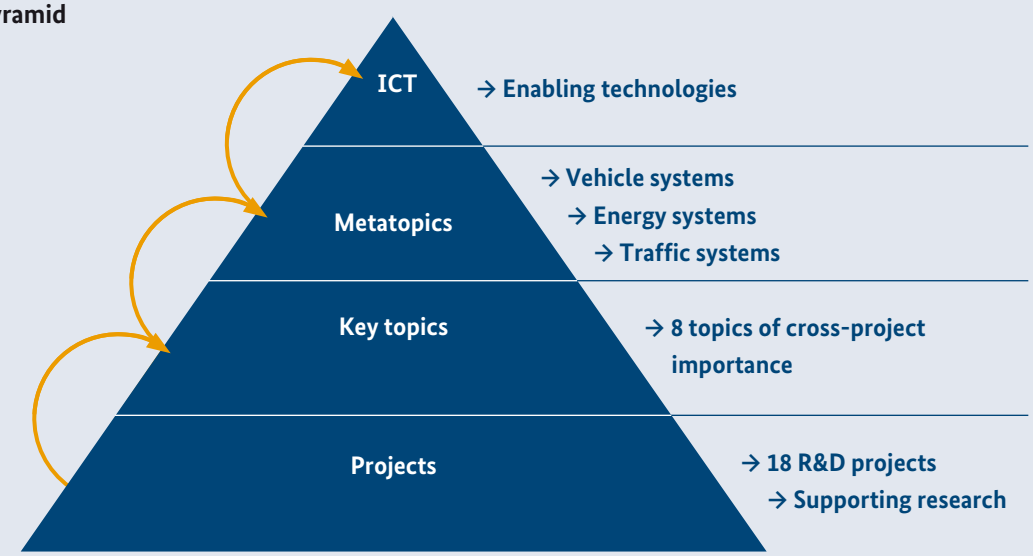
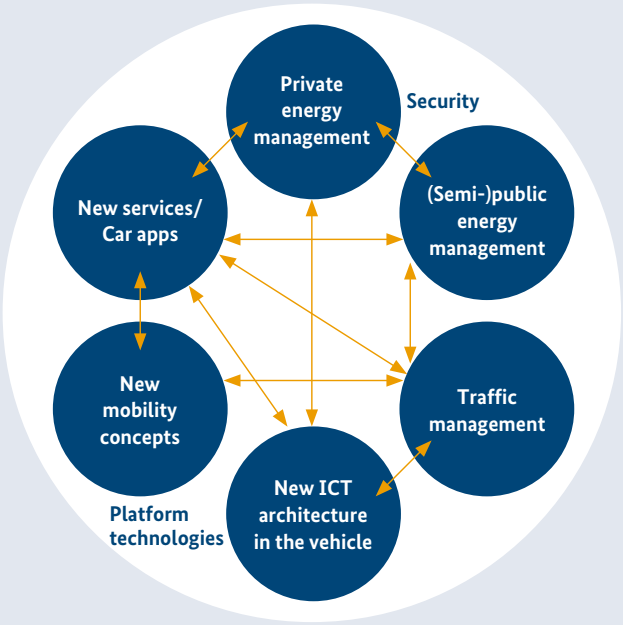


Fig. 2 Key topics and networking



The research into the key topics conducted in the projects is a precondition for progress in the three metatopics "vehicle systems", "energy systems" and "traffic systems" which, for their part, are all rooted in information and communication technologies (ICT) as "enabling technologies". As part of supporting research, these key topics are hence examined in terms of technological challenges and research approaches, and innovation hurdles are identified.

The topics of new services/car apps, private energy management, (semi-)public energy management, traffic management, new ICT architecture in the vehicle as well as new mobility concepts have been identified as key topics.

These topics are in contrast to the cross-cutting topics of security and platform technology. The arrows in Fig. 2 show how the topic areas are networked, private and (semi-)public energy management are directly linked.

→ 1. New services/Car apps

Future electric vehicles will be connected by a fast data connection to a "cloud" or to a "service platform" and this will enable a host of new functions. These functions may include apps that allow motorists to book parking space and charging stations, for instance, or to have special offers displayed based on the motorist's position. Furthermore, it will be possible to perform much more detailed and intensive remote maintenance, diagnosis and software updates for vehicles. An overarching platform is to collect, evaluate and process the data from the vehicles along with route planning. In this way, individual proposals can be provided to motorists in order to optimise travel time (including proposals for using charging stations). In other words, the vehicle can provide a higher-level platform with information about itself (destination, charge status, etc.) and receive important information (changes in route planning, occupancy of charging stations, information on rates). This added value can be made available to motorists through apps. New billing concepts and electric mobility services will pave the way for innovative business models. The key topic of new services/car apps is linked to the other key topics, such as secure authentication of individuals and cars, platform technologies or traffic management
Projects in which research is being conducted into the key topic of new services/car apps: Adaptive City Mobility, econnect Germany, iZEUS, Mobility Broker, open ECOSPhERE, O(SC)²ar, SecMobil, Shared E-Fleet, sMobiliTy

→ 2. Private energy management

Private (or even local) energy management involves the coordination of decentrally generated power in order to charge electric vehicles, for example, at home. The energy generated, for instance, in private households (e.g. photovoltaic systems, CHP systems) is to be used in a smart manner in the house employing suitable control instruments and then made available to the electric vehicle. Topics of research are stationary buffer storage units and fast-charging possibilities as well as reselling energy to the grid in a grid-compatible manner. In private energy management, load control can be coupled with locally generated renewable energy. Energy management offers many benefits not just for private households, but also for small commercial businesses. Farms, for instance, can generate their own energy and use this to power electric mobil machinery and commercial vehicles. In both cases, it is necessary to have a precise forecast of energy generation and energy demand. The issue of coupling smart homes in a grid-compatible manner to the regional power grid is becoming increasingly important.
Projects in which research is being conducted into the key topic of private energy management: econnect Germany, iZEUS, LokSMART Jetzt!, open ECOSPhERE, SESAM, sMobiliTy

→ 3. (Semi-)public energy management

(Semi-)public energy management addresses load management from the perspective of the energy generator/distribution grid rather than from an individual vehicle/household perspective. In this way, renewable energy from supra-regional generation can be optimally balanced to the needs of the local distribution grid. What's needed once again here is a reliable forecast of overall energy supply and the potential demand required. (Semi-)public energy management allows balancing between generation and consumption and hence not only allows grid quality to be maintained, but also contributes to the cost-optimised expansion of the grid. However, this must also be ensured in the case of fast charging. To that end, issues related to grid-controlled and market-controlled charging must be addressed as well as incentive-based and time-based approaches for smart load and charging management. Who specifies the framework conditions and how can and will users respond to this? Home charging and charging at work scenarios will dominate, especially at the beginning, and therefore the possibilities for home charging for all vehicles connected to a distribution grid must be examined and new control strategies developed. Vehicles can only assist the energy supplier when they are connected to the grid, however, there are not nearly enough charging stations, especially in public areas. It will be necessary to implement an ideally allocated public charging infrastructure, i.e. adapted to the number of vehicles, as well as optimised control of charging processes (analysis of optimum locations for charging stations and utilisation forecasts, refer to 5.). Consideration will have to be given to issues of failsafe supply, protection against attacks (ICT) and simple billing concepts (for external charging stations). Energy management will not only cover private traffic but urban commercial traffic will also be included in the future.
Projects in which research is is being conducted into the key topic of (semi-)public energy management: BESIC, econnect Germany, iZEUS, open ECOSPhERE, SecMobil, SESAM, Shared E-Fleet, sMobiliTy

→ 4. New ICT architecture in the vehicle

The ICT architecture in today's vehicles enables a host of functions but is very complex, expensive and hence not really future-enabled. The ICT architecture will have to be revolutionised in order to exploit the full potential of electric vehicles. The aim here is a much simpler hardware and grid structure that features scalable, central computer units, largely homogeneous grid technology as well as smart sensors and actuators. The goal here is the electrification and electric control of all components of a vehicle, if possible, i.e. the all-electric car. In today's vehicles, new functions are usually enabled by new control devices. It is these control devices that now account for a large part of overall energy consumption in vehicles which should be reduced by centralised computer units. More and more processing power is needed especially when it comes to new driver assistance systems. The vehicle platform must therefore be broadband, realtime capable and fault tolerant. Research is also to be carried out into what a manufacturer-independent interface with the vehicle could look like which would provide information about the vehicle and the environment to other systems. The vehicle's ICT architecture must be compatible with and aligned to a higher level platform (refer to 8.). Such an interface would enable many new functions (refer to 1.). However, issues related to security and liability (legal aspects) must also be taken into account. The ICT architecture should feature a modular design so that it can also be used in new vehicle concepts. A new ICT architecture should, among other things, enable simple retrofitting of functions (plug&play), range optimisation or vehicle environment/situation recognition. This will pave the way for (semi-)autonomous driving. This is a step towards the vision of accident-free and energy-neutral driving.

Projects in which research is being conducted into the key topic of new ICT architecture in the vehicle: Adaptive City Mobility, econnect Germany, O(SC)²ar, RACE, SmartCityLogistik Erfurt, sMobiliTy

→ 5. Traffic management

Communication between the vehicle and the infrastructure will enable a new form of traffic management (Smart Traffic). Vehicle swarm behaviour can be measured, forecast and effectively controlled through interaction with traffic management systems. This requires interaction between the control centre (higher level) and the regional traffic management system (also enables operation of traffic light systems). The foundation for this should be realtime GPS data (location/speed) and route planning from as many vehicles as possible along with networked sensor platforms on tactile roads so that future traffic developments can be forecast. The individual vehicle in this scenario benefits from new apps which can, for instance, adapt individual route planning. This not only reduces overall energy consumption, but also shortens the average travel time for motorists. All the same, the flow of traffic occasionally has priority over individual route planning. However, research into precise planning and control is not only looking into public road traffic, but also into transport and logistics systems.

Projects in which research is being conducted into the key topic of traffic management: Adaptive City Mobility, BESIC, econnect Germany, iZEUS, SmartCityLogistik Erfurt, sMobiliTy

→ 6. New mobility concepts

There is no stopping the trend towards the ever-greater demand for mobility. Future (electric) vehicles, however, will also increasingly be adapted specifically to demand. New mobility concepts can help motorists to select the best vehicle for the journey ahead or perhaps to travel part of the route by train, for instance. This calls for door-to-door navigation (using a smartphone) which, on the other hand, will have to access data and analyses on central platforms (refer to 8.) and other data (e.g. regarding delays in rail

transport). Moreover, new ownership and business models are gaining ground (refer to 1.), also for business car sharing fleets. In this case, the charging station locations for intermodal trips or for Park & Charge & Ride must be optimised. Since use behaviour is important for new mobility concepts, extensive analyses and simulations will be needed here. When it comes to car sharing and new vehicle concepts, research is also focused on man-machine interface.
Projects in which research is being conducted into the key topic of new mobility concepts: Adaptive City Mobility, BESIC, econnect Germany, iZEUS, Mobility Broker, Shared E-Fleet, sMobiliTy, VEM

→ 7. Security

Due to the integration of smart vehicles into energy grids, vehicles will communicate with their environment to a much greater extent than before. This will enable many new functions, but at the same time calls for a new ICT architecture for the vehicle (refer to 4.). This greater networking, however, also poses new kinds of risks which must be analysed and prevented. Cost-efficient solutions must be created in order to authenticate vehicles and individuals. Furthermore, the module, system, vehicle and infrastructure level must also be protected against attacks. A nationwide failure would be fatal. Another important aspect is data security (movement profiles) or secure billing models (unauthorised capture of purchase transactions). New basic/enabling technologies for security must be examined in order to prevent hacking and malware. In this respect, security is of considerable importance as a cross-cutting topic.
Projects in which research is being conducted into the key topic of security: econnect Germany, iZEUS, open ECOSPhERE, RACE, SecMobil, Shared E-Fleet

→ 8. Platform technologies

ICT offer considerable added value for electric mobility through smart interconnection of existing and new platforms. These new ICT connect the various platforms of the vehicle, the infrastructure, the energy grid and traffic management. They provide the basis for controlling traffic flows and load management and for implementing new mobility concepts. Smart networking of different systems is carried out using multi-cast based cloud computing approaches, including new mobile phone technologies, such as LTE, and results in one or more central platforms. This is where, for instance, all the information regarding the vehicle, route planning, the energy systems and traffic situation is processed and analysed. A forecast of the future traffic situation could be drawn up, for example, and recommendations derived for the route. New services for new mobility concepts can be implemented based on this networked information. In addition to the IT platform, the technical criteria of the transmission technology are also important aspects of this platform technology. Communication technologies will have to meet new “automotive” requirements in terms of grid coverage, broadband and quality. These requirements are due to security aspects as well as the implementation of new infotainment systems. However, research into framework concepts for the integration of new functions and services into the platform is also needed. Tools are needed, for instance, to search the platform for information and events as a basis for new services. Basic/enabling technologies for security are another platform technology. These are used to securely authenticate vehicles and users, to encrypt information transmission and to warrant the failsafety of distributed systems. In this case, performance requirements pose an additional major challenge. The key topic of “platform technology” must be seen as a cross-cutting topic comprising other key technologies.
Projects in which research is being conducted into the key topic of platform technologies: BESIC, iZEUS, O(SC)²ar, RACE, SecMobil, SmartCityLogistik Erfurt, sMobiliTy

Adaptive City Mobility

A vision for new mobility in major cities

Germany's roads are congested. In many major cities, motorists are barely faster than cyclists due to the volume of traffic. This results in various negative consequences: high carbon emissions not only threaten the environment, they are also harmful for humans. Noise is a burden for residents. Parking is very limited. Environmentally compatible traffic concepts, such as the large-scale use of pedelecs in inner cities, have already been introduced in order to tackle these problems and to make life in major cities more sustainable and more environmentally friendly.

The Adaptive City Mobility (ACM) project picks up on the idea of mobility and is developing a "comprehensive emission-free system for cities" that is based on electric mobility. An electrically driven lightweight vehicle, more evocative of an Asian rickshaw than a car, is being developed as a basis. The vehicle is being specifically designed for commercial use in cities and is suitable for both passenger transport and city logistics. Due to state-of-the-art information and communication technologies (ICT) combined with manually operated low-voltage battery replacement systems, these so-called SCVs (Small City Vehicles) will be integrated into the power supply.

ACM is now starting to test these lightweight vehicles as eTaxis in cities. Paul Leibold from VISPIRON CARSYNC GmbH, ACM consortium leader, is certain that the number of electrically driven small vehicles (SCVs) in use will increase: "A new vehicle mix comprising pedelecs, escooters, electric SCVs and conventional combustion vehicle will develop, especially in big cities." According to Leibold, what is more important, however, is a change in consumer opinion. "Away from ownership, towards vehicle sharing. Away from vehicles as an ego symbol, towards mobility geared to the environment and resources."

Information and communication technologies have a decisive role to play in ACM: "ICT allow the networking of vehicles with each other and to the environment. Intelligently networked vehicle systems supply all the necessary information in realtime, such as battery status, range, next charging station, etc. and this is what makes electric mobility work in the first place, helping it achieve the necessary acceptance. This will make it easier to solve many of today's traffic problems. With fewer but better-utilised vehicles, the volume of traffic can be reduced significantly, especially in cities. "This is a goal that we too want to contribute to," explains Paul Leibold.

The use of modern ICT enables anticipatory planning of eTaxi schedules. This new ICT intelligence offers further advantages for traffic management, especially when it comes to entire fleets of small eTaxis. The ongoing exchange of GPS data in realtime enables a more efficient route planning. Traffic congestions can be bypassed and lines of waiting taxis at taxi ranks can be reduced thanks to the smart traffic system.

The aim of ACM is to show how conventional taxis and transporters, which are far too big and cause too much pollution in inner cities, can be supplemented and replaced by small, simple and environmentally friendly SCV fleets.

For more information, please visit:
www.adaptive-city-mobility.de

Partners:
VISPIRON CARSYNC GmbH (consortium leader), BMZ Batterie-Montage-Zentrum GmbH, Fraunhofer-Gesellschaft e. V., Heinzmann GmbH & Co. KG, Roding Automobile GmbH

Adaptive City Mobility

BESIC

Economic and environmentally friendly electric mobility for container terminal operations

Hamburg's port is deemed to be the gateway to the world. Each year, around nine million standard containers with goods from 170 countries are handled – 24 hours a day, 360 days a year, in wind and rain, ice and snow. For the year 2020, Hamburg-based Hamburger Hafen und Logistik AG (HHLA), a leading container and logistics enterprise, has set itself the target of reducing carbon emissions for each container handled by 30 percent compared to the 2008 reference year.

One important project designed to reach this goal was launched early in 2013 at HHLA Container Terminal Altenwerder, one of the most advanced terminals in the world: autonomous vehicles for transporting containers have been retrofitted for battery operation. Thanks to a sophisticated battery-exchange concept, the batteries are to be charged with peak loads of green energy. As part of the BESIC (Battery Electric Heavy Goods Transports within the Intelligent Container Terminal Operation) project, intelligent charging strategies (smart charging) and intelligent integration into the electricity grid (Smart Grid) are to show that economic advantages can be combined with ecological benefits. "We are truly putting technology to the test, because it takes a lot for a system to be recognised as suitable for port operations," explains Boris Wulff, HHLA project manager and BESIC consortium manager.

Due to fluctuations in electricity production from offshore wind farms, there is sometimes too much electricity in the grid. "We are exploring how our charging station can recharge replacement batteries at precisely the point in time when the grid has excess electricity from renewable sources without this having an adverse impact on terminal operations," explains Boris Wulff. For the terminal, this means lower costs and lower carbon emissions. For the electricity supplier, this means stabilisation and thereby more efficient operation of the grid, as well as fewer wholesale risks.

The battery replacement station decouples the charging process from continuous vehicle operations. This flexibility will help to better exploit the potential of renewable energy sources. Since the container terminal's electricity demand can be derived from the shipping schedule, today's ICT can be used to identify the best-possible time for charging. In this case, a battery management system, which is being developed in the BESIC project, will compare the workload forecast data supplied by the terminal control system with load forecast data from the power supplier. "The results from BESIC are paving the way for the entire transport and energy sector," Wulff explains. "What we aim to do is to perfectly control electric vehicles and electricity loads in closed logistics systems between the ship and container terminal. This principle can then be transferred, for instance, to apron operations at airports or to public transport. BESIC is demonstrating that the use of electric mobility and smart ICT not only makes economic sense, but also leads to economic benefits."

Partners:
HHLA Container Terminal Altenwerder GmbH (consortium leader), Carl von Ossietzky Universität Oldenburg, Georg-August-Universität Göttingen, Gottwald Port Technology GmbH, TU Clausthal, Vattenfall Europe Innovation GmbH

econnect Germany

Nationwide research into electric mobility

econnect Germany is a research alliance between eleven partners from industry, four universities and seven municipal works from all over Germany. The municipal works are managing so-called hubs which, at seven locations, are working on topics related to Smart Traffic and Smart Grid. The aim is to cover the entire range of electric mobility topics for energy utilities. In this interview, Hauke Hinrichs from smartlab Innovationsgesellschaft mbH, the consortium lead of econnect Germany, explains the concept and goals of the research project.

What is the goal of econnect Germany?
With econnect Germany, we hope to make electric mobility a tangible experience by developing future top products for the transport and energy sector based on technological research and development work, and to ensure better networking within the municipal works landscape when it comes to innovative topics.

How can this come about?
The econnect Germany project is exploring all areas where electric vehicles are being used in Germany – in urban centres, large cities or rural regions, for private use, in company fleets, for carsharing or also in tourism. Other research activities will also include, for instance, load management or European interoperability in the case of the public charging station infrastructure.

How are you organised within the project?
Seven research and development centres have been set up in the econnect Germany project. Under the leadership of the regional municipal works, these centres are exploring the development of intelligent electric mobile traffic applications (Smart Traffic) and the integration of electric mobility into the intelligent grid (Smart Grid). The so-called competence centres – also referred to as hubs – are located on the island of Sylt, in Osnabrück, Duisburg, Leipzig, Aachen, Trier and in the Allgäu.

What are the main topics of this project?
Where smart grid research is concerned, the focus is on intelligent charging along with the integration of electric vehicles into the grid, both from a distribution and grid

perspective. The project is examining charging at home, at work or in the public area, and with the help of ICT, electric mobility is being embedded into existing systems, such as Smart Home (Aachen hub), Smart Facility (Trier and Allgäu hubs) or the "car park of the future" (Trier hub) and then showcased in the field. The Aachen model region is working on an IT platform where the various access and billing systems of the public charging infrastructure are brought together (Clearing House). In the case of smart traffic applications, the hubs involved are focussing on electrically driven, intermodal traffic. The related mobility services, such as information, reservation and booking systems (Osnabrück hub) or fleet management are being developed as new IT systems specifically for the field of electric mobility or are being integrated into existing systems. On the island of Sylt and in the Allgäu, other mobility concepts, such as the use of electric vehicles in tourism, are being implemented using ICT and subsequently tested in the field.

For more information, please visit:
www.econnect-germany.de

Partners:
smartlab Innovationsgesellschaft mbH (consortium leader), ABB AG, Allgäuer Überlandwerk GmbH, Energieversorgung Sylt GmbH, FH Kempten, HaCon Ingenieurgesellschaft mbH, Hochschule Trier, John Deere GmbH & Co. KG, Kellendonk Elektronik GmbH, MSR-Solutions GmbH, Phoenix Contact Electronics GmbH, PSI AG, RWTH Aachen, Schleupen AG, Siemens AG, Soloplan GmbH, STAWAG Stadtwerke Aachen AG, Stadtwerke Duisburg AG, Stadtwerke Leipzig GmbH, Stadtwerke Osnabrück AG, Stadtwerke Trier AöR, Universität Duisburg-Essen

iZEUS

Intelligent traffic planning and control with electricity

The iZEUS (intelligent Zero Emission Urban System) project focuses on research, development and practical demonstration in conjunction with a so-called "multi-modal smart traffic concept". Smart Traffic and Smart Grid are the main topics of this project.

Electric mobility doesn't simply mean exchanging a petrol-driven car for an electric car. While a functioning infrastructure is a matter of course for conventional cars with their 100 years of development history, this kind of infrastructure has yet to be built for electric cars. Electric cars need electricity and this means that connection to the grid is crucial. It also means that traffic networks and electricity grids, which up to now worked independently of each other, will now have to cooperate.

"The reduction of investment and operating costs and increasing customer acceptance are among the central challenges facing electric mobility. However, the optimisation of existing systems and services is the key to sustainable success," says Lars Walch from iZEUS' consortium leader EnBW AG, and goes on to explain the basic idea behind the project: "What is needed are smart traffic systems, innovative billing systems, sophisticated fleet management concepts and decentralised energy and charging management in order to exploit the potential of electric mobility." At the heart of this so-called "multi-modal smart traffic concept" is intelligent traffic control and planning that integrates electric mobility into private traffic and urban commercial traffic. Thanks to innovative value-added services, a uniform, multi-modal smart traffic concept is being created. This concept is being developed in the project and then tried and tested in fleet tests with a significant number of vehicles. The aim is to use approx. 120 vehicles.

ICT will be used to integrate traffic and energy systems and, additionally to enable roaming, innovative billing concepts and energy-efficient navigation solutions, it will also pave the way for improved integration of renewable energy sources and stabilisation of distribution grids through decentralised energy and charging management. In addition to this, the legal framework and standards will be developed further through political and standard-related recommendations for action, e.g. using the electric mobility reference model.

Furthermore, roaming is being tested with other partners, both in and beyond Baden-Wuerttemberg. The aim here is to use standardised data exchange formats and interfaces in order to exchange authentication, authorisation and billing data while observing general data protection requirements. The system is being continuously optimised in the field test phase.

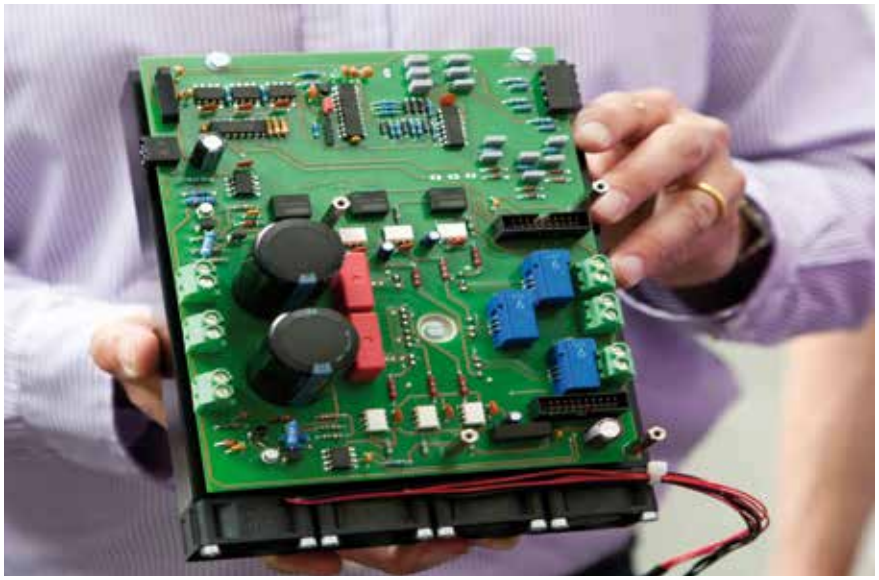
For more information, please visit:
www.izeus.de

Partners:
EnBW Energie Baden-Württemberg AG (consortium leader), Adam Opel AG, ads-tec GmbH, Daimler AG, Fraunhofer-Gesellschaft e. V., Karlsruher Institut für Technologie (KIT), PTV Planung Transport Verkehr AG, SAP AG, TWT GmbH Science & Innovation

LokSMART Jetzt!

Local smart grids NOW!

In future, electricity will not only to be supplied by traditional utilities, but will come from plants that generate electricity from renewable sources or local combined heat and power plants, for instance, from the solar systems on the roof of a house or from the battery in an electric car which was charged at night with low-cost electricity and then delivers this during the day.



However, power from renewable sources fluctuates, especially the more solar and wind power is fed into the grid. The Smart Grid of the future is to balance these fluctuations using state-of-the-art communication technology. A cold-storage warehouse, for instance, is to run at full power and cool even below the target temperature when electricity supply is particularly high. If supply falls, then the cold store can be shut down for a period of time to save energy.

According to the latest forecasts, it will only be possible to implement the expected adjustment of the big electricity grids with smart grid services – in this case primarily the demand-orientated storage and provision of electricity from suitable storage media – in the medium to long term. This is due to the comprehensive infrastructural requirements as well as the very far-reaching ICT requirements for nationwide implementation of smart grid functions.

The LokSMART Jetzt! project aims to ensure that local electricity grids will be created today that already offer smart grid services. With this in mind, controllers are being developed for combined use of small combined heat and power plants (CHP) and mini wind-power plants, photovoltaic plants or other renewable sources. These controllers will be connected to fast-charging, bi-directional stationary and mobile battery buffer storage units. This will make it possible to develop local decentralised electricity supply units geared towards sustainability which will enable early smart grid-based operation of electric vehicles, long before the generally available grids will be able to do so. Buffer storage in local grids can also help to lessen the burden on grids as a whole, because peak power generated from renewable sources can be buffered before it reaches the grid.

LokSMART Jetzt! is analysing the market and use potentials and is modelling controller and storage functions. Another aim of the project is to develop a CHP and/or charging station for electric vehicles fed with regenerative power and a bi-directional fast charging option with optional buffer storage for this charging station. The system will feature an open configuration so that other sources of energy can be integrated.

For more information, please visit:
www.planungsbuero-koenzen.de/koenzen/html/Elektro/Index_elektro.htm

Partners:
Planungsbüro Koenzen (consortium leader), Hochschule Osnabrück, SenerTec Center Sachsen e. K., Stadtwerke Hilden GmbH, Westsächsische Hochschule Zwickau (FH)

Mobility Broker

On the move with an app

Having your own car as a means of transport in inner cities is becoming less important, especially for younger people. At the same time, there is a growing demand for ressource-friendly, low-cost, individually available mobility options. This means: the car today, the bike tomorrow and the bus or train the day after tomorrow. Or, a combination of all of these on a single route – a trend referred to by experts as multi-modal mobility. The Mobility Broker project brings together mobility offers on a single internet platform. Birgit Brand, head of marketing at consortium leader ASEAG Aachener Straßenbahn und Energieversorgungs-AG, explains about the project.

What goal is being pursued with Mobility Broker?
The goal is to bring together all mobility offers publicly available in a region on one web-based and app-based marketplace, i.e. the Mobility Broker. This paves the way to local public passenger transport, because the customer only needs to contact one information medium, the Mobility Broker, communicates with one supplier only and receives just one bill for all services. Anyone wishing to travel from A to B can find the right form of transport at a glance by entering their individual preferences. The optimum route to the selected destination is also suggested.

Which target groups do you have in mind?
The aim is to offer a simple and user-friendly product that smart phone users of all ages can use without difficulty. In the long term, we are hoping to introduce electric mobility and rental offers not only to customary users of short distance public transport, like students or job-ticket holders, but also to occasional users of public transport.

How is the mobility system to be put into practice?
The first operative phase of the project will be initially tested with our own employees in the Aachen region – the key purpose of this will be to gain important basic experience. An eCar pool for trips to work and home and for business appointments will be set up in this phase. An integrated booking and billing system is to be developed at the same time with all the project partners. In a second phase of the project, the system will be made available to the employees of Aachen University (RWTH) in combination with an existing job ticket. The project will then be expanded to include private users in order to ensure that workflows are smooth there too.

How do the individual project partners at Mobility Broker supplement each other?
As a transport company, ASEAG has many years of experience in short distance public transport, the same can also be said for Stadtwerke Osnabrück. Aachen University (RWTH) is supporting the project with experts in information, telecommunications and IT systems. IVU Traffic Technologies AG and regio iT, Gesellschaft für Informationstechnologie mbH, are additionally contributing their expertise in the development of mobile information systems and the testing of security mechanisms.

For more information, please visit:
www.mobility-broker.com

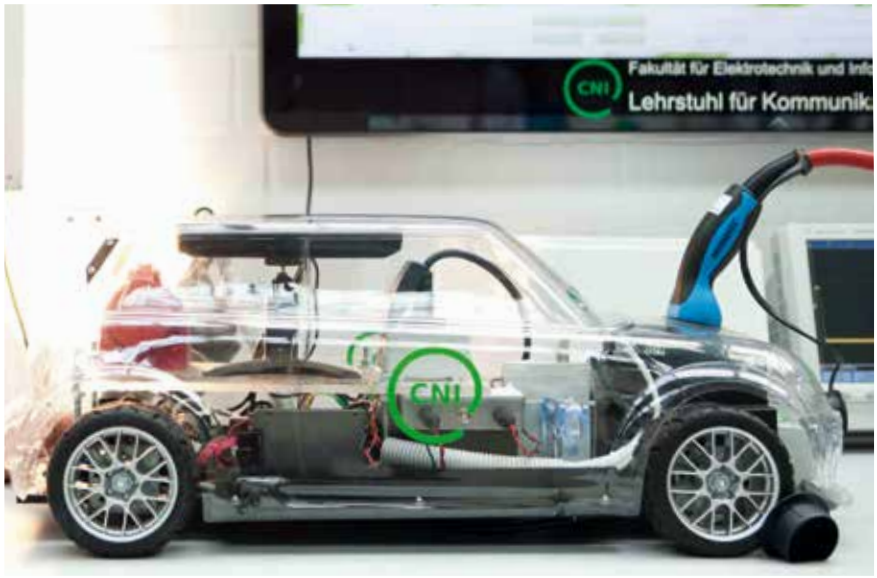
Partners:
ASEAG Aachener Straßenbahn und Energieversorgungs-AG (consortium leader),
IVU Traffic Technologies AG, regio iT gesellschaft für informationstechnologie mbH,
RWTH Aachen, Stadtwerke Osnabrück AG

mobility broker

open ECOSPhERE

Electric vehicles as consumers and storage of renewable energy

As a result of Germany's energy turnaround, electricity grids and the entire energy system face a growing number of new challenges. Potential instability due to irregular feeding of eco-electricity to the grid must be balanced and new possibilities for storing energy from renewable sources have to be found. In order for "green" solutions like electric cars to play an active role in this, users must be convinced of the advantages of environmentally friendly technology and handling must be simplified.



These are the starting points for the open ECOSPhERE (Enabling open Markets with Grid & Customer-oriented Services for Plug-in Electric Vehicles) project: "On the one hand, electric mobility is to play an important role in Germany's energy turnaround. That's why we are examining how electric vehicles can be used on a large scale as active consumers of and storage units for renewable energy. On the other hand, user comfort must also be boosted. For this reason, we are working on powerful, state-of-the-art ICT solutions in two fields of innovation," says Claus Fest from RWE Effizienz GmbH, consortium leader for the project.

The project is exploring how electric vehicles can be integrated into the energy system. In doing so, the project also takes into account that renewable energy is used optimally, that cars are charged with low carbon emissions and can still be reliably supplied with power. In order to precisely identify hourly carbon emissions for low-carbon charging of electric vehicles, on the one hand a model is being developed under the open ECOSPhERE project that can forecast the network load, the influence of renewable energy and the use of conventional power stations. An algorithm is also being developed which can draw up an optimum charging plan for motorists of electric cars based on energy, grid and commercial parameters. The project is also looking into the user requirements for vehicles, their charging behaviour and the infrastructure needed for this. The aim is to boost user friendliness and hence acceptance for electric vehicles among motorists. To achieve this, ICT applications are being developed that are both service orientated and user friendly. Smart phone apps, for instance, are to show users where they can find the next charging station so that they can plan when to charge.

Other services are also being tested, such as cash-free payment, or plug & charge, a method where the charging process can be started by simply connecting the car to a charging station using a charge cable. The vehicle and charging system communicate with each other and exchange contract data via a secure connection. Electric mobility is also to be made more user friendly by extending billing to different grids, so-called roaming.

Partners:
RWE Effizienz GmbH (consortium leader), Continental Automotive GmbH, Ewald Consulting GmbH & Co. KG, Power PLUS Communications AG, RWTH Aachen, SAP AG, TU Dortmund

O(SC)²ar

Value-added services thanks to cloud-based smart phone apps

The goal of the O(SC)²ar (Open Service Cloud for the Smart Car) project is to improve communication for electric vehicles: A cloud-based platform is being created which will not only improve communication between vehicles but will, above all, improve the exchange of information with external systems, such as charging stations.

Prof. Dr. Achim Kampker from StreetScooter GmbH, consortium leader of O(SC)²ar, explains: "The open service cloud is a platform on the Internet where apps will be made available and which users can then use as needed. For the entire duration of its service life, the Smart Car can then also integrate new ICT applications through this platform and hence continuously enhance itself."

The open service cloud will be developed as a communication platform with two levels. In a special manufacturer area, security-sensitive and competition-related data can be exchanged. In a public area, electric car drivers can easily and quickly contact a service technician or, while on the move, book a parking space with a charging station. In order to enable communication between the vehicle and the cloud, the project partners are developing new ICT, electric and electronic architecture for electric cars. This new architecture will feature an open design to ensure compatibility with other software programs and architectures. This will enable communication with other systems and continuous updating.

This permanent exchange with the cloud offers a special advantage for users of car sharing services: "When a motorist gets into a car sharing vehicle, he identifies himself and his personal settings, such as his favourite radio station or his preferred charging stations are already set," explains Prof. Kampker. This happens after an app downloads the matching data from the service cloud after the driver has identified himself. The vehicle serves as a platform through which the user can purchase various mobility and entertainment services.

The mobile connection to a service cloud, however, is not only suitable for individual services. Whilst up to now electric cars have usually been connected to a permanent server and hence have had access to only a limited selection of apps, new and innovative functions could be continuously integrated with an open service cloud. By means of the cloud, vehicle manufacturers, operators of carsharing services and repair shops can offer their own apps and communicate with each other as well as with their customers. This will not only regularly boost the user friendliness of these apps, it will also promote the economic efficiency and performance of electric vehicles.

Partners:
StreetScooter GmbH (consortium leader), DEE Dräxlmaier Elektrik- und Elektroniksysteme GmbH, FEV GmbH, Forschungsinstitut für Rationalisierung (FIR) e. V., Hans Hess Autoteile GmbH, QSC AG, regio iT gesellschaft für informationstechnologie mbH, RWTH Aachen

RACE

A new ICT architecture for electric vehicles

Today's cars are equipped with more and more information and communication technologies (ICT). The complexity of this architecture of controllers, communication systems and software, which has grown over the course of years, is becoming increasingly difficult to understand and is hence slowing down innovation. The RACE (Robust and Reliant Automotive Computing Environment for Future eCars) project is therefore developing a new and centralised ICT architecture. In this interview, Dr. Cornel Klein from Siemens AG, consortium leader for the project, explains the challenges of his work.

What is the aim of your project?
Our aim is to install new functions in the vehicle, independent of hardware and no longer in the form of controllers, but only as software. What we are trying to do is to distribute the functions to just a few central computers and develop a new ICT architecture in this way for the vehicles of tomorrow.

How is this taking place?
Under the RACE project, research and development as well as prototype implementation are centred around a scalable, standardised, open and hence easily expanded base platform with a considerably reduced hardware and network structure as well as uniform communication systems. System reliability is important so that particularly safety-critical functions can be easily implemented, such as Steer-by-Wire. Steer-by-Wire is a function where a sensor passes steering commands in electronic form via a controller to the wheels. In future, highly complex functions, such as (partial) autonomy and integration, are to be incorporated into a smart environment with a minimum of effort.

What advantage does this development have to offer?
For users of electric mobility, this brings huge benefits because it means flexible retrofitting of vehicles (plug&play functionality). Later on, innovations in infotainment or automatic parking systems, for instance, can then be easily integrated. Furthermore, communication between the future smart grid environment and the vehicle will be supported, for example, when the vehicle batteries are being charged. In order to ensure that the proposed ICT architecture can in principle be accepted by the automotive industry, it is crucial that the legal requirements in conjunction with approval capability be considered. From the very start, the architectural design must take certification standards into account.

In other words, modern ICT are the heart of your project?
ICT enable the implementation of software-based innovations in the vehicle. However, due to their complexity, ICT make it difficult today to introduce new innovations to the vehicle and this often slows down innovation. A redesigned ICT architecture, on the other hand, enables simple and low-cost implementation of new software-based innovations in the vehicle and thus drives innovation. The transition to electric mobility provides an opportunity to redesign the evolutionarily grown ICT architecture and hence paves the way for fast integration of new functions.

For more information, please visit:
www.projekt-race.de

Partners:
Siemens AG (consortium leader), AVL Software and Functions GmbH, fortiss GmbH, Fraunhofer-Gesellschaft e. V., Lucas Varity GmbH, RWTH Aachen, TU München, Universität Stuttgart

SecMobil

IT security for electric mobility

Protecting computers and servers with anti-virus programs and firewalls is a run of the mill task today for both companies and private individuals. But when it comes to electric mobility, IT security is also becoming important. Since vehicles, the energy infrastructure, and ICT systems are all strongly dependent on each other here, it is crucial that attacks from outside and damage from inside be prevented. Secure services protect the system against misuse, billing systems against manipulation and warrant security for the exchange of contractual declarations.

The SecMobil (Secure eMobility) project is developing a holistic approach that takes into account both the electric vehicle as well as the grid and traffic infrastructure in order to bring IT security to electric mobility. Security functions should not only work for the vehicle, they must also consider the energy and communication infrastructure. “Existing IT security solutions tend to concentrate on PC and server-systems. We are developing the first-ever holistic approach that covers all components of electric mobility across all the different systems,” explains Matthias Küster from ESCRYPT GmbH and SecMobil consortium leader.

Future mobility is based on interaction between Smart Car, Smart Grid and Smart Traffic. This means that vehicles are integrated into the electricity supply system and there is also extensive communication between vehicles. What the industry needs now are open standards, so that secure framework conditions can be created for all stakeholders, especially car manufacturers, electricity suppliers, transport companies, traffic control systems, service providers and cross-cutting traffic control systems. In the SecMobil project, IT security not only serves to protect systems and participants but, as an enabling technology, it will also pave the way for new applications and business models. Using universal and manufacturer-independent solutions, companies will be able to exchange standardised and trusted information on different business models.

The project is focusing on the topics of “E-Metering”, “Secure Infrastructure” and “Secure Services”. “E-Metering” addresses secure data capture, e.g. the secure and economic measuring of electricity by comparing the data in the vehicle and in the charging station. The topic of “Secure Infrastructure” focuses on the trusted exchange of messages between Smart Car, Smart Grid and Smart Traffic. This involves legal aspects which are important, for instance, when it comes to signature functions and functions for encrypting sensitive data.

In this area, SecMobil is also working on new business models to promote the use of electricity grids by creating incentives for users. The topic of secure services is dedicated, among other things, to the security of apps for the vehicle, for billing, software updates or ID management with the new German ID card.

For more information, please visit:
www.secmobil.com

Partners:
ESCRYPT GmbH - Embedded Security (consortium leader), Daimler AG, ELMOS Semiconductor AG (until 2012), Ruhr-Universität Bochum, smartlab Innovationsgesellschaft mbH, Westfälische Hochschule Gelsenkirchen Bocholt Recklinghausen

secmobil

SESAM

A tractor for harvesting electricity

Renewable energy from wind and sun is primarily generated in the countryside. However, in order to ensure that not only rural areas but also cities can benefit from this, smart grids are needed to intelligently control the generation, distribution, storage and consumption of electric energy. The more energy generators and consumers are integrated into smart grids, the more efficient these grids will become and this means that less will have to be spent on setting up new infrastructures.

This effect multiplies the closer electricity consumption can be moved towards generation, because then energy transmission routes and transmission losses can be minimised. The integration of electricity consumers in close proximity to decentralised wind power and PV plants lowers the need for higher power or new electric lines. Farmers themselves can use decentralised electricity from renewable energy sources in stationary facilities (e. g. stables and greenhouses). But also mobile machines, like tractors, can be electrified and connected to the smart grid. If these stationary and mobile consumers can also be controlled in the time domain (something that is often possible in agriculture), smart grids can then lessen the burden on the grid infrastructure by avoiding consumption requests from many consumers at the same time and hence become even more profitable.

In order to use stationarily produced renewable electric energy on mobile agricultural machines, concepts are being developed under the SESAM project for fully electric agricultural machines. Two different electrification paths are being pursued. The first one is based on the concept of machines that are connected to the power grid by an electric cable. The other concept involving a tractor that is fully electrified using batteries is implemented as a prototype and tested.

The vision being pursued in this project is a fully electrified agricultural machine that allows the use of decentrally generated electricity from renewable sources (e. g. solar cells) which increases environmental compatibility and efficiency and reduces pollution and noise emissions and hence makes agricultural operations less dependent when it comes to energy. An ICT infrastructure enables energy and fleet management. At the same time, the infrastructure also helps farmers to access considerable potential income which has not yet been exploited to any great extent. Vehicle batteries can be used as power storage. With a battery replacement concept, storage capacity can even be made available while the vehicles are being used. This requires the connection of the farms to the control centre and the machines to be networked in order to transmit information.

The concepts developed for agriculture are to demonstrate the economic efficiency of electric mobility in general. Farmers do not need a nationwide charging infrastructure since the machines can be charged at the farmyard. Furthermore, the electric battery-powered machines can be used as both stationary and mobile buffers of the energy produced at the farm itself. This means a greater return on the higher investment in electric machines.

Partners:
John Deere GmbH & Co. KG (consortium leader), B.A.U.M. Consult GmbH, TU Kaiserslautern

Shared E-Fleet

The “green” company car fleet of tomorrow

For many companies, the mobility of their staff and hence company car use are crucial for success. Getting quickly and easily from A to B is very important, for instance, for procurement, sales and customer support staff. However, a company car fleet is a very expensive matter.

Low utilisation and long downtimes often mean that keeping a company car fleet costs too much and involves an investment that especially small and medium-sized enterprises (SMEs) often simply cannot or do not want to afford. The Shared E-Fleet project hopes to change all that with state-of-the-art car sharing concepts for eFleets. Innovative information and communication technologies (ICT) will ensure that intelligent, efficient, low-cost and environment-friendly “green” company car fleets can be operated in the business world and across different companies. The basic idea is that eFleets will be used jointly by several companies (Business & Business), making them more profitable for all the participants.

Cloud-based ICT solutions will enable smart networking of fleets and maximum utilisation of each individual vehicle.

The central features of tomorrow‘s company car fleet are innovative charging and billing systems, improved usability and hence comfortable control using smart phones as well as interaction with smart power grids and traffic systems.

The project specifically addresses small and medium-sized enterprises which are located close to each other. The systems developed are being tested in real application scenarios and prototype systems are being implemented with companies at locations in Munich, Stuttgart and Magdeburg. In these technology parks or industrial estates, pilot users can share the eFleets for business trips. This not only means lower costs, it also goes a long way towards protecting the environment. If employees are also permitted to use the electric vehicles privately, this will enhance the degree of utilisation even further (Business & Private). The solutions developed can also be used by city administrations, for instance, involving several related public agencies and organisations, or by individual corporations.

The Shared E-Fleet concept also includes feasible business models for joint use (Smart Fleet), smart energy management beyond charging stations (Smart Energy) and linking to other forms of transport and partner pools, as well as dynamic route optimisation with on-street parking space management (Smart Traffic). The security of the cloud solution and user anonymity are ensured by a “trust centre”.

For more information, please visit:
www.shared-e-fleet.de

Partners:
Carano Software Solutions GmbH (consortium leader), baimos technologies gmbh, Fraunhofer-Gesellschaft e. V., Ludwig-Maximilians-Universität München, Marquardt GmbH, MGH-Münchner Gewerbehof- und Technologiezentrums-gesellschaft mbH, Siemens AG, STEP Stuttgarter Engineering Park GmbH, TWT GmbH Science & Innovation

Shared e-Fleet

SmartCityLogistik Erfurt

Electric vehicles in the logistics chain

Constant stopping and starting, waiting at traffic lights and congestion at rush hour: despite mostly short trips, inner-city traffic poses a challenge to suppliers and logistics companies. The use of electric vehicles could save unnecessary costs and reduce pollution and noise, especially in urban settings. The SmartCityLogistik Erfurt project is exploring possibilities for expanding existing logistics system on the basis of electric mobility, as consortium leader Thomas Becker from DAKO Systemtechnik und Service GmbH & Co. KG explains.

Why are you testing the use of electric delivery vehicles in urban areas?
We believe that the use of electric vehicles has enormous benefits in this area of traffic. Combustion-driven vehicles are difficult here both from a financial and an energy perspective – high fuel consumption is a burden for transport companies while residents suffer due to exhaust and noise emissions. On account of the at times limited range of electric vehicles, we are not currently aiming to replace the entire fleet. Instead, we are working on partial integration of electric vehicles into existing logistics systems while taking into account the use restrictions that are specific to electric mobility.

What approach are you taking?
The aim of SmartCityLogistik is to develop an ICT solution that links planning and in-service data in realtime, derives suitable response models and enables monitoring and optimisation on site. In order to prepare the efficient use of eCars, we have to know the routes and times where they offer relative advantages compared to combustion-driven vehicles. That's why we are collecting all the relevant in-service data, such as vehicle location, local traffic and climate situation, freight data, as well as information on the driver and driving behaviour. Our ICT system platform will then offer services in the field of electric mobility in order to expand and optimise existing logistics systems. We are currently drawing up a prototype demonstrator of the system for the Erfurt city area.

What do you hope to achieve with this project in the long term?
If the field test is successful, the partner companies involved are planning to quickly launch products with series maturity and to market these for our target group of logistics companies, but also IT service providers in the field of transport optimisation. The logistics partners working on the project are of course themselves hoping to use the system developed and are now already benefiting from the learning effects with a view to their own processes. By involving research institutes from Friedrich Schiller University Jena and Erfurt University of Applied Sciences I believe that we will come up with scientifically applicable results which could raise electric mobility as a whole to more widespread use.

For more information, please visit:
www.smartcitylogistik.de

Partners:
DAKO Systemtechnik und Service GmbH & Co. KG (consortium leader), BTF GmbH & Co. KG, ELOG Systembetrieb GmbH, EPSa Elektronik & Präzisionsbau Saalfeld GmbH, FH Erfurt, Friedrich-Schiller-Universität Jena, Navimatix GmbH, TVT Tabakwarenvertriebsgesellschaft Thüringen mbH & Co. KG

SMART CITY LOGISTIK

sMobiliTy

Smart use of existing structures

The widespread use of electric vehicles in everyday life calls for either high investment in a nationwide network of fast-charging stations or smart use of existing infrastructures and technical systems. The latter approach is being pursued in the "Smart Mobility in Thuringia" project that is using the cloud to create a system and service platform so that existing technical systems and solutions can be intelligently networked and technical and commercial services for electric mobility can be provided. In this interview, sMobiliTy consortium leader, Frank Schnellhardt from INNOMAN GmbH, explains how this works.

What is the aim of the sMobiliTy project?
We aim to design a cloud-based ICT architecture which will network existing technical systems and infrastructures – for instance, vehicle, road, power grid and traffic technology – and hence form the basis for smart support for the use of electric vehicles. Thanks to suitable interaction between the systems, electric mobility is to become more cost-efficient.

Can you explain this in more detail?
First of all, the ICT platform will be developed. This platform enables networking of technical systems, such as the power grid, traffic infrastructure, etc. Based on this, we are planning examplary two solutions. On the one hand, we are developing a new type of navigation solution. With a smart phone app, the choice of route can be influenced by taking the current local traffic situation into account and hence travel time and the energy consumed by the vehicle can both be minimised. As part of the project, a large-scale trial in the federal state capital Erfurt will demonstrate how suitable this innovative idea is for everyday use.

We also aim to implement controlled charging in homes and are using the radio ripple control technology already widely used in grid control. User requests – for fast or cost-optimised charging – are also being considered here just as much as grid load and energy supply. We are hence demonstrating the technical viability and economic feasibility of controlled charging and a field test is underway with 200 participants. The platform is open for the integration of further applications.

How important are modern information and communication technologies (ICT) for the success of your project?
The entire development approach being pursued in sMobiliTy is based on modern ICT. They are what enable the networking of previously separate technical systems and infrastructures. With ICT, new functions can be implemented, such as time-dependent or load-dependent charging of vehicles, differentiated recording and control of traffic flows, or recording and processing of driving behaviour and vehicle information to optimise options for using the electric vehicles themselves. Finally, ICT support new utilisation and action concepts with a view to individual and public mobility.

What do you think future mobility will look like?
Future mobility behaviour will be marked by the use of mobility services unlike the current individual maintenance of ineffective mobility capacities. In the foreseeable future, the individual, permanently available self-owned vehicle will be gradually replaced by a host of nationwide mobility services, thus expanding individual freedom even further.

For more information, please visit:
www.smart-mobility-thueringen.de

Partners:
INNOMAN GmbH (consortium leader), ACX GmbH, Bauhaus-Universität Weimar, envia Mitteldeutsche Energie AG, EPSa Elektronik & Präzisionsbau Saalfeld GmbH, Fraunhofer-Gesellschaft e. V., HKW-Elektronik GmbH, IMMS GmbH, Landeshauptstadt Erfurt, TAF mobile GmbH

VEM

Taking an eTaxi through the city

Driving through Munich with an eTaxi? The VEM – Virtual Electric Mobility in taxi and commercial traffic of Munich – project is making this (for now, virtually) possible. VEM is examining the suitability of electric vehicles for vehicle fleets of manual trades businesses and taxi companies.

Up to now, many companies have been hesitant to use electric vehicles. They do not have access to empirical values and on top of that there are still gaps in charging infrastructure coverage. In this project, smart phones fitted in conventional vehicles record all the data needed in order to simulate an electric vehicle in realtime. In this way, the use behaviour of many commercial vehicles and taxis in the greater Munich area can be precisely analysed. Based on the analysis of mobility behaviour, the project is looking into whether and under what conditions it is conceivable to use electric vehicles. In this interview, Benedikt Jäger from Technische Universität München, a member of the VEM project staff, explains the goals that have been set.

How will you test the use of commercial electric vehicles?
We will equip a total of 130 vehicles from selected taxi operators and manual trades businesses in Munich with smart phones. The sensors in the smart phones will record the signals needed for the simulation. Using the virtual fleet test, we hope to make the trial approach more flexible. The aim is to gain a comprehensive insight into the effectiveness and the cost of electrification of larger vehicle fleets with a view to technical, ecological and economic impact.

How are you approaching the project?
We are aiming to identify the economic efficiency of electric mobility for taxi operators and manual trades businesses in Munich as well as explore the technical practicability and analyse acceptance among operators and users. To do this, we will create a simulation program that maps both the electric vehicle and the charging infrastructure and hence identify the need for charging stations. The results are also to be used in order to estimate the potential of various energy storage and drive concepts depending on the individual application scenario.

How will the virtual data become reality?
The experience gained in the virtual trial will be validated in a second phase of the project where it will be used in real electric vehicles. We want to show that the approach can also be used for other larger fleet tests, for other cities and for various means of transport.

How important are modern information and communication technologies (ICT) for the success of your project?
In our project, it is crucial that ICT enable the simulation of a large fleet of electric vehicles. Thanks to the use of smart phones to simulate electrically driven vehicles, the costs of the trial can be reduced significantly. Another advantage is that our method allows us to examine a large range of electric vehicles in a short space of time. A holistic approach can be used to examine the requirements for the vehicles and the infrastructure.

For more information, please visit:
www.vem.ftm.mw.tum.de

Partners:
Stadtwerke München GmbH (consortium leader), Handwerkskammer für München und Oberbayern, Taxi-Verband München e. V., TU München

Completed Projects

The projects MEMO (July 2010 – May 2013), IRENE (April 2011 – December 2013) and sms&charge (January 2012 – February 2014) have already been completed.

IRENE

The IRENE (integration of regenerative energy and electric mobility) project tested the intelligent integration of buffer memory into the electricity grid in a model community in the Allgäu region. The aim was to use innovative measurement as well as information and communication technologies to achieve better coordination between electricity generation and electricity consumption. This was used to derive business models for operating electricity grids involving a high share of renewable energy.

Partners:
Allgäuer Überlandwerk GmbH (consortium leader), Hochschule Kempten, RWTH Aachen, Siemens AG

MEMO

MEMO (media-based learning and collaboration services for electric mobility) developed a collection of internet-based learning and training offers for further education and training in the trades and tested these using electric mobility as an example. The aim of this project was to make the transfer of knowledge related to these technologies quickly available using teaching games, video blogs, eBooks, etc., and to supplement conventional training and further education offers.

Partners:
PLANET IC GmbH (consortium leader), Berufsbildungszentrum der Kreishandwerkerschaft Märkischer Kreis e.V., Copendia GmbH & Co KG, Fraunhofer-Gesellschaft e.V., Handwerks-Bildungsstätten e.V., imc information multimedia communication AG

sms&charge

The sms&charge project developed a charging system for electric vehicles which controls and bills the charging process via mobile phones. In addition to much simpler authorisation and billing using mobile phones, the focus was also on reducing the costs of billing and the charging infrastructure.

Partners:
Elektro-Bauelemente GmbH (consortium leader), Allgäuer Überlandwerk GmbH, EWE AG, sunhill technologies GmbH, TU Dortmund

Real Dialogue in the Virtual World

Online platform networks the project partners and promotes consensus

Research and innovation thrive on the exchange of opinions and ideas. But this exchange is not always possible face to face. The interactive online platform "Electric Mobility in Dialogue" offers project partners under the ICT for Electric Mobility II programme the opportunity to maintain ongoing, project-spanning and interdisciplinary communication. It also offers users the chance to network with external electric mobility experts and decision-makers. The dialogue platform is like a virtual conference centre. Once users enter their password, they will find a plenum, a forum with many meeting rooms and a library.

The plenum is the stage for dialogue on controversial topics. The aim is to provide a protected area where possibilities for consensus can be explored and recommendations for action can be made in order to accelerate the development of marketable innovations. The forum provides meeting rooms in which specific projects can be initiated on a confidential basis and where specialist groups from the projects supported can meet. The forum is also where discussions that began at events, for instance, at the "Innovations(T)Raum Elektromobilität 2013" event can be continued in open topic workshops. In the library, finally, the decision-relevant documents are stored and can be accessed.

Following a test phase that lasted several months, the plenum was opened in spring 2012. The theses tabled here for discussion were previously identified in individual talks with 140 experts and decision-makers from various industries and sectors. These theses hence reflect topics where there is considerable demand for dialogue and decision-making. Supported by an active moderation process, dialogue during the first year in the plenum has already resulted in eight reports from which recommendations for actions can be derived. These can be used to arrive at business and political decisions which reflect electric mobility as a disruptive innovation and its potential economic importance.

Through structured packaging of opinions in the online plenum, topics can be identified that are particularly crucial for success, such as the establishment of a public charging infrastructure or the implementation of new mobility concepts. These topics are to be pursued further in offline events in order to prepare a broad consensus that is borne by the worlds of business, science, politics and society.

In line with the needs of the projects funded by the ICT for Electric Mobility II programme and in addition to the 12 theses, where ongoing discussions have not yet resulted in a report, new theses will be drawn up which will be geared towards the central topics of smart vehicle systems (Smart Car), smart energy systems (Smart Grid) and smart traffic systems (Smart Traffic).

Supporting Research

As part of the supporting research, VDE Verband der Elektrotechnik Elektronik Informationstechnik e. V. and Deutsches Dialog Institut are supporting the projects on behalf of the German Federal Ministry for Economic Affairs and Energy with a view to identifying and overcoming innovation obstacles during project-spanning cooperation with other partners and in conjunction with the transfer of results.

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