e-mobil BW

State Agency for Electric Mobility and
Fuel Cell Technology Baden-Wuerttemberg GmbH

# BADEN-WUERTTEMBERG
# EXPERTISE IN ELECTRIC MOBILITY


Stuttgart Region Economic Development Corporation

electric mobility south-west

Baden-Württemberg

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# EXPERTISE IN ELECTRIC MOBILITY

e-mobil BW GmbH – State Agency for Electric Mobility and Fuel Cell Technology

State of Baden-Wuerttemberg

Leading-edge cluster Electric Mobility South-West

The Stuttgart Region Economic Development Corporation (WRS)

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# GREETING

Baden-Wuerttemberg is focusing on environmental and climate-friendly mobility for the future. In this process electric mobility and alternative drive research are leading the way. This makes the cooperation of key industries – automotive, energy, production, information and communication technology – especially important. On the long term, this will strengthen Baden-Wuerttemberg as an industrial location. However, we also need to improve the diverse research and educational landscape of Baden-Wuerttemberg by continually adapting it to the new technologies.

On the way to future mobility, e-mobil BW, the State Agency for Electric Mobility and Fuel Cell Technology, plays a central role. It is the point of contact for all questions surrounding electric mobility in Baden-Wuerttemberg, and brings together stakeholders from industry, science and research as well as public authorities.

This source book of electric mobility can be utilised to tighten existing networks or form new ones. It provides information about general activities and introduces companies, research institutions, universities and universities of Applied Sciences working in this area. Providing a comprehensive overview of relevant regional players from Baden-Wuerttemberg, it is an important source for future cooperation and business opportunities.

May all readers discover new ideas and gain new insights exploring e-mobility in Baden-Wuerttemberg.

Winfried Kretschmann
Minister-President of the State of Baden-Wuerttemberg

# PREFACE

Sustainable mobility of the future must meet three key requirements: it must be ecological, economical and also social. To turn this holistic approach into practice, the system of electric mobility must be presented and explored in its complex entirety. In addition to the electrification of the drive-train, this includes the development of intermodal mobility concepts that can be controlled intelligently and are tightly linked to a sustainable energy supply. The new edition of the source book of electric mobility reflects this holistic approach: it presents the diverse spectrum of activities surrounding electric mobility in Baden-Wuerttemberg along the entire value-adding chain – from bicycle and motorcycle, to passenger car and commercial vehicle.

In Germany and Europe, Baden-Wuerttemberg and the Stuttgart Region are pioneers in electric mobility. ‘Electric Mobility Pilot Region’, the ‘Leading-edge cluster Electric Mobility South-West’ and the ‘Showcase Region for Electric Mobility LivingLab BW$^{e}$ mobil’ are only a few examples of the large-scale research projects sponsored by the federal government. These are being realised with the support of the State of Baden-Wuerttemberg and the Stuttgart Region, which will help electric mobility gain even more momentum. e-mobil BW and WRS coordinate all these electric mobility project activities jointly.

This comprehensive source book presents Baden-Wuerttemberg stakeholders in the area of electric mobility. We would like to thank all the parties involved for their work.

The future of mobility has already begun. It is now up to us to shape it.

Franz Loogen
Managing Director of e-mobil BW GmbH

Dr. Walter Rogg
Managing Director of Wirtschaftsförderung Region Stuttgart GmbH (WRS)

Chapter 1

# ELECTRIC MOBILITY – POTENTIAL FOR BADEN-WUERTTEMBERG

## Securing the future by technological change

Electric mobility is the mobility of the future. The years to come will be characterised by ever stricter regulatory provisions as to the necessary reduction of harmful $CO_2$ emissions from vehicles. At the same time, we will experience a shortage of fossil fuels. Concepts for sustainable mobility solutions, in which electric mobility is one of the key elements, are required to cope with these ecological challenges and, at the same time, create economic growth.

Power-train electrification is reality and no longer a vision of the future. This technology will continue in its development over the coming years in different forms: from hybrid (mild, full or plug-in hybrid, range extender) to battery-powered vehicles. Compared to today, car sales will increase by approximately 50 percent on a global scale by 2020. However, the share of new vehicles sold with combustion engines will decrease, from 98 per cent today to approximately 67 per cent in 2020. In that time period, the share of fully battery-powered vehicles could rise to 5 per cent.

E-mobile drive concepts involve all passenger cars, commercial vehicles, motorcycles and bicycles using electric power exclusively, for at least part of the way, irrespective of whether this energy comes from a battery or a fuel cell. Furthermore, this includes vehicle concepts using electric components to optimise their combustion engines. The 'Structure Study BW$^e$ mobil 2011' examined the different concepts in detail, their technological bases and possible developments.

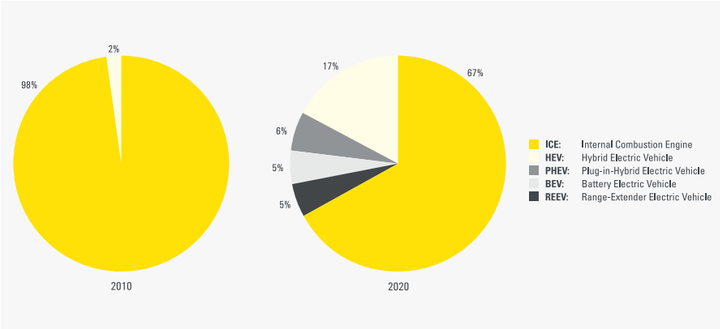


Figure 1: Results of 'Drive concepts market development' meta-analysis (Source: Structure Study BW$^e$ mobil 2011 – Baden-Wuerttemberg on the way to electric mobility)

Vehicle drive concepts can be basically divided into conventional and e-mobile concepts, in which conventional drive concepts mean vehicles with conventional or consumption-optimised combustion engines. Electric mobile drive concepts, however, include hybrid vehicles (parallel, power-split), plug-in hybrid vehicles, electric vehicles with range extension (serial hybrid) and battery electric and fuel cell-powered vehicles, as shown in Figure 2.

Electrification of the drive-train means an enormous shift in the automobile industry: vehicle components and technologies – some becoming obsolete, others emerging – will cause changes in the value-adding chains and market shares of different stakeholders, and economic regions may even relocate. A global market potential worth approximately 100 billion euros is expected for electric drive-train components (electric motors, power electronics, battery systems, charging devices) and vehicle electronics by 2020.

It is essential to create a strong vertical value-adding chain for the 'new drive-train components', to generate a strong influence on employment in Baden-Wuerttemberg in the future. This requires transferring knowledge and expertise from research and development to industrial production. The plant and mechanical engineering industry, with its excellent position in the global markets, must accompany this process. If existing potentials are utilised optimally, this may create almost 10,000 new jobs by 2020.

As a cross-industry trend, electric mobility will not only influence the automobile industry but in fact lead to a merging of the automobile, ICT and energy sectors. Only through the strategic and close cooperation of these three key industries, including the production sector that relates to them all, can market-critical synergies be developed and an industrialisation of electric mobility brought forward. With its well-established structure of strong and innovative companies and its excellent research and educational institutions, Baden-Wuerttemberg is one of the most innovative regions in Europe.

**Structure Study BW$^e$ mobil 2011 – Baden-Wuerttemberg on the way to electric mobility**

'Structure Study BW$^e$ mobil 2011 – Baden-Wuerttemberg on the way to electric mobility' provides a comprehensive insight and outlook to the various technologies and aspects of electric mobility, and shows that Baden-Wuerttemberg is in a great position to secure a leading position in this future market. This study is available free of charge at www.e-mobilbw.de.

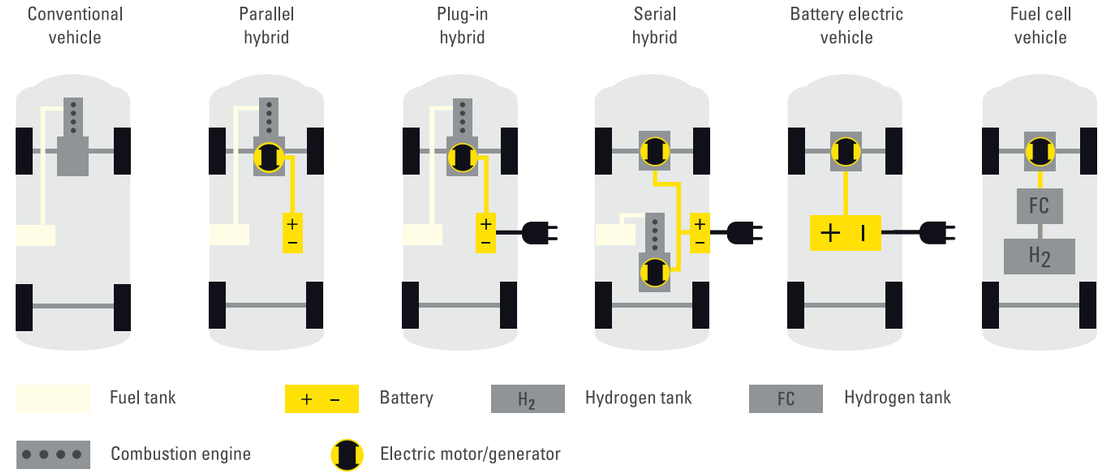


Figure 2: Diversity of e-mobile drive concepts compared to conventional drives (Source: Structure Study BW$^e$ mobil 2011 – Baden-Wuerttemberg on the way to electric mobility)

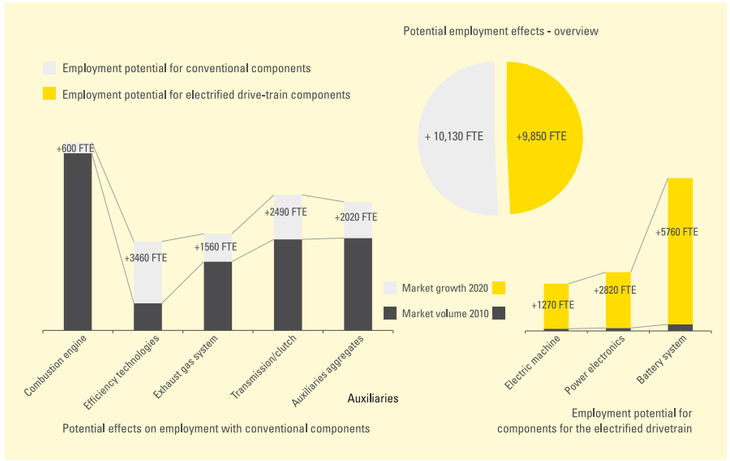


Figure 3: Potential effects on employment in Baden-Wuerttemberg by 2020 (Source: Structure Study BW$^{e}$ mobil 2011 – Baden-Wuerttemberg on the way to electric mobility)

It is not only the electrification of the drive-train that moves the automobile, ICT and energy sectors forward. User behaviour is changing too. Today, owning a car is not considered so important any more. An early indicator of this is the decrease over recent years of the number of younger buyers of cars, while at the same time the number of carsharing users has strongly increased (see Figure 4).

Industry has recognised this trend: Daimler has taken the first step from producer to mobility service provider with its car2go carsharing service (www.car2go.com). Established carsharing providers, Stadtmobil and Deutsche Bahn for example, have started integrating electric vehicles into their vehicle fleets. This development provides opportunities for new operation and business models in the individual but shared mobility sector. New potentials for shared resource mobility surface in the area of mobility services and operating models, which, in the case of electric vehicles, also extends to include infrastructure. Vehicle manufacturers, utility companies, car rental companies and new 'mobility integrators' can take the position of the mobility service provider.

We have only started on our way to future-proof, sustainable and intelligent mobility. This requires a major change of view and offers great opportunities, but bears risks for all parties involved. With many initiatives and a great commitment to e-mobility, Baden-Wuerttemberg has secured an excellent starting position for itself. The following pages will provide you with an overview of the most important activities, for example the 'Leading-edge cluster Electric Mobility South-West' , the 'Showcase Region for Electric Mobility LivingLab BW$^{e}$ mobil' and the 'Electric Mobility Pilot Region' projects.

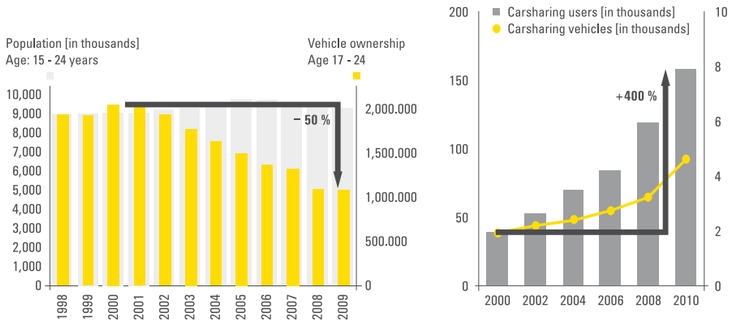


Figure 4: Development of vehicle ownership and carsharing use 2000–2010 (Source: Structure Study BW$^{e}$ mobil 2011 – Baden-Wuerttemberg on the way to electric mobility)



Chapter 2

# BADEN-WUERTTEMBERG – PILOT REGION FOR ELECTRIC MOBILITY

## Regional clusters, networks and initiatives – drivers of innovation par excellence

Mobility is a basic requirement. And future-proof mobility solutions are a good gauge for life quality. Sustainable mobility solutions therefore provide great potential for all of those involved in the development of these solutions. Ever since research in this area began, Baden-Wuerttemberg has been at the forefront promoting the transfer of knowledge between research and industry, thus contributing to the development of joint cross-industry solutions and approaches. With both of its e-mobility initiatives – Elektromobilität I and II – the state's government will have invested about EUR 80 million in structural programmes and projects by 2015 to support the transition from combustion via hybrid to electric and fuel-cell-powered vehicles. Baden-Wuerttemberg presents itself as both an important stakeholder and significant market for these latest technologies in Germany and all over the world.

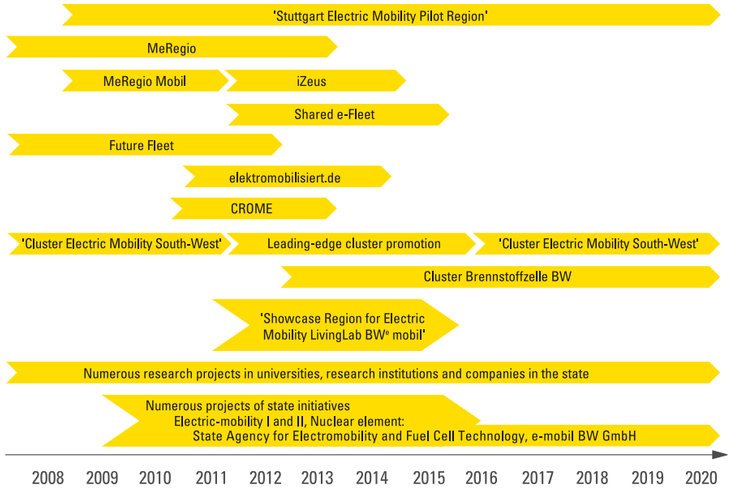


Figure 1: Examples of research and development projects in Baden-Wuerttemberg (in 2013)

**State Agency for Electric Mobility and Fuel Cell Technology in Baden-Wuerttemberg**

e-mobil BW

At the core of the state initiative is e-mobil BW GmbH, the State Agency for Electric Mobility and Fuel Cell Technology in Baden-Wuerttemberg. Topmost goal of this initiative is to demonstrate the practical use of electric mobility, and to make it visible and tangible. To achieve this, the state initiative implements measures to promote research and knowledge transfer, and support the procurement of electric vehicles, the development of the required infrastructure and the establishment of demonstration projects in rural areas.

**Leading-edge cluster**
**Electric Mobility South-West**

electric mobility south-west

With its more than 80 members from industry, universities and research institutions, the ‘Leading-edge cluster Electric Mobility South-West’, founded in 2008, is one of the most significant regional e-mobility networks within Europe. It is the cluster’s goal to advance the industrialisation of electric mobility in Germany, and make Baden-Wuerttemberg a major supplier of e-mobile solutions. In 2012, it was among the five winners of the Leading-Edge Cluster competition held by the Federal Ministry of Education and Research (BMBF). This BMBF competition awards EUR 40 million to winners to be used for research projects. The ‘Leading-edge cluster Electric Mobility South-West’ will use it for the development of electric vehicles, production systems, charging technology and IT solutions for serial production. This worldwide unique cooperation between leading region-based vehicle manufacturers, suppliers, utility companies, ITC organisations and mechanical engineering companies is the perfect basis for the development and production of top products. In addition, top-class universities and research institutions within the cluster transfer the required education and knowledge. The cluster therefore supports the implementation of the federal government’s high-tech strategy in this area. e-mobil BW GmbH – the State Agency for Electric Mobility and Fuel Cell Technology – is responsible for managing the cluster and, with its modern approach of methodical project management, supports the cluster’s activities.

INVENTED IN GERMANY

SPONSORED BY THE
Federal Ministry of Education and Research


Figure 2: The diverse partner landscape of the ‘Leading-edge cluster Electric Mobility South-West’ (examples)

# Application-oriented funding projects

**Electric Mobility Pilot Regions**

Model Regions Electromobility
Modellregion Elektromobilität Region Stuttgart

In addition to the leading-edge cluster competition, the federal government provides several other application-oriented funding projects which include the ‘Electric Mobility Pilot Regions’. In 2009, ‘Stuttgart Region Economic Development Corporation (WRS)’ managed to position Stuttgart as a pilot region for the Federal Ministry of Transport, Building and Urban Development (BMVBS). This includes funding in the amount of EUR 23.4 million so far, which has been used for various projects, for a large number of diverse electric vehicles (cars, buses, vans, scooters, pedelecs, segways) and for developing a public charging infrastructure. In many areas, the pilot region projects are the basis for integrating electric mobility into the transport system within the Stuttgart Region. They provide the foundation for Baden-Wuerttemberg‘s successful application as a ‘Showcase Region for Electric Mobility’.

Funded by:
Federal Ministry of Transport, Building and Urban Development

Coordinated by:
NOW National Organisation Hydrogen and Fuel Cell Technology

**Showcase Region for Electric Mobility LivingLab BW$^{e}$ mobil**

schaufenster elektromobilität
Eine Initiative der Bundesregierung

In April 2012, Baden-Wuerttemberg was nominated as one of four electric mobility showcase projects by the German federal government. These large-scale regional demonstration and pilot projects are also application-oriented research projects. These projects will test the interface between electric mobility and the energy, vehicle and transport systems. The federal government provides a total of EUR 180 million in funding for the showcase programme. It was decided by the German Bundestag, the federal parliament, to use it for the research and development of alternative drive systems.

Around 40 subprojects are being realised in the Stuttgart region and the city of Karlsruhe within the Baden-Wuerttemberg ‘LivingLab BW$^{e}$ mobil’ showcase project. The federal government supports this large-scale ‘LivingLab BW$^{e}$ mobil’ research project with up to EUR 45 million. The state of Baden-Wuerttemberg and the Stuttgart Region is funding the umbrella project with an additional EUR 15 million. LivingLab BW$^{e}$ mobil is coordinated jointly by e-mobil BW and WRS through their common project management office.

livinglab BW$^{e}$mobil
Supported by the State of Baden-Wuerttemberg

Showcase, pilot region and leading-edge cluster complement each other perfectly in their synergy. They present a unique opportunity for Baden-Wuerttemberg to lay the foundation for the industrialisation of electric mobility and future products within the leading-edge cluster. At the same time, capable business models are developed and practical e-mobility is demonstrated in the pilot region and projects in the showcase programme.

**automotive-bw**

The state-wide automotive-bw network coordinated by RKW Baden-Wuerttemberg intends to improve the interaction of stakeholders in the Baden-Wuerttemberg automotive sector. A special focus is placed on connecting vehicle manufacturers and system suppliers with small and medium-sized companies. To this end, automotive-bw founded TecNet groups for central issues in this field, to design approaches for technological challenges and initiate pre-competition cooperation projects. e-mobil BW is a cooperation partner in the ‘Elektromobilität’ TecNet group which was launched in November 2010.

**Baden-Wuerttemberg International (bw-i)**

An important partner in all e-mobility initiatives within the state is Baden-Wuerttemberg International (bw-i), the competence centre of the state of Baden-Wuerttemberg for the internationalisation of industry, science and research. bw-i has already supported several trips to relevant e-mobility locations, for example to China and the US. In addition, bw-i provides opportunities, especially for smaller and medium-sized companies, to participate in trade fairs. This gives them the opportunity to present themselves at important international exhibitions. In 2013, for example, 31 Baden-Wuerttemberg companies, universities, research institutions, regions and associations were exhibitors at the MobiliTec fair, held at the Hanover trade fair centre. They all shared a booth organised by bw-i and e-mobil BW.



Chapter 3

# EDUCATION AND QUALIFICATION IN SUSTAINABLE MOBILITY

## Basis of the development of future-proof technologies

Baden-Wuerttemberg’s strong automotive and automotive supply industry has a high demand for qualified employees in the most diverse of professions, now and in the future. After all, competent and motivated employees, people with strong commitment and ideas, are the ones that make Baden-Wuerttemberg a world leader in sustainable mobility.

All along the value-adding chain – from research and development to production, sales, after-sales and recycling – scientists, social scientists, engineers, business experts, skilled workers, craftspeople and many other professions are required. They will need the proper skills and competencies in sustainable mobility and be able to put them into practice. Education and qualification are the cornerstones in the development of future-proof technologies. In its second report, the ‘National Platform for Electric Mobility’, a consulting board for the federal German government comprised of experts from industry, politics, science, associations and labour unions, emphasised the significance of university education and occupational training.

Aligning the educational programmes of universities and universities of applied sciences to the needs of industry is essential for Germany and especially Baden-Wuerttemberg to continue their leadership role in sustainable mobility. Occupational training programmes that train and qualify workers are equally important to fulfil these new requirements.

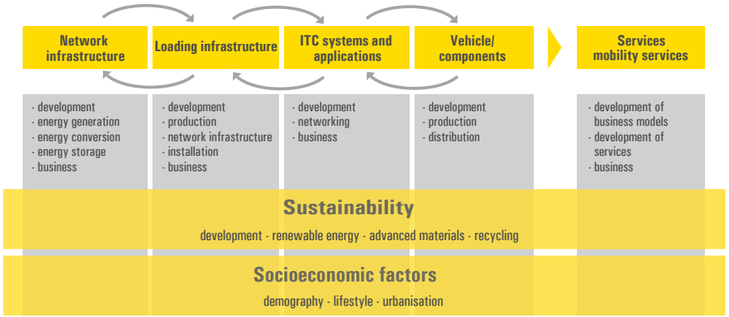


Figure 1: Sustainable mobility system (Source: Academic qualification – analysis of the educational landscape with regard to sustainable mobility)

A core element of qualification is the transfer of a thorough understanding of the complex system of sustainable mobility (see Figure 1). This is best achieved by involving an interdisciplinary linkage of engineering and non-technological competencies (for example, economics).

Baden-Wuerttemberg’s diverse educational system (comprising universities, universities of applied sciences, cooperative state universities) meets the most diverse requirements of industry. Figure 3 shows the distribution of academic programmes for sustainable mobility in Germany. Of equal relevance are the advanced training programmes for persons in employment.


Figure 2: Topics of sustainable mobility (Source: Academic qualification – analysis of the educational landscape with regard to sustainable mobility)

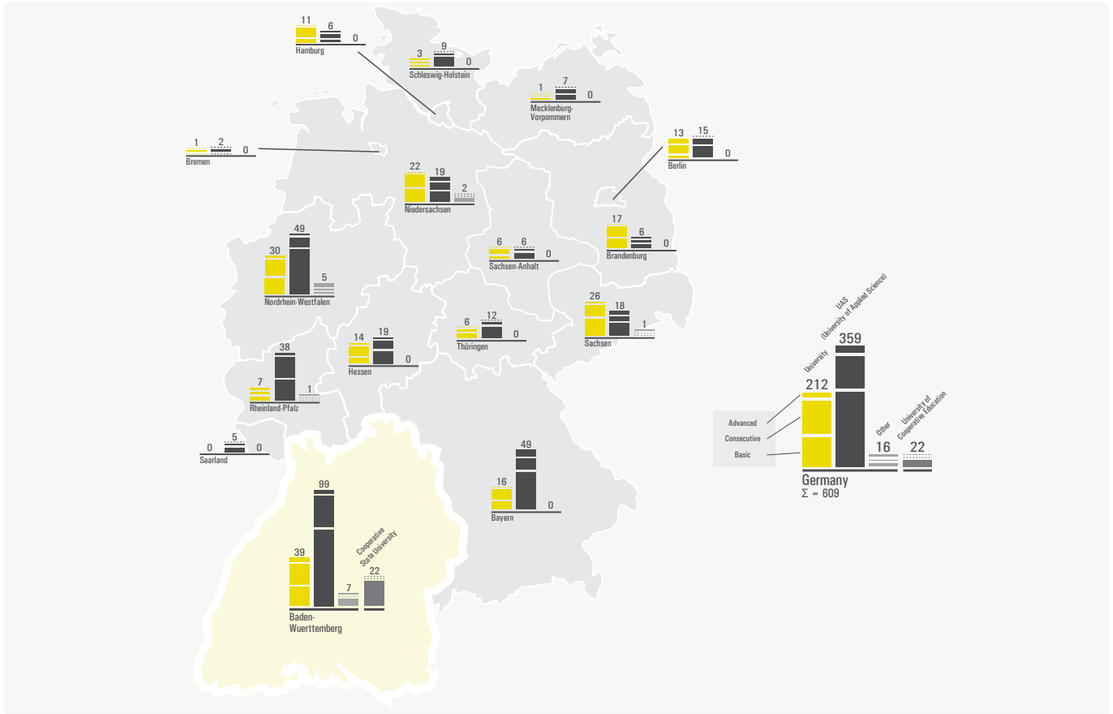


Figure 3: Distribution of academic programmes in the area of sustainable mobility (Source: Academic qualification – analysis of the educational landscape with regard to sustainable mobility)

In 2012, e-mobil BW commissioned a comprehensive study on academic qualification, which gives the reader an overview of educational programmes in the area of sustainable mobility in Germany. The study, which also shows what universities and graduates need to fulfil to meet industry requirements, is available for download at www.e-mobilbw.de.

**Academic qualification – analysis of the educational landscape with regard to sustainable mobility**

This comprehensive study gives companies an overview of Germany's educational institutions with regard to sustainable mobility. Furthermore, it lists what companies expect from universities and graduates, and it includes recommendations on how administrations can contribute to more effective information and communication processes between universities and companies.
(Available in German only.)



Chapter 4

# ELECTRIC MOBILITY CHANGES OUR LIVING ENVIRONMENT

## Sustainable added value through integration and networks

Integrating electric mobility into our everyday lives makes sense in the long run, but only if the entire system is considered. To this end, the switch to electric mobility represents an important factor in Germany's energy transition. Electric mobility offers an opportunity to meet international consumption and $CO_2$ emissions limits over the long term, by severing energy consumption from fossil fuels. Moreover, electric vehicles can be used as flexible storage units that store energy from renewable sources, then release it when needed – a valuable contribution to grid stability.

This transition towards sustainable mobility will affect various aspects of our lives, directly and indirectly, and will permanently alter our living environment. There is plenty of potential for electric mobility, especially in the area of innovative residential construction, as evidenced in several current projects in Baden-Wuerttemberg.

In the Fellbach ZEROplus showcase project, for example, seven urban houses were built that generate more energy than required by the people living in them. What's more, the now familiar Plus Energy House concept was expanded to include electric mobility. In the future, solar power generated by photovoltaic systems on the roofs of houses will supply families with power and charge several electric vehicles.

In other 'LivingLab BW$^e$ mobil' projects, the residential and e-mobility project in Stuttgart's Rosenstein quarter for example, residents of apartment buildings are carsharing electrically powered cars as an alternative to private ownership. Another example that is currently being realised in Stuttgart, but is not part of the funding programme, is the residential project at Europaplatz. The common goal of these projects is to use vehicles as efficiently as possible. The use of electric, but also conventional, carsharing vehicles has a positive effect on inner-city congestion as it reduces the number of cars on the road. Clever linking with the public transport system can significantly improve this effect and reduce emissions even more.

Electric mobility's contribution to urban development and to achieving climate-protection goals in medium-sized cities is being examined in the EMiS project (electric mobility in the Staufer region). This joint project of the cities of Göppingen and Schwäbisch Gmünd is being sponsored by the German Ministry of Transport, Building and Urban Development, as part of the 'Electric Mobility Pilot Regions' programme. Its intention is to develop guidelines for municipalities by the end of 2014, showing how, and under which conditions, urban areas may develop into 'e-mobile cities'.

However, integration options for electric mobility are not only limited to residential properties. In Sindelfingen, for example, an industrial zone is to become sustainable, energy-efficient and resource-saving. This restructuring measure is funded by the Baden-Wuerttemberg Ministry of the Environment. The 'eCarPark Sindelfingen' showcase project involves a smart grid that integrates several electric vehicles. These vehicles use on-site generated renewable energy and behave as flexible, mobile energy storage units; this contributes to a beneficial energy balance of the industrial zone as a whole.

These examples show the diverse field of application for e-mobility already in existence today, and how intelligent e-mobile solutions can help shape a sustainable living environment.

Chapter 5

# MUNICIPAL MOBILITY SOLUTIONS

## Creating the future – actively and responsibly

The need for mobility will continue to increase throughout the coming years. This is especially true on a global scale, but also for Baden-Wuerttemberg.

Increasing mobility presents extreme challenges for cities and towns. While mobility is an important aspect for the improvement of life quality, it also has its adverse effects. Traffic congestion impacts the environment and the quality of life; as a consequence, the competitiveness of a town or city suffers. Innovative environmental technologies and mobility concepts that cater to the need for mobility of the individual have therefore become crucial.

The goal of area-wide and sustainable mobility will go through various phases, according to the reports of 'National Platform for Electric Mobility'. The current phase of market preparation includes the realisation of individual model and demonstration projects and some pilot projects. Testing these new technologies in specific locations is made possible above all through the support of local governments.

Municipal decision-makers are initiating and actively promoting these different projects and are also participating in funding programmes run by the federal government or the state of Baden-Wuerttemberg. Several municipalities are involved in the 'Electric Mobility Pilot Regions' and the 'Showcase Region for Electric Mobility LivingLab BW$^{e}$ mobil', where the application of new technologies is at the top of the agenda. They demonstrate to the region, and to the nation, that they are actively and responsibly taking part in creating the future. Many of the municipalities are using renewable energies and integrating electric vehicles into their fleets where possible.

The state capital of Stuttgart is setting a good example: it has established a charging infrastructure for electric vehicles, as a preparatory project for 'LivingLab BW$^{e}$ mobil'. The project is funded by the state of Baden-Wuerttemberg and realised by EnBW. About 160 charging stations were built in public areas throughout Stuttgart. Their use and acceptance is now being studied within the showcase project 'Ladeinfrastruktur Stuttgart und Region'. Solutions for ensuring long-term barrier-free access to public charging stations include providing access codes via text message. This allows users of electric mobility to charge their vehicles flexibly, and independent of their utility companies. The proper business models for charging infrastructure in public or semi-public areas are also being examined. For example, the showcase project 'charge@work', headed by Daimler AG, is studying charging infrastructures at the workplace.

Public transport is an important factor in the introduction of sustainable mobility. Here, in close cooperation with municipal and regional transport companies, municipalities have a number of innovative technologies available for their new infrastructure. This not only concerns the use of vehicles with alternative drives; SSB in Stuttgart, for example, employs several plug-in hybrid buses within the showcase project. Esslingen has used trolley buses for some years now, and Fellbach and Stuttgart launched buses utilising fuel cell technology in October 2013. Furthermore, public transport can be used to develop new intelligent mobility solutions. In this connection, 'intermodality' plays an important role, linking multiple modes of transport. The Stuttgart Region is examining intermodal mobility management within the 'LivingLab BW$^{e}$ mobil' project, which combines different transport systems. The Stuttgart Service Card integrates ticket, booking and service in one platform and allows the use of different (e-mobile) means of transport within a network.

Behind the Stuttgart Service Card project is a complex technical system applying software solutions. These technical solutions are also used in fleet management and, especially in public service fleets, can help identify potentials for the electrification of the vehicle fleet. The city of Ludwigsburg, for example, after having analysed its user profile, has now integrated several e-vehicles – from motorcycles to cars – into the municipal vehicle fleet. The Ministry of Transport and Infrastructure had also analysed the fleets of the state authorities within the 'LivingLab BW$^{e}$ mobil' project and is integrating e-vehicles where possible.

To realise comprehensive and future-proof mobility systems, electric mobility projects must no longer be limited to certain towns or cities. This requires the interlinking of municipalities as done for example in the EMiS project within the 'Electric Mobililty Pilot Region'. In Göppingen and Schwäbisch Gmünd, the project examines the potential of electric mobility for urban development. The goal is to create a manual that helps communities and offers recommendations with respect to the integration of electric mobility into modern urban planning and traffic concepts.

The Lake Constance district has also identified the need for linking mobility in this regard. At the beginning of 2011, a work group of district representatives from the cities and towns of Friedrichshafen, Überlingen, Meckenbeuren, Hagnau and Deggenhausertal was established. Together with the local utility company and the Baden-Wuerttemberg Cooperative State University (DHBW), the work group focuses on technical, organisational, administrative and other questions surrounding this future-oriented topic, and coordinates individual participant activities. Several municipalities of the Lake Constance district cooperate within the BodenseEmobil project. The goal of this project is to promote electric mobility in a rural region that is characterised by industrial zones and tourism, through threefold integration (public transport, energy, communication).

Any comprehensive transition towards sustainable and future-proof mobility starts within the local communities. Only when practical solutions and sustainable business models are found can technological change be expanded and transferred to the people. With their activities in different sponsored projects in the wide area of electric mobility, towns and cities in Baden-Wuerttemberg are evolving and developing to become e-mobile pioneers.

**New options for communities**

With our publication 'New options for communities – electric mobility as a building block of future-proof municipal development in Baden-Wuerttemberg', responsible officers in the state's communities are introduced to the topic of sustainable mobility. Practical examples show how electric mobility can be realised in their local communities for the benefit of their inhabitants. It presents options for activities, concepts and ideas for communities that support them in initiating and expanding e-mobility programmes. (Available in German only.)

Chapter 6

# COMPANIES

6.1

# ENERGY TRANSITION. MADE IN BADEN-WUERTTEMBERG

## Lithium-ion energy storage systems for stationary applications

**ads-tec GmbH**

Raiffeisenstrasse 14
70771 Leinfelden-Echterdingen, Germany

**Year of establishment:** 1980
**Employees:** > 230 (2012)
**Turnover:** approx. EUR 40 – 50 million (2011)


electric mobility south-west

livinglab BW°mobil

ads-tec develops and produces lithium-ion-based energy storage systems for stationary applications. These systems are scalable (including MWh range), and can therefore be used in many different energy transition applications, for example in e-mobility infrastructures. Big-LinX is an ads-tec-developed IT management cloud, for the intelligent and secure control and integration of energy flow, charging and discharging systems. ads-tec participates in numerous research and development projects. For example, ads-tec cooperates with EnBW within the iZEUS project to test the integration of an energy storage unit into a smart grid and its control via Big-LinX. The project researches, among other things, the management of all grid members through the central cloud system.

The focus here is to guarantee the efficient interaction of energy storage units and photovoltaic systems, and e-mobility charging stations (within the Smart Traffic subproject) and Smart Homes. ads-tec has 100 per cent process and development expertise and is therefore an able partner in the development and production of customised battery systems. These energy storage units are produced in Germany.

ads-tec is also involved in the Elektromobilität Süd-West cluster and the Schaufenster Elektromobilität project, and therefore remains in close contact with companies and research institutions along the entire value-adding chain.

**www.ads-tec.de**

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t.speidel@ads-tec.de



6.2

# INNOVATIVE MOBILITY SOLUTIONS –

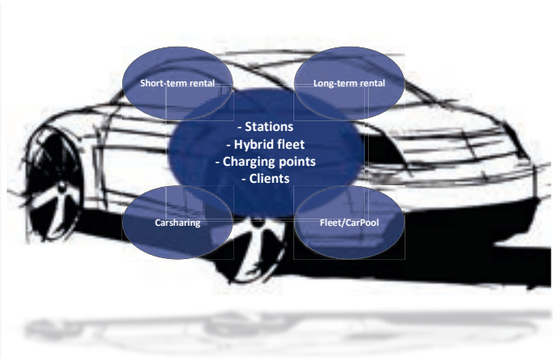
## Sustainable fleet management

**Ametras rentconcept GmbH**

Ottostrasse 2
76275 Ettlingen, Germany

**Year of establishment:** 2001
**Employees:** 35 (2012)
**Turnover:** EUR 3.7 million (2012)

AMETRAS rentconcept




electric mobility south-west

No matter how mobility might look like tomorrow, we're offering the software solutions for your company today. Our market-leading ERP AMS mobility and rental platform suits your business model, whether it is carsharing, car pool or short-term or long-term rental. Boasting more than 100 installations all over Europe, with a customer base ranging from small enterprise to global player and an enterprise system architecture that is unlimited with respect to users, number of vehicles and renting operations, AMETRAS RENTCONCEPT's success is proof of the efficiency of its products.

E-mobility within a hybrid fleet is specifically demanding for automatic vehicle planning in a fleet management system. Range limitations and set-up times caused by the need for recharging represent a new challenge for fleet management. These challenges, and the goal to make our future mobility more sustainable, are the centre of AMETRAS RENTCONCEPT's focus. Therefore, we participate in the 'Leading-edge cluster Electric Mobility South-West' and offer solutions to analyse and optimise the different types of electric vehicles in a given fleet. Furthermore, we provide support for your mid- and long-term strategic and economic fleet planning regarding electric vehicles and provide an opportunity to manage your hybrid fleet and your charging stations economically and efficiently.

**www.ametras.com**

**Contact**

Claus-Michael Keun
Phone: +49 7243 505360
Fax: +49 7243 505370
michael.keun@rentconcept.de

6.3

# AREUS ENGINEERING

## Think ahead. For a better solution.

**Areus Engineering GmbH**

Hertzstrasse 16
71083 Herrenberg, Germany

**Year of establishment:** 2004
**Employees:** 33
**Turnover:** EUR 2.9 million (2012)


**Contact**

Oliver Kraus
Phone: +49 7032 32098 0
Fax: +49 7032 32098 29
geschaeftsleitung@areus-e.com

To actively partake in the design of the fuel cell of the future, Areus Engineering has developed an infrared communication unit for communication between vehicle and charging station; IR interface and control unit are located in the charging station. This innovation significantly improves fuel cell economy. Step by step, we approach our goal of emission-free driving and, at the same time, solve the conflict between a globally increasing demand for mobility and effective environmental protection. Integrating electric drive-trains requires experience and system expertise.
For Areus Engineering, the following design projects are the focus of their activities:

- Efficient battery management
- Innovations for vehicles (new electronic components, modules and control units)
- New products for the interior (haptic and acoustic switches and buttons, interior LED lighting)
- Driver assistance and pedestrian recognition using camera systems
- Infrastructure innovations (charging process optimisation)
- Integration of apps / software products for vehicle operation

Areus Engineering GmbH is a leading development partner for the automobile and medical engineering industry. Our core competencies are electronic controllers, antennae, telematics and infotainment systems as well as testing and diagnostic systems for integrating controllers.

**www.areus-e.com**

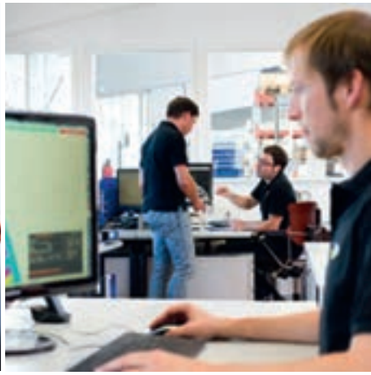
6.4

# MAKE THE WORLD A BETTER PLACE

## With highly efficient electric drives

**ATE Antriebstechnik und Entwicklungs GmbH**
Brandenburger Strasse 10
88299 Leutkirch im Allgäu, Germany

**Year of establishment:** 2000
**Employees:** 65 (2012)
**Turnover:** EUR 18 million (2012)



electric mobility south-west

**Contact**

Wolfgang Thaler
Phone: +49 7561 98248 0
Fax: +49 7561 98248 22
info@ate-system.de

ATE stands for drive technology and development – but above all for a team of highly motivated specialists and engineers with only one common goal: the development and production of stator and rotor components for highly sophisticated electric drives. In brief, for electric motors with maximum individuality, efficiency and durability. And ATE has the capacities to fulfil all requests – from prototype to serial product.

In our workshops, we use CNC machine tools, vacuum casting and laser cutting machines. Right from the start, we leave nothing to chance when we develop the perfect drive unit. We use the latest calculation tools and finite element methods. This makes ATE the leading supplier in the innovative niche markets of the e-mobility industry. Many ATE prototypes in automotive engineering, racing and marine technology easily leave their competitors behind. ATE also supplies assemblies for other areas, such as e-fans and pumps for example. ATE's motor topologies range from permanent magnet synchronous motors to asynchronous motors and reluctance motors. Dimensions range from an overall diameter of the stator assembly of 10 mm to 1 m.

**www.ate-system.de**

6.5

# ATTRACK – THE MOBILITY COMPANY

## Technology I Design I Consulting

**AtTrack GmbH**
**Gesellschaft für Mobilität**
Holderäckerstrasse 23
70499 Stuttgart, Germany

**Year of establishment:** 2004

electric mobility south-west

With its TG700, AtTrack GmbH created a completely new class of vehicle. Package, construction and drive-train topology are truly unique. A payload factor of 47 per cent verifies this. With a vehicle weight of 300 kg, the vehicle features a payload of 270 kg. This clearly shows how important lightweight construction is in connection with electric drive-trains.

We, the AtTrack team, have all the skills and expertise you need for your projects:

- Design and construction of vehicles and components
- Exterior and interior design
- Construction design (for example, carbon fibre body)
- Design and construction of drive-trains for electric motors and combustion engines
- Development of vehicle characteristics (for example, efficiency technology, aerodynamics)
- Production of prototypes and small series, also for racing
- Consulting: e-mobility, innovation/product management

We'd be happy to help you crack your toughest challenge.
**www.attrack.de**

**Contact**

Dr. Ulrich W. Schiefer
Phone: +49 711 3516530
Fax: +49 711 3516532
info@attrack.de

6.6

# THE AUDI TRON FAMILY

## Development of new technologies

**AUDI AG**

Postfach 10 04 57
85045 Ingolstadt, Germany

**Year of establishment:** 1909
**Employees:** 71,210 (2012)
**Turnover:** EUR 48.8 billion (2012)

Audi
Vorsprung durch Technik

livinglab BW[e] mobil

One main goal of Audi is: to develop technologies that uniquely combine fun and sustainability in driving. This involves solutions that allow balanced mobility where economy and ecology have equal weight. g-tron stands for natural gas and synthetic e-gas-powered drive systems that achieve the best possible $CO_2$ emission rates. e-tron stands for consistent drive-train electrification.
Designed as a plug-in hybrid vehicle, the A3 Sportback e-tron combines the best from two automobile technologies – a combustion engine and an electric motor. In parallel drive-trains, a 1.4 l TFSI engine works together with a powerful electric motor. The liquid-cooled lithium-ion battery is mounted in front of the rear axle; it stores 8.8 kWh of energy and has a range of 50 kilometres.

The A3 Sportback g-tron is a pioneer in sustainable mobility. Its 1.4 l TDSI uses Audi e-gas, a synthetic fuel that, in chemical terms, is almost identical to natural gas. This fuel is produced by Audi and is $CO_2$ neutral. Its starting components are water and carbon dioxide and it is produced using renewable energy only.

As part of the 'National Platform for Electric Mobility', a programme funded by the German government, the A1 e-tron model is being used by AUDI AG in the showcase project 'LivingLab BW[e] mobil' to collect practical data in the handling of electric vehicles. The Audi NEoS project conducts customer-oriented research involving test subjects.

**www.audi.de**

**Contact**

Michael Baumann
Phone: +49 841 42593
michael1.baumann@audi.de

6.7

# RELIABLE INTERCONNECT SOLUTIONS FOR E-CAR APPLICATIONS

## Power interconnect for batteries

**AXON' KABEL GMBH**

Hertichstrasse 23
71229 Leonberg, Germany

**Year of establishment:** 1971
**Employees:** 27 – 1650 worldwide
**Turnover:** EUR 115 million


**Contact**

Anthony Cormier
Phone: +49 715 297992 0
Fax: +49 715 297992 7
sales@axon-cable.de


Axon' Cable engineers flat flexible cables for connecting different parts of batteries or inverter systems converting direct current into alternating current. Insulated with polyimide, they resist high temperatures of up to 150°C. The cable's flat configuration saves space in the engine cell. This is an ideal solution for systems requiring energy dissipation.
Axon' specialises in flat flexible cables (FFC), metal contacts and pressfit terminals for board-to-board or PCB connections. Axon' engineers help you select and design special flat cable solutions and connection systems for e-Car applications.
Today, more and more high-tech electronics are used in Advanced Driver Assistance Systems, making it a real challenge to connect all the devices with less and less available space. Reliability, EMC and weight: these are the requirements that Axon' takes into account when designing connectors, cables and cable assemblies for automotive electronics.
For sensors, brake systems and body and engine applications, for example, Axon' supplies composite cables and connections that resist engine fluids, prevent water ingress and resist low and high temperatures.

The Axon' group employs around 1,650 people worldwide, in 11 subsidiaries across Europe, America and Asia.

**www.axon-cable.de**

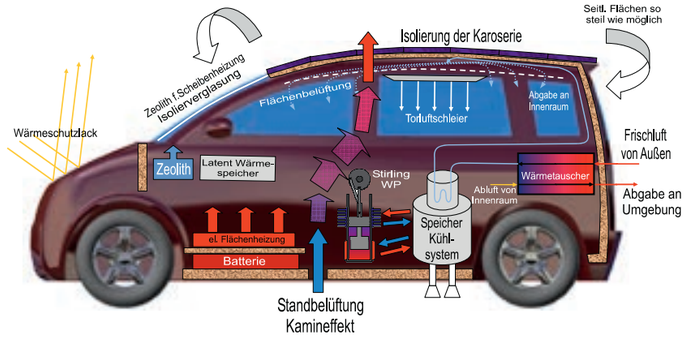
6.8

# MOBILE MEASURING TECHNOLOGY, CONTROLLERS AND THERMAL MANAGEMENT

**Berger Elektronik GmbH**

Kolumbusstrasse 15
71063 Sindelfingen, Germany

**Year of establishment:** 1984
**Employees:** 105 (2012)
**Turnover:** EUR 8.6 million (2012)





**Contact**

Dipl.-Ing. Jochen Retter
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jochen.retter@bergerelektronik.de


For electric vehicles, the efficient use of stored energy is a critical issue. It significantly affects purchasing costs and range. Berger Elektronik develops and produces wireless high-voltage measurement technology that measures and analyses currents and voltages in vehicles to be applied during the development and launch phases of electric and hybrid vehicles, and to transmit the results to stationary units via UMTS or WLAN. Berger also supplies IL and HIL assemblies for the development phase; this includes Linux-based freely configurable restbus simulators for LIN/CAN and Flexray. We supply cost-efficient rapid prototyping controllers with a Matlab Simulink® interface for the prototyping phase. To achieve maximum range, ancillary units – especially air conditioning systems – must be optimised. In addition, Berger supports vehicle manufacturers' pilot projects with a focus on PDUs, ancillary units and thermal management systems. Berger provides project assistance, software, electrics and electronics. We also supply controllers suitable for automobiles for small series and prototypes. For field analyses of high-voltage batteries, we supply sensors and data loggers. And we develop training systems for hybrid and electric vehicles for engineering and vocational schools.
In our large workshop, we can refit vehicle electrics, assemble and lay high-voltage cables, install measurement technology and even carry out complete vehicle test series.

**www.bergerelektronik.com**

6.9

# ELECTRONICS AT BERTRANDT

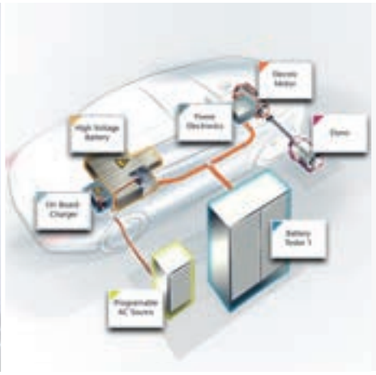
## Simulated. Designed. Integrated. Tested.

**Bertrandt AG**

Birkensee 1
71139 Ehningen, Germany

**Year of establishment:** 1974
**Employees:** 9,952 (2012)
**Turnover:** EUR 709 million (2012)

bertrandt



Each design begins with an idea. Together with its customers, Bertrandt covers the full development process, from first design studies to assistance in series production. In the area of e-mobility, our focus is on design services for complete battery systems and electrical components such as charger units, inverters and DC/DC converters. Engineers and technicians design and pick the right packaging and develop hardware and software that fulfil the requirements of high-voltage and functional safety. Plus system integration, diagnosis and support in series production.

In 2012, Bertrandt opened up a new battery testing centre in Ehningen. It integrates all relevant tests for ensuring and optimising forward-looking solutions. Three battery test stands provide reliable information even in the test phase. For its customers, Bertrandt is able to test components like batteries, e-machines, power electronics and charging units, individually or in combination, in very different environments: for power ranges up to 850 V/1000 A with a maximum of 300 kW.

Today, full-service engineering is a key performance indicator in electric mobility – from the design of electric drive-trains for prototypes and series-production cars to lightweight construction, electronic networks and integrated power-train management (including all safeguarding measures, for example simulation, testing and prototyping).

**www.bertrandt.com**

**Contact**

Klaus Härtl
Phone: +49 7034 656 0
Fax: +49 7034 656 4100
elektronik@bertrandt.com



6.10

# PRIMOVE: DRIVING TRUE ELECTRIC MOBILITY

## The only one-stop shop for charging, battery and propulsion systems for all e-vehicles

**Bombardier Transportation (PRIMOVE)**
Schöneberger Ufer 1
10785 Berlin, Germany

**Year of establishment:** 1942
**Employees:** 36,000 (2012)
**Turnover:** USD 8.1 billion (2012)

BOMBARDIER
the evolution of mobility

primove
true e-mobility

Modellregion Elektromobilität Region Stuttgart

The timing for clean and more sustainable forms of mobility is right as cities worldwide face increasing pressure to reduce $CO_2$ emissions. That is why Bombardier has developed the world's only one-stop shop for true e-mobility, offering vehicle manufacturers and operators the flexible PRIMOVE portfolio.

**Complete package for electric rail and road vehicles**

The fully integrated system of light, long-life batteries, fast inductive charging and efficient propulsion equipment allows cities to readily adopt e-mobility. It makes the shift from conventional transportation to clean e-mobility easy and convenient. Plus, it's affordable. PRIMOVE reduces total cost of ownership by combining automatic wireless opportunity charging with highly efficient energy transfer and compact components that can be integrated into vehicles unobtrusively and that don't reduce their capacity.

**PRIMOVE – e-mobility unplugged**

Thanks to contactless energy transfer between components installed under the road and under the floor of the vehicle, PRIMOVE doesn't need any catenaries, cables or wires. Charging stations and times are integrated into normal operations. With that, neither driving behaviour nor operational processes need changing. There is also no need for additional fleet vehicles or spare batteries, making urban transport more flexible and convenient than ever before.

**www.primove.bombardier.com**

**Contact**
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Fax: +49 30 98607 2146
susanne.schwarz@de.transport.bombardier.com

6.11

# BOSCH PAVES THE WAY FOR ELECTRIC MOBILITY

## From battery to electric motor


**Robert Bosch GmbH**

Postfach 30 02 40
70442 Stuttgart, Germany


**Year of establishment:** 1886
**Employees:** 306,200 (2012)
**Turnover:** EUR 52.3 billion (2012)

BOSCH
Technik fürs Leben

Modellregion Elektromobilität Region Stuttgart

electric mobility south-west

livinglab BW[e]mobil


**Contact**

Ian Faye
Phone: +49 711 811 34437
ian.faye@de.bosch.com



**Contact**

Gerhard Rapport
Phone: +49 711 811 24479
gerhard.rapport@de.bosch.com


As a truly innovative technology company, Bosch has made a major contribution to the development of electric mobility. Bosch's commitment goes far beyond automobile technology, also including a wide range of products and services. These include renewable energies, integrated charging infrastructure and battery technology and drive systems for hybrid and electric vehicles. Not forgetting electric drives for e-bikes and e-scooters. Bosch benefits from its long experience as a supplier to the automotive industry; its outstanding system expertise allows them to offer integrated full-range solutions.

Bosch has already established a comprehensive product portfolio for hybrid and electric drives. This includes core competencies such as power electronics, electric motors and batteries. Bosch is able to supply complete electric drive technology – from energy storage to e-motor. The use of hybrid or electric drives affects many other components and systems in a vehicle. Bosch is dedicated in this area too, which includes efficient electric auxiliary systems such as electrically driven steering aids.
Bosch also supplies special brake and ESP systems adapted for hybrid and electric vehicles, which coordinate brake power between conventional friction brakes and regenerative brakes. Furthermore, efficient thermal management for heating and cooling systems in electric vehicles and navigation systems that calculate the best energy-saving routes are included in the Bosch technology portfolio.

**www.bosch.com**



6.12

# CHARGING INFRASTRUCTURE AS A SERVICE

## eMobility Starter Package


**Bosch Software Innovations GmbH**

Ziegelei 7
88090 Immenstaad, Germany


**Year of establishment:** 1997
**Employees:** > 500

BOSCH
Technik fürs Leben


livinglab BW[e]mobil


**Contact**

James Wells
Phone: +49 711 811 58109
Fax: +49 711 811 58100
james.wells@bosch-si.com


The eMobility Starter Package from Bosch Software Innovations allows the easy operation of a charging infrastructure for electric vehicles. All core processes of the charging infrastructure are run as a comprehensive software-as-a-service (SaaS) solution, provided and operated by Bosch Software Innovations. State-of-the-art internet services join remote charging stations.
Intuitive internet portals make it easier for the operators and drivers of electric vehicles to use the charging infrastructure. All charging operations are reliably identified for billing purposes.

**Key benefits**

- Simple, fast and cost-effective entry through software-as-a-service
- Incredibly safe investment as the system can always be easily extended to additional users, charging stations, functions and services
- User-friendly, thanks to intuitive operation

**Intelligent fleet management**
Our effective fleet management module serves as the perfect complement to the eMobility Starter Package, and facilitates the use of fleet vehicles more flexibly and cost-effectively.

**Current projects**
Bosch Software Innovations is involved in many projects at a national, European and international level. The large-scale projects Get eReady and Stuttgart Services within the 'LivingLab BW[e] mobil' initiative represent two examples within Baden-Wuerttemberg.

Further information:
**www.bosch-si.com**

6.13

# 360° ICT CONSULTING

## bridgingIT releases energy intelligently

**bridgingIT GmbH**

N7, 5-6
68161 Mannheim, Germany

**Year of establishment:** 2008
**Employees:** 270 (2012)
**Turnover:** EUR 28.9 million (2012)

bridging IT
Menschen Methoden Lösungen



electric mobility south-west

bridgingIT advises and supports companies with comprehensive and cross-industry knowledge. In the context of our '360° ICT' consulting services, our bridgingIT experts plan and develop innovative ICT solutions in the following areas:

- Smart Energy
- Smart Mobility
- Smart Cities/Smart Buildings

We take into consideration the current issues of energy supply and new mobility concepts in a truly comprehensive manner and then link them with sensible ICT solutions. The goal here is to ensure sustainable competitiveness. This 360° ICT approach helps to look at and develop the requirements and solutions from very differing positions – for example for business models, technologies, products and services.

bridgingIT GmbH was founded in 2008 as an independent IT consultancy. It is an innovative service provider and brings together IT requirements with technical aspects. Around 270 employees at the Munich, Mannheim, Frankfurt, Karlsruhe, Stuttgart and Cologne locations provide consulting services to medium-sized and major customers, realising corporate strategies and implementing modern technologies. As a full-service provider, bridgingIT offers a focused service portfolio, and operates in each case independent of the manufacturer.

**www.bridging-it.de**

**Contact**

Detlef Schumann
Mobile: +49 152 5669 4008
detlef.schumann@bridging-it.de



6.14

# EMOTION INSTEAD OF EMISSION

## car2go electrifies Stuttgart

**car2go Europe GmbH**

Palmenwaldstrasse
Gebäude 3/21
73733 Esslingen, Germany

**Year of establishment:** 2011


livinglab BW-e mobil

Germany's largest electric fleet was launched in Stuttgart in 2012, with 300 battery-driven smart fortwo vehicles. It operates as a carsharing business. Daimler's car2go subsidiary, which started as a pilot project in Ulm in 2008, makes electric mobility affordable for all. It is an associated partner in the Baden-Wuerttemberg 'Showcase Region for Electric Mobility LivingLab BW$^{e}$ mobil'. With car2go, anyone in Stuttgart can now test an e-car for daily use. A smartphone app informs customers where the next available car2go is parked. The membership card opens the car door and locks it afterwards. Prior reservation is not necessary. Customers can park the car in any public parking space within the 75 square kilometre car2go territory. The territory is in the process of expansion; by 2013 it should cover the entire Stuttgart Region. car2go project partners are the State of Baden-Wuerttemberg, the state capital Stuttgart, EnBW (as the operating company of the charging infrastructure) and SSB. The demand for the electric vehicles was so great that only 100 days after car2go was launched it became necessary to increase the fleet to 400. It will be increased to 500 by the end of 2013. Now, more than 20,000 customers use car2go in Stuttgart. car2go was the first in this flexible carsharing segment, and is market leader worldwide with more than 450,000 customers. In addition to Stuttgart, car2go operates electric fleets in 22 other cities, among them Amsterdam, Netherlands, and San Diego, California. car2go mobility will be available in more than 50 cities worldwide by 2015.

**www.car2go.com/de/stuttgart/**

**Contact**

Andreas Leo
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andreas.leo@daimler.com

6.15

# PROFESSIONAL. TELEMATIC. SERVICES.

## Smart charging and remote diagnosis

**CarMedialab GmbH**

Zeiloch 6a
76646 Bruchsal, Germany

**Year of establishment:** 2003
**Employees:** 10 (2011)
**Turnover:** EUR 2 million (2011)

electric mobility south-west

CarMedialab is the leading supplier of remote diagnosis and smart charging systems. Our product spectrum ranges from embedded systems for use in vehicles and charging stations to the operation of comprehensive telematics systems.

For the production of its control units, CarMedialab works exclusively with qualified and TS16949-certified companies. We select the matching partner from our producer network, depending on volume, complexity and required flexibility. This ensures that our company meets its own quality and performance requirements. What really differentiates CarMedialab from its competitors is that it not only supplies embedded systems but also acts as a telematics services provider. It has not only developed and designed systems for the automobile industry for many years – it has also reliably run them throughout their entire operative life cycles.

Researchers from the Karlsruhe Institute of Technology (KIT) cooperate with the companies RA Consulting and CarMedialab for the ELISE project of the 'Leading-edge cluster Electric Mobility South-West', supported by the German Ministry of Education and Research. ELISE is involved with data processing concepts for cars as well as independent charging units. It also researches the interactions between driver, vehicle and environment. Its goal is to make electric vehicles more reliable and more economic and ultimately establish e-mobility in the market.
**www.carmedialab.com**

**Contact**

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Fax: +49 7251 3862 51
heiko.bauer@carmedialab.com

6.16

# CHARGEPARTNER: E-MOBILITY OPERATING SYSTEM

## Authorise, manage and bill charging operations

**Chargepartner GmbH**

Altrottstrasse 31
69190 Walldorf, Germany

**Year of establishment:** 12/2012
**Employees:** 5

**Contact**

Frank Thurecht
Phone: +49 6203 6007511
thurecht@chargepartner.de

Chargepartner offers tested and proven full-service solutions for charging electric vehicles, for individual transport and corporate fleets.

The Chargepartner system integrates charging stations by various manufacturers into a powerful authorisation and billing infrastructure, under a software-as-a-service model. Based on the partner's various roles (for example user, e-mobility provider, utility company, charging station operator, authorisation and collection service provider), Chargepartner provides an IT structure that allows the flexible and cost-efficient realisation of various e-mobility business models.

For our customers, including global leaders in the ERP software or professional catering industries, we plan and operate their e-mobility infrastructures, all from a single source.

At present, Chargepartner operates some of the largest charging parks in the region of Germany, Austria and German-speaking Switzerland. This software solution is highly scalable and supports multiple clients. Internet connection and real-time monitoring of the charging parks allow services such as the booking of charging stations.

**www.chargepartner.de**

6.17

# INNOVATIVE TESTING AND MEASURING TECHNOLOGY

## comemso mobilises systematically – for safe control units in electric mobility

**comemso GmbH**

Talstrasse 49
73760 Ostfildern, Germany

**Year of establishment:** 2009

comemso
your partner for complex embedded solutions


electric mobility south-west

comemso GmbH is the innovative specialist for testing and measuring technology, individual customised solutions in the automotive area and in e-mobility. comemso stands for outstanding products in the field of complex testing and measuring systems for electric mobility. For this we have a highly precise Battery Cell Simulator, to design and validate modern battery management systems (BMS) for electric and hybrid vehicles. Our product portfolio also includes different measurement systems for synchronous high-voltage and high-current measurements. Another one of our innovations is the comemso EV Charging Analyser for examining charging operations and analysing aborted charging operations between charging station and electric vehicle.

With our quality standards and also short development and production cycles, we provide automotive suppliers and OEMs time and market advantages. comemso's embedded system solutions are the result of ISO-certified quality and efficient in-house networking of our product design, product development in hardware and software, electrical systems, production, marketing and sales departments. Our customer-orientation and the extraordinary commitment of our skilled workers and engineers ensure the technical superiority of our products. comemso is certified by DEKRA Certification GmbH in accordance with ISO 9001, ISO 14001 and BS OHSAS 18001.

**www.comemso.de**

**Contact**

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anita.lamparter@comemso.de



6.18

# ALWAYS ONE STEP AHEAD FOR ELECTRIC MOBILITY!

## Sustainable system solutions for individual mobility

**Competence & Design Center for Mobility Innovations**
Graf-Zeppelin-Platz / Flugfeld
71034 Böblingen, Germany

**Year of establishment:** 2009
**Employees:** 5 – 12 (depending on project)

COMPETENCE & DESIGN CENTER FOR MOBILITY INNOVATIONS

electric mobility south-west

Competence & Design Center for Mobility Innovations, founded by Prof. Johann Tomforde – a pioneer of electric mobility and former head of development for smart, stands for systematic and comprehensive solutions in all areas of electric mobility.

An internal team of experts comprising strategy developers, designers, engineers and economists work on sustainable energy-efficient concepts, innovations and system solutions in close cooperation with external experts and system partners. Target industries are:

- Automobile and supplier industry
- Transport and logistics industries
- Utility and infrastructure companies
- and New types of mobility systems, such as TEAMOBILITY

www.**mobility-innovations.de**

**Contact**

Prof. Johann Tomforde
Phone: +49 7031 30695 95
Fax: +49 7031 30695 96
tomforde@mobility-innovations.de

6.19

# CHARGE AND GO!

## Charging technology of the future has been proven in practice

**Conductix-Wampfler GmbH**

Rheinstrasse 27 + 33
79576 Weil am Rhein, Germany

electric mobility south-west

**Contact**

Mathias Wechlin
Phone: +49 7621 662287
Fax: +49 7621 6627287
mathias.wechlin@conductix.com

Consumer use and acceptance of wireless charging solutions has been proven: a family chosen to live in the Efficiency House Plus, a model project sponsored by the Federal Ministry of Transport, Building and Urban Development, is very pleased with the easy handling of the Mercedes A-Class E-CELL vehicle. We quote: “Inductor coils? Fabulous! Okay, at first we thought wireless charging was just a toy for tech-loving engineers. But then we came to love the convenience – no need to plug it in; just park it and the car is good to go in the morning.” The family’s blog on the Ministry’s website speaks for itself.

More experts conclude that in the future electric vehicles will become central in public transport. Projects are being launched all over the world targeting the plugless charging of electric vehicles; energy transfer within a matter of minutes at the bus stop. For instance, an electric bus field trial in Italy shows that opportunity charging done along the route provides sufficient energy and reduces long-term costs. For more than ten years, these 30 buses have been in operation via Inductive Power Transfer (IPT®) from the Conductix-Wampfler system. In the Netherlands, a field trial launched in 2012 of an electric bus shows that one 120 kWh battery covers some 280 km per day, without longer stops for charging than the bus schedule allows. Conductix-Wampfler, the specialist for energy supply and data transmission and, since 1997, for inductive power transfer.

**www.conductix.com**

6.20

# CTC CARTECH COMPANY GMBH

## Enthusiasm and passion for technology on wheels

**CTC cartech company GmbH**

Hanns-Klemm-Strasse 40
71034 Böblingen, Germany

**Year of establishment:** 2007
**Employees:** 45 (2013)

electric mobility south-west

**Contact**

Heiner Schmeck
Phone: +49 7031 2040580
Fax: +49 7031 2040589
info@cartech-company.com

CTC cartech company develops and designs customised electronic components that are unique in the automobile industry, and specifically unique in the area of e-mobility, measurement, control and testing technology. Electric drives and related components such as charging systems, power distributors, converters, power storage systems and cable harnesses have become our key development areas.

Besides this, our focus is on complete vehicle networks and vehicle topology. For the comprehensive testing of these components, CTC operates testing facilities that meet the performance but also safety standards for high-voltage equipment approval.

Actively extending the value-adding chain, CTC goes beyond the usual volumes in prototyping and actually manufactures their component and system designs – we have the capacities to produce small series in our affiliated factory.

Today, the company’s product range includes systems for controlling drive assemblies, solutions for testing automation, sensors, controllers for electric actuators, measurement and testing equipment, solar- and mains-operated charging equipment, cable harnesses and electric mechanical components.

CTC cartech company GmbH has been certified in accordance with DIN EN ISO 9001:2008 in all these areas. Its headquarters are in Böblingen with another site located in Fellbach.
**www.cartech-company.com**

6.21

# INTO THE FUTURE WITH ZERO EMISSIONS

## Daimler offers the widest range of electric vehicles worldwide


**Daimler AG**

Epplestrasse 225
70567 Stuttgart, Germany

**Year of establishment:** 1926
(Daimler-Benz AG)
**Employees:** 275,087 (2012)
**Turnover:** EUR 114.3 billion (2012)


Modellregion Elektromobilität Region Stuttgart

electric mobility south-west

livinglab BW^e mobil

Daimler AG is one of the most successful automotive companies in the world. With its divisions Mercedes-Benz Cars, Daimler Trucks, Mercedes-Benz Vans, Daimler Buses and Daimler Financial Services, it is one of the biggest manufacturers of premium class passenger cars and the largest producer of commercial vehicles with a global footprint. Daimler Financial Services offers financing, leasing, fleet management, insurance and innovative mobility services.

As a pioneer in automotive engineering, Daimler continues to design the future of mobility today: the company's focus is on innovative and green technologies and on safe and high-quality vehicles to fascinate and inspire. Daimler has continuously invested in the development of alternative drive concepts, with the goal to achieve emission-free driving in the long term. In addition to their hybrid vehicles, Daimler offers electric vehicles with battery or fuel cell technology. With a current total of eight locally emission-free models in its portfolio, Daimler is unique in the automotive industry. Vehicles range from passenger car and van to lightweight truck and bus. Daimler designs the mobility of tomorrow with its innovative mobility services with great customer value – first and foremost with car2go, where you can spontaneously rent a car and leave it parked anywhere afterwards within the city limits. Currently, car2go is available in Europe and North America. In three cities, car2go even offers a 100 per cent electric fleet: in San Diego, Amsterdam and Stuttgart.

**www.daimler.com**


**Contact**

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Fax: +49 711 17 94365
matthias.brock@daimler.com




6.22

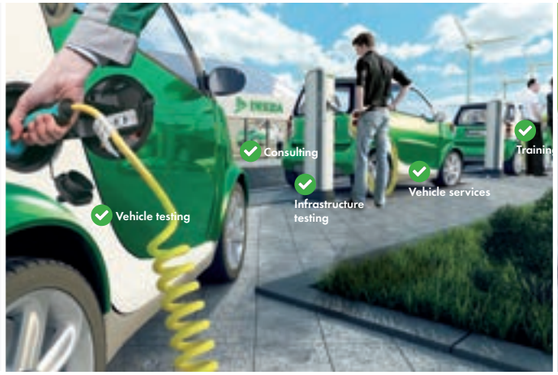
# ELECTRIC MOBILITY NEEDS EXPERTS

## DEKRA offers a wide range of services


**DEKRA SE**

Handwerkstrasse 15
70565 Stuttgart, Germany

**Year of establishment:** 1925
**Employees:** 27,500 (2011)
**Turnover:** EUR 2 billion (2011)


electric mobility south-west

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**Contact**

Andreas Richter
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Fax: +49 711 7861 2470
a.richter@dekra.com


DEKRA, the globally active organisation of experts, under the coordination of the DEKRA Competence Center Elektromobilität in Stuttgart, has given much thought to the complex issue of electric mobility. In this field, DEKRA is involved in the areas of homologation, product safety, standardisation, field tests, crash tests, certification and training. DEKRA provides for charging station infrastructure safety – for example with its DEKRA certificate it launched in 2012 the first independent testing and certification standard specifically designed for e-mobility charging stations. The homologation and testing experts at the DEKRA Automobile Test Center have years of experience in examining and assessing components, systems and vehicles. They test electric and hybrid vehicles in accordance with national and international standards. At the DEKRA Crash Test Center, electric and hybrid vehicles have been tested for years, in addition to conventionally powered vehicles. In the area of education and training, DEKRA developed a detailed training concept for work on high-voltage vehicles. In addition, DEKRA has always committed its activities to making electric mobility safer – for example by developing safety standards as a member of the National Platform for E-Mobility (NPE), or by conducting research together with various partners. It is also the official technology partner of Formula Student Electric, a competition for electrically powered race cars, where DEKRA contributes its racing and e-mobility expertise.

**www.dekra.com**

6.23

# ELECTRIC MOBILITY – MADE IN GERMANY

## Lithium-ion batteries – energy for a new era of mobility

**Deutsche ACCUmotive GmbH & Co. KG**
Neue Strasse 95
73230 Kirchheim u. Teck, Germany

**Year of establishment:** 2009
**Employees:** 199 (2012)

**Contact**

Frank Blome
Phone: +49 3578 3737 300
frank.blome@daimler.com

The key to consistent automotive electrification is powerful, reliable and durable battery technology. Deutsche ACCUmotive GmbH & Co. KG was founded in 2009, as a joint venture between Daimler AG and Evonik Industries AG. Their shared target was the realisation of automotive electrification with the help of powerful, reliable and competitive battery technology.
This makes Daimler one of the few car manufacturers worldwide to have developed, and since 2012 produced, its own batteries for automotive applications. The company's headquarters and its R&D location are in Kirchheim unter Teck, Baden-Wuerttemberg. Its production site is located in Kamenz, Saxony.

Company philosophy: invest in the drive system of the future. Energy storage is at the core of vehicle electrification. Electric drive systems for vehicles require battery systems that meet specific requirements of the automotive industry with regard to safety and environment, power, robustness, durability and cost. With a motivated team of specialists and executives, Deutsche ACCUmotive has advanced the development of these systems and considerably contributed to their progress. Its vision to become the leading supplier of HV batteries is based on the company's extensive expertise, many years of practical experience and an international network in the area of lithium-ion battery development.

**www.accumotive.com**



6.24

# DEVELOPMENTS AROUND ELECTRIC POWER-TRAINS

## Research within the ProBat project

**Dürr AG**

Carl-Benz-Strasse 34
74321 Bietigheim-Bissingen, Germany

**Year of establishment:** 1895
**Employees:** approx. 7,700 (2012)
**Turnover:** EUR 2.4 billion (2012)

**Contact**

Dr. Ralf Schurer
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Fax: +49 7142 75 551900
ralf.schurer@durr.com

As the leading international supplier of painting and production facilities for the automobile industry, Dürr has dedicated its activities to the development of production technologies in the area of e-mobility. Based on its competencies and expertise in assembly technology and automation, Dürr has made the development of production facilities for vehicle batteries and related products their key concern: Dürr develops new concepts for installing batteries into vehicles but also for assembling batteries as such.

In the course of this, Dürr has participated actively in various development projects under the Baden-Wuerttemberg leading-edge cluster. The ProBat (PROjection of quality-oriented, series-flexible BATtery production systems) project was launched to study concepts and instruments for planning and controlling quality-oriented battery system production. For this, methodical plant layouts and quality assurance systems are examined and assessed with regard to their safety and cost-efficiency and then bundled in a software-based planning tool. This tool is used to describe production systems, scalable from small series to mass production.

Dürr, as the project manager, carries out this project together with the Karlsruhe Institute of Technology (KIT) and renowned partners from industry.

**www.durr.com**

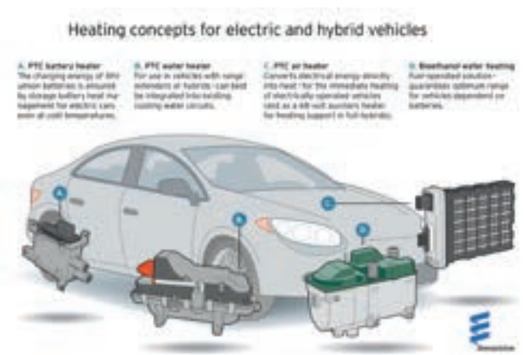
6.25

# E-MOBILITY

## Eberspächer delivers perfect heating comfort

**Eberspächer Climate Control Systems GmbH & Co. KG**
Eberspächerstrasse 24
73730 Esslingen, Germany

**Year of establishment:** 1865
**Employees:** 7,300 (2012)
**Turnover:** EUR 2.8 billion (2012)




**Contact**

Frank Barthel
Phone: +49 711 939 0286
Fax: +49 711 939 160286
frank.barthel@eberspaecher.de

Whether hybrid or electric vehicle, Eberspächer offers custom-made heating systems for all drive types. The thermo-management specialist in this way meets the two challenges of future vehicle generations: economic interior temperature control and the conditioning of sensitive batteries. As the only full-service provider in the industry, Eberspächer provides the right system for each vehicle type and each drive type. Its product range includes air and water heating systems, electrically and fuel powered.
Eberspächer catem, specialist for additional electric heaters, has already developed the second generation of compact high-voltage PTC heaters. These innovative components are used in almost every electric vehicle and operate with voltages of up to 600 volts. E-heaters are specifically suitable for short-distance vehicles, as these zero-emission units help keep the air clean in metropolitan areas.
Fuel-powered heaters from Eberspächer work independently from the vehicle's power system. These systems are easy on batteries, which make them first choice for longer distances. Such heaters tolerate alternative fuels such as biodiesel, and are available for use with 100 per cent ethanol fuel, as well.

In addition, Eberspächer works on solutions for pre-heating high-voltage batteries. Such batteries need a specific temperature range for optimal performance. For electric vehicles with hybrid drive, Eberspächer catem offers high-voltage PTC water heaters that control the vehicle battery temperature as well, if necessary.
**www.eberspaecher.com**



6.26

# EVERYTHING FOR YOUR E-MOBILITY IDEAS AND PROJECTS

## Consulting – Design – Production – Distribution

**E-CAR-TECH Consulting GmbH**

Geislinger Strasse 6
72348 Rosenfeld, Germany

**Year of establishment:** 2010
**Employees:** 5 (2013)

Modellregion Elektromobilität Region Stuttgart

**Contact**

Martin Oberdörfer-Schmidt
Mobile: +49 174 8047633
Fax: +49 7428 918194
oberdoerfer-schmidt@e-car-tech.de

The major car manufacturers have finally started selling electric vehicles! However, if you have your own e-mobility ideas and would like to realise them too, you need to find the suitable components and technical support. E-CAR-TECH Consulting GmbH closes this gap with its wide range of services and comprehensive product portfolio comprising ready-made systems and components for electric drive concepts.

Our competencies and expertise provides you with effective solutions for new e-car projects and refitting projects for combustion engine vehicles. We participate in international projects as system and component suppliers for vehicles independent of manufacturer. We are an exclusive cooperation partner of Curtis Instruments, a global leader in the market for high-quality drive systems. We advise and train our customers in the practical application and in programming by passing on our know-how, so that electric mobility has the chance to develop into an interesting field of business. The modular E-CAR-TECH concept is proven in practice and offers a wide range of applications in many areas of business. It combines the high quality of individual components with innovative technology and safety. The modular system contains open interfaces and is perfect for training and educational purposes by conveying the technical and electronic areas of e-mobility in a very practical manner.

**www.e-car-tech.de**

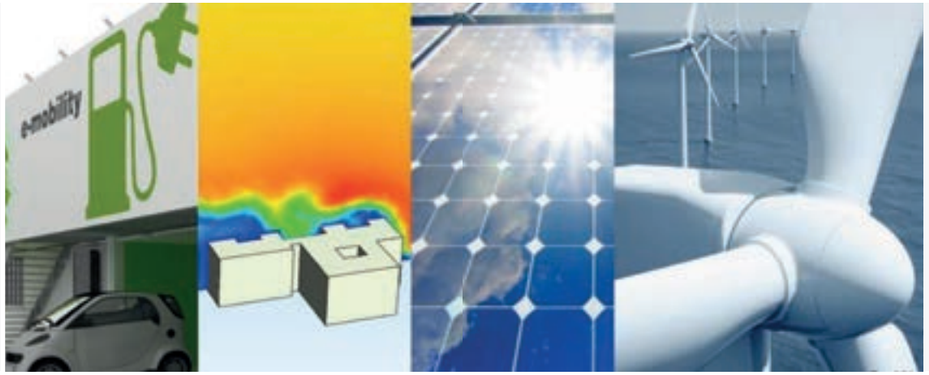
6.27

# INTEGRATED ENERGY CONCEPTS

## Facility management

**EFG Engineering Facility Group Ingenieurgesellschaft mbH**
Berblinger Strasse 12
71254 Ditzingen, Germany

**Year of establishment:** 2001
**Employees:** 18 (2012)
**Turnover:** EUR 1.3 million (2012)




livinglab BW mobil

EFG Engineering Facility Group is an engineering consultancy focused on energy management, engineering and facility management project planning and consulting.

By using the latest simulation tools, EFG develops innovative concepts for the efficient and resource-friendly power supply for new and existing buildings.

EFG's portfolio includes the planning of complex building technology as well as the drafting of building management concepts to run through the entire course of the property life cycle. EFG planning and consulting services supervises all phases of projects being conducted within Germany, as well as abroad. In addition, EFG drafts integrated energy and climate protection concepts for municipalities and major industry projects. These holistic concepts include the use of electric mobility for smart grid solutions, as a component that combines the supply of sustainable power and innovative mobility technology.

In its participation in various research projects, such as Schaufenster E-Mobilität Baden-Wuerttemberg or Energetikom, EFG contributes to the development of new, future-oriented ideas.

**www.efg-gmbh.de**

**Contact**

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Fax: +49 7156 93739 61
info@efg-gmbh.de



6.28

# EMISSION-FREE E-MOBILITY

## Emotional charge

**EIGHT GmbH & Co. KG**

Carl-Zeiss-Strasse 12
73079 Süßen, Germany

**Year of establishment:** 2011
**Employees:** 2 (2011)

**Contact**

Christoph B. Rößner
Phone: +49 7162 9619 10
Fax: +49 7162 9619 81
info@eight.eu

EIGHT aims to inspire people to go for emission-free mobility. Therefore the company develops solar-powered charging stations that incorporate all positive characteristics of electric mobility and may help electric vehicles to become part of a modern urban lifestyle. Innovative production technologies and a digital process chain provide the platform for the efficient realisation of individually designed products.

EIGHT's first public appearance was at the eCarTec fair in 2011 where they presented their Point.One solar charging station. This basic four-car model produces clean power for 40,000 kilometres each year. The weather protection provided by the integrated solar roof means parked cars need to put less energy into heating or cooling, which makes the battery last longer. The integration of the latest technologies from the world of information and telecommunication helps to create positive business cases. Point. One provides an attractive solution to the challenging interaction between people, their cars and solar energy and therefore makes the potential of emission-free mobility visible, tangible and usable. Awards from Fraunhofer IAO and the Federal Ministry of Transport and many other organisations confirm this. This holistic approach combining design, technology, user-friendliness and sustainability – which also distinguishes EIGHT from its competitors – creates a symbol that makes electric mobility an attractive option.

**www.eight.eu**

6.29

# ECONOMIC E-MOBILITY FOR COMMERCIAL VEHICLES

## Electric vehicles with 3.5-tonne load capacity – customers from greengrocer to parcel service

**ElektroFahrzeuge Schwaben GmbH (EFA-S)**
Raubisstrasse 1
73119 Zell unter Aichelberg, Germany

**Year of establishment:** 2008


**Contact**

Bastian Beutel
Phone: +49 7164 919847
Fax: +49 7164 919848
info@efa-s.de

ElektroFahrzeuge Schwaben GmbH (EFA-S) develops eco-friendly and highly efficient electric power-trains for passenger cars and commercial vehicles to make e-mobility affordable and profitable. This Swabian company's competitive edge is based on a combination of three factors:

- Extensive know-how and innovations in battery technology and battery management
- Use of the latest three-phase synchronous motors
- Retrofitting existing vehicles, making the purchase of new ones unnecessary

EFA-S retrofits existing, already amortised but reliable vehicles, which mostly have engines that don't comply with today's environmental protection regulations and have a negative impact on the company's image. As fully electrically powered vehicles they can be used in low-emission zones and promote a positive image. EFA-S retrofits vehicles with load capacities of up to 7.5 tonnes with electric drive-trains, irrespective of the brand or vehicle type. The list of retrofitted vehicles ranges from VW Polo to VW Transporter/Bus, or vans such as Iveco Daily and Renault Master.
EFA-S vehicles are used by the greengrocer next door, who sells goods at regional markets and might even pull a two-tonne trailer, and such large enterprises as UPS. The parcel service has its traditional brown service vans of the type P80 retrofitted by EFA-S to electric with a load capacity of 3.5 tonnes. The vehicles are used in the regions of the Swabian Alb, the Ruhr region, in Karlsruhe and Amsterdam.

**www.efa-s.de**

6.30

# ELECTRIC MOBILITY MADE IN STUTTGART

## Discover your new drive

**ELMOTO – ID-Bike GmbH**

Ludwigstrasse 59
70176 Stuttgart, Germany

**Year of establishment:** 2008
**Employees:** 12 (2012)
**Turnover:** EUR 1,500.00

**Contact**

Sven Holtermann
Tel.: +49 711 25360410
Fax: +49 711 25360419
info@elmoto.com

The creators of ELMOTO started off in 2009 with the mission to revolutionise urban mobility with electric vehicles. Fun, design and suitability for daily use were their focus, as well as green and emission-free driving.
The result was a completely new class of vehicle between bicycle and scooter – the ELMOTO.

No pedals, electric drive, 45 km/h top speed and only 47 kg of weight equip the driver with a totally new driving experience. The extraordinary design of the HR 2, as well as the super-quiet ride, guarantees prying eyes when driving to work through the city.

The similarities to bicycles make it easy to drive. Also smaller persons feel comfortable due to the light weight of the HR 2. Comparable scooters are at least twice as heavy and therefore more difficult to handle. Take your driving license for cars or scooters (class M), put your helmet on and off you go!

Not only the young enjoy the ELMOTO; adults with a taste for good design, quality and driving experience find this new type of driving experience super fun and exciting.

**www.elmoto.com**

6.31

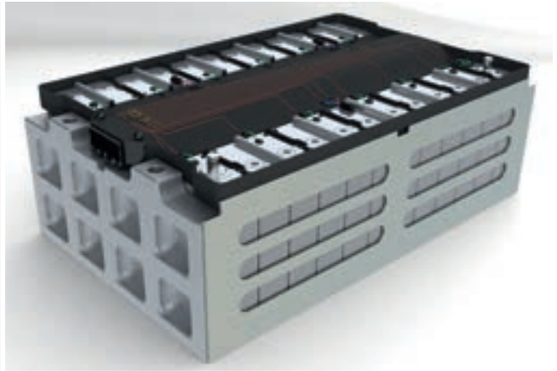
# PARTNER FOR GROUNDBREAKING INNOVATIONS

## ElringKlinger. Experience mobility – drive the future

**ElringKlinger AG**

Max-Eyth-Strasse 2
72581 Dettingen/Erms, Germany

**Year of establishment:** 1879
**Employees:** 6,257 (2012)
**Turnover:** EUR 1,127.2 million (2012)



electric mobility south-west

**Contact**
Battery Technology
Jan Groshert
Phone: +49 7123 724 0
Fax: +49 7123 724 9006
info@elringklinger.com

**Contact**
Fuel Cell Technology
Dr. Uwe Maier
Phone: +49 7123 724 0
Fax: +49 7123 724 9006
info@elringklinger.com

Whether the focus is on combustion engine or e-mobility, ElringKlinger is one of just a few automotive suppliers with the necessary expertise to provide customised product solutions and engineering services for all the drive technologies of the future. We supply cylinder-head gaskets, speciality gaskets, plastic housing modules and shielding components for engine, transmission, exhaust tract and underbody applications for almost every vehicle and engine manufacturer worldwide. Exhaust gas purification technology and components for lithium-ion batteries and fuel cells complement our portfolio. ElringKlinger started early in the development of products for alternative drive concepts and at the same time invested in special manufacturing facilities. Since mid-2011 we have been launching series production of cell contact systems and module connectors for lithium-ion batteries used in hybrid and electric vehicles. In addition, the company produces components and sub-components for high- and low-temperature fuel cells. This includes SOFC stacks for the on-board electricity supply of trucks, bipolar plates with integrated sealing elements used in PEMFC stacks in passenger car drive-trains and complete PEMFC stacks for warehousing operations. We harness our material and process know-how for groundbreaking innovations and eco-friendly mobility. These efforts are supported by our committed workforce of more than 6,200 people at 41 locations worldwide.

**www.elringklinger.com**



6.32

# eML – ECONOMICAL E-MOBILITY

## Holistic mobility concepts from a single source

**e-Motion Line GmbH**

Heinrich-Wittmann-Strasse 23
76131 Karlsruhe, Germany

**Year of establishment:** 2011

e-Motion Line





livinglab BW mobil

**Contact**

Max Nastold
Phone: +49 721 66597 138
Fax: +49 721 66597 139
max.nastold@e-motion-line.de

The benefits of e-mobility can already be exploited to an extent that economical uses can be realised today. This does not just mean cost-efficient mobility but also maximising the ecological benefit of the technology. With these advantages in mind e-Motion Line GmbH (eML), a spin-off of the Karlsruhe Institute of Technology (KIT), designs individually customised mobility concepts for its customers.
As an electric mobility operator eML offers a full range of services including:

- Analysis and design of operations
- Provision of electric vehicles including infrastructure
- Safety training courses
- Vehicle operation and mobility guarantee
- Optimisation and metering of operations
- E-bus profitability calculation

Based on its years of experience eML has developed introductory and operative processes specifically to implement commercial e-mobility. Through this approach eML can guarantee no limitations of the existing operations and ensure the sustainable and feasible use of this technology. eML relies on the latest generation of electric vehicles and charging infrastructure. One of eML's current projects is the RheinMobil showcase project, a three-year fleet test which intends to prove the profitability of cross-border e-commuter traffic. As the central electric mobility operator eML designed the mobility concepts and provides the vehicles for the participating companies Siemens and Michelin.

**www.e-motion-line.de**

6.33

# ELECTRIC MOBILITY AT ENBW

## We're making Baden-Wuerttemberg e-mobile

**EnBW Energie Baden-Wuerttemberg AG**

Durlacher Allee 93
76131 Karlsruhe, Germany

**Year of establishment:** 1997
**Employees:** 20,000
**Turnover:** EUR 19 billion

Modellregion Elektromobilität Region Stuttgart

electric mobility south-west

livinglab BW mobil

**Contact**
Stephan Wunnerlich
Senior Manager Strategy & Business Development
Phone: +49 721 6314476
Fax: +49 721 6313139
s.wunnerlich@enbw.com

The energy sector is changing – and we, EnBW Energie Baden-Wuerttemberg AG, intend to actively take part in this process. We seriously believe electric mobility plays an important role here. In addition to the decentralised generation and storage of power, energy efficiency and intelligent use of energy, EnBW develops sustainable charging infrastructure and mobility solutions. Moreover, in the future electric vehicles could be seen as energy storage units, to be intelligently integrated in other energy and mobility applications. Based on various research projects, EnBW has, together with its partners, established an interoperable charging infrastructure with about 600 publicly accessible charging points in Baden-Wuerttemberg.
These charging stations are supplied with 100 er cent green electricity from hydropower, primarily from southern German power generation plants. These charging stations are regularly used by, the e-vehicle fleet of the Stuttgart carsharing provider car2go. In order to provide the charging of e-vehicles all over Germany, EnBW takes part in the development of the German 'Hubject' roaming platform.
Even today, EnBW translates these research findings into practice, in products such as the EnBW 'Elektronauten' Charging Card and the EnBW 'Elektronauten' Charging Box – with even more interesting mobility solutions to follow. This is how EnBW contributes to the creation of tomorrow's mobility.

**www.enbw.com**

6.34

# ENERGY4U GMBH – ALWAYS ONE STEP AHEAD!

## Comprehensive know-how in the design and integration of IT-based e-mobility services

**ENERGY4U GmbH**
**An Atos Worldgrid Company**
Emmy-Noether-Strasse 17
76131 Karlsruhe, Germany

**Year of establishment:** 2000
**Employees:** 140 (2013)
**Turnover:** EUR 27,829.000 (2012)

electric mobility south-west

**Contact**

Tobias Krimmling
Phone: +49 721 6105 2100
Fax: +49 721 6105 2105
tobias.krimmling@energy4u.org

ENERGY4U is an IT consultancy, whose core competence is the implementation of all components of SAP for Utilities (IS-U) and SAP NetWeaver for companies in the power supply industry. Its service portfolio includes all services involving the SAP Utilities suite, SAP data conversion (migration, harmonisation, consolidation), mobile services (mobile business processes for real-time providers), smart metering and e-mobility.

ENERGY4U GmbH has gained comprehensive expertise in numerous projects in the fields of e-mobility and smart grid technology to integrate the processes relating to e-mobility into the business processes of the energy sector. Besides the development of a virtual power plant system within the AlpEnergy research project, ENERGY4U supported the eE-Tour Allgäu project for the energy sector. There, as the leading SAP Special Expertise Partner, ENERGY4U was responsible for the billing package and the development of new business models.

ENERGY4U is also a partner in the Smart Grid Integration (SGI) research project within the framework of the Elektromobilität Süd-West cluster. The SGI project researches energy management systems that ensure user comfort and also grid stability.

**www.energy4u.org**

6.35

# KNOW-HOW MEETS INNOVATION

## FAUDE – full of action!

**FAUDE GmbH**

Max Planck Strasse 10
71116 Gärtringen, Germany

**Year of establishment:** 1990
**Employees:** 20 (2013)
**Turnover:** EUR 2,857 millions (2011)

FAUDE®
Automatisierungstechnik GmbH

electric mobility south-west

Faude GmbH translates sound knowledge into trendsetting technologies. Our highly qualified employees from various fields of expertise are key factors to, and the pillars of, our company's success. As a leading international supplier of production and process automation technology, our customers rely on our quality and individual solutions. Our top priorities are to think and act in a customer-oriented manner, foster long-term business relations and continuously evaluate customer requirements to find the optimal solution.

FAUDE Automatisierungstechnik GmbH supplies services and solutions in the areas of software engineering, image processing, 3D CAD design, CAE electrical engineering, control unit construction, commissioning and general engineering. FAUDE is an innovator when it comes to the development and realisation of automation systems in the most diverse of areas.

Our latest projects were in the automotive field: the separation of bulk goods, fully automated assembly of vehicle seats and robotic bin-picking solutions are some examples of our competencies in these innovative technologies.

As an expert for risk analyses, FAUDE provides an 'all-round package'.
FAUDE is where innovation, expertise and conviction meet. Your partner for finding the most economical and profitable solution. Be a fan too.

**www.faude.de**

**Contact**

Dieter Faude
Phone: +49 7034 256718
Fax: +49 7034 2567718
faude@faude.de

6.36

# AUTOMATION ON THE FAST TRACK

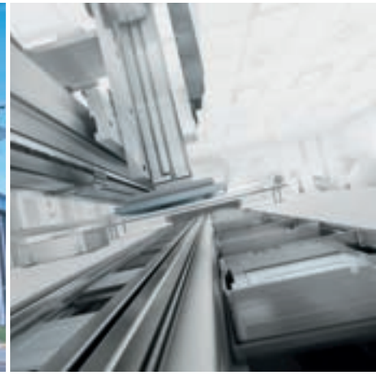
## Producing faster battery cells

**Festo AG & Co. KG**

Ruiterstrasse 82
73734 Esslingen, Germany

**Year of establishment:** 1925
**Employees:** 16,200 (2012)
**Turnover:** EUR 2.24 billion (2012)

FESTO



electric mobility south-west

The key factor in the widespread introduction of e-mobility is the automated production of batteries. Festo, the automation specialist, supplies innovative solutions based on pneumatic and electric drive technology that allow reliable and cost-efficient serial production. System modules are used for working with battery cells and in battery module assembly but also in the production of new drive and control systems for electric vehicles.

Festo is a partner in the AutoSpEM project sponsored by the Federal Ministry of Education and Research, a joint project for 'automation for the reliable and economic production of storage batteries for electric mobility'. Its focus is on finding solutions for the high-speed handling of sensitive battery cells, using vacuum technology in battery assembly.

Festo leads worldwide in automation technology and is the market leader in basic technical and advanced training. Festo's pneumatic and electric drive technology stands for innovation and quality in industry and process automation – from single product to turnkey solution.

**www.festo.com**

**Contact**

Oliver Klein
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Fax: +49 711 34754 3699
okl@de.festo.com

6.37

# REDUCE CONSUMPTION. INCREASE EFFICIENCY. FLEETBOARD.

## Telematic systems for more economy

**Daimler FleetBoard GmbH**

Am Wallgraben 125
70565 Stuttgart, Germany

**Year of establishment:** 2003



electric mobility south-west

Daimler FleetBoard is among the leading European suppliers of telematics-based internet services for trucks, vans and buses. Our modular FleetBoard services help forwarding companies in the long-distance transport, distribution and construction business manage their tours optimally and, at the same time, reduce their fleet operating costs. The wholly owned Daimler subsidiary with headquarters in Stuttgart was awarded several prizes and is DEKRA and DIN EN ISO 9001:2008 certified. FleetBoard sales representatives are available all over Europe, in the Middle East, South Africa, China, Brazil and Russia. In addition to this, the Mercedes-Benz sales and service network provides services in many more countries worldwide.

More than 4,000 customers control their trucks with our proven telematics systems, to save fuel and resources and for environment friendly operation. Since FleetBoard's establishment in 2000, more than 115,000 vehicles were installed with our systems. Thanks to reasonable hardware costs and service fees, which includes a European flatrate, such an investment amortises quickly. The hardware is installed as standard in the new Actros series at the Mercedes-Benz truck production site. Retrofitting of the telematics system is possible for other makes too. All vehicles benefit from the comprehensive sales and service network. A great advantage in the transport business.

**www.fleetboard.com**

**Contact**

FleetBoard Support
Phone: +49 711 17919 99
support@fleetboard.com

6.38

# 100% CUSTOM MADE IN BADEN-WUERTTEMBERG

## FXX means flexibility and individuality

**FXX CYCLES**
**Flötinger Chainworxx**
Sylvanerweg 4
71691 Freiberg am Neckar, Germany

**Year of establishment:** 2011
**Employees:** 3
**Turnover:** EUR 250,000 (2012)

malprini.com

malprini.com

Modellregion Elektromobilität Region Stuttgart

**Contact**

Florian Dobner
Phone: +49 7141 5054428
info@fxxcycles.de

As a enthusiastic sportsman who has always spent much of his time outdoors, I have a strong interest in integrating this passion into my profession. This first led me to competitive sports, where I developed my own ideas and products for sports and normal use, ending in my own bicycle brand called FXX CYCLES. Combine the extraordinary with the useful, with an emphasis on a well-balanced appearance and the highest quality in workmanship and design – this is my philosophy.

This high standard is reflected in each and every one of our products. Our bicycles are attractive for so many different types of people, because their specific distinctiveness appeals to them. In any part in the world, FXX CYCLES are very special and express individuality and innovation 'Made in Baden-Wuerttemberg'.

Our customer service is a further product that bundles all the expertise we gained in almost 20 years in the sports business, and from contacts we made during this time. We offer consulting services in electric mobility, infrastructure concepts involving a pedelec renting system for city centres, innovative B2B solutions and employee mobility and motivation.

**www.fxxcycles.com**

6.39

# GETRAG E-DRIVE –

## For a cleaner environment

**GETRAG Corporate Group**

Hermann-Hagenmeyer-Strasse
74199 Untergruppenbach, Germany

**Year of establishment:** 1935
**Employees:** 13,000
**Turnover:** EUR 3 million (2011)

GETRAG

Precision. Passion. Partnership.

Modellregion Elektromobilität Region Stuttgart

livinglab BW-mobil


**Contact**

Vera Münch
Phone: +49 7131 644 5601
Fax: +49 7131 644 4614
GETRAG.Corporate-Press@getrag.com


GETRAG has been involved with electric drive-train technology for more than 20 years. Today, our portfolio covers the most diverse solutions in the wide area of e-mobility.

With regard to purely electric drive-trains, GETRAG has developed transmissions with constant ratios in accordance with the current market standards. Furthermore, we have developed multi-gear solutions. Drive-trains with multiple gears feature an energy-saving potential in the double-digit per cent range.
Since 1992, GETRAG engineers have developed drive-train systems for electric vehicles. That means that we have many years of experience in integrating such e-drives into the drive-train structures of common passenger cars. This applies to e-drives with constant ratios or multiple gears, and to such using additional mechanic drive shafts or with an option to disconnect such shafts at certain operating points or speeds. We have also developed electric drive-trains for front-wheel drive and rear-wheel drive.

High-rev e-motor solutions are more effective and feature a better weight ratio compared to low-rev e-motors, especially when using multiple gears. This results in improved performance and range as well as battery size reduction.

The transmissions are adapted to the respective e-motors and the necessary controls and inverters, in close coordination or cooperation with renowned car manufacturers.

**www.getrag.com**



6.40

# CONSULTING SERVICES FOR FUTURE MOBILITY

## We take Waiblingen eMOBIL from theory to practice

**gevas humberg & partner Ingenieurgesellschaft für Verkehrsplanung und Verkehrstechnik mbH**
Kaiserstrasse 185
76133 Karlsruhe, Germany
**Year of establishment:** 1980
**Employees:** 40 (2013)

gevas humberg&partner

Renault ZOEs received by stadtmobil Stuttgart e.V. on 15 July 2013 from the city of Waiblingen (source: city of Waiblingen)

Example of e-mobile stadtmobil car with project partner logo (source: city of Waiblingen)


**Contact**

Werner Frey
Phone: +49 721 831835 18
Fax: +49 721 831835 11
w.frey@gevas-ingenieure.de


gevas humberg & partner is an independent consultancy for transport planning and traffic engineering services mainly throughout Germany. Founded in Munich in 1980, the company has established branch offices in Essen, Karlsruhe and Augsburg. Our team of about 40 employees supports our clients in the following business fields:

- Transport planning
- Public transport
- Traffic management and road transport telematics (ITS)
- Urban and interurban traffic control
- Project management
- Research and development

From the transport planning point of view we are absolutely convinced that e-mobility can be used as an approach to design sustainable future mobility. Our services are:

- Coordination of funding processes, cost estimation
- analysis of potentials and effects
- analysis and modelling of influencing factors on the transport system and the users' behaviour
- support of public relations
- project management

We supply the above services, for example, in the project 'WAIBLINGEN eMOBIL' funded by the Verband Region Stuttgart (with EUR 180,000) within the 'Model region for sustainable mobility' programme. The project work includes:

- E-mobile carsharing
- e-mobile company cars
- erection of charging stations
- setting up of an online mobility platform and an information centre

**www.gevas-ingenieure.de**
**www.waiblingen.de > Wirtschaft & Umwelt > Mobilitätsportal**

6.41

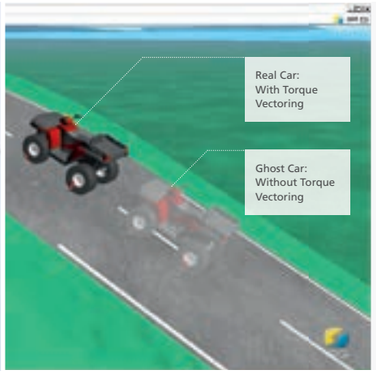
# SINGLE-WHEEL DRIVE SYSTEM FOR ELECTRIC QUAD

## Test vehicle for research, development and training

**GIGATRONIK-Gruppe**

Hortensienweg 21
70374 Stuttgart, Germany

**Year of establishment:** 2001
**Employees:** around 850 (2013)
**Turnover:** approx. EUR 72 million (2012)




livinglab BW mobil

**Contact**

Dr.-Ing. Gunter Wiedemann
Phone: +49 711 849609 473
Fax: +49 711 849609 99
gunter.wiedemann@gigatronik.com

GIGATRONIC is your development and consulting partner, specialised in electronics and information technology. In 2012, GIGATRONIK built an ATV quad with electric single-wheel drive. This vehicle with a maximum speed of 50 km/h served as a test vehicle and training object for employees and students. The project is the result of the further development of the popular ELMOTO e-bike, for which GIGATRONIK developed the motor controller in 2009. This controller, in a new upgraded version, is mounted four times in the e-quad. Belt drives specifically designed for this project transmit the 5 kW from each BLDC motor independently to each of the four axles. The modern lithium-ion battery system guarantees a range of currently 40 kilometres. A central control unit from our GIGATRONIK Tool Suite coordinates drive and vehicle management. Traction components and controllers are connected via CAN and LIN.
Refitting with an electric drive was realised with almost no weight change. Only minimal modifications to the frame are required for this 300 kg vehicle to receive road service approval. Design and development were prototyped using state-of-the-art automotive industry methods, processes and development tools. GIGATRONIK is currently simulating drive dynamic functions of the e-quad – such as torque vectoring, ASR and recuperation – using CarMaker® from IPG Automotive GmbH, where they will be virtually tested and verified.

**www.gigatronik.com**

6.42

# FULL-RANGE SOLUTIONS FOR EFFICIENT E-MOBILITY

## Quick and easy charging

**GILDEMEISTER energy efficiency GmbH**

Hohenheimer Strasse 9
70184 Stuttgart, Germany

**Year of establishment:** 2006
**Employees:** 150 (2012)
**Turnover:** EUR 71.7 million (2012)

**Contact**

Maximilian Heindl
Phone: +49 711 389309 46
Fax: +49 711 389309 44
energyefficiency@gildemeister.com

Whether you have your own e-fleet, rent out e-vehicles or simply want to provide state-of-the-art services for your customers or visitors: GILDEMEISTER energy solutions' full-range solution makes green electric power available for everyone.

Twenty-four hours a day, seven days a week. Get away from the public power supply and rising power rates! Benefit from renewable energy sources. Any time. The full-service e-station from GILDEMEISTER energy solutions is not only clean, but is efficient too; it charges electric vehicles at a charging capacity of up to 44 kW. Its long-life and low-maintenance vanadium redox-flow storage system ensures uninterrupted energy from solar and wind power plants.

Storing up to 130 kW/h with minimum loss, the CellCube not only provides power for e-vehicles, but also supplies energy for illumination and the e-station display.

**www.energy.gildemeister.com**

6.43

# THE BIKE FOR A BETTER FUTURE

## The all-purpose cargo bike

**gobaX GmbH**

Heerweg 19
72116 Mössingen, Germany

**Year of establishment:** 2011
**Employees:** 14 (2012)
**Turnover:** EUR 1 million (2012)

**Contact**

Axel Franck
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Fax: +49 7473 3785820
info@gobax-bikes.de

Because traffic congests regularly in city centres, we decided to reinvent the bicycle! The robust and sporty cargo bike is the foundation of future mobility. It is robustly built for heavy-duty service, including commercial use, and can be adapted individually to any transportation application. It is equipped with the best and most sophisticated of components, for example powerful electric motors and batteries.

Our motto: Only the best! This is why we have used only quality components from renowned manufacturers for our bikes. And we added our own proven and tested features. Combined with a durable frame featuring excellent driving geometry, this results in a high-performance, heavy-duty bike that copes with the toughest of situations.

The rack system is built on a sturdy stainless steel base which is firmly bolted to the frame via special eyes. This accommodates a safely fixed adapter plate for cargo containers. These are also solidly fastened to the installation. This result is a variable and sophisticated system that makes every transport with the cargo bike easy and safe.
The cargo bike is the best ecological and economic alternative for transporting small goods within an urban environment. For short distances, the bike easily outperforms all other means of transport.
Awards:
New Brand Award, Bike Expo München IF-Award Eurobike Friedrichshafen Gründerpreis des Landes Baden-Wuerttemberg
**www.gobax-bikes.de**



6.44

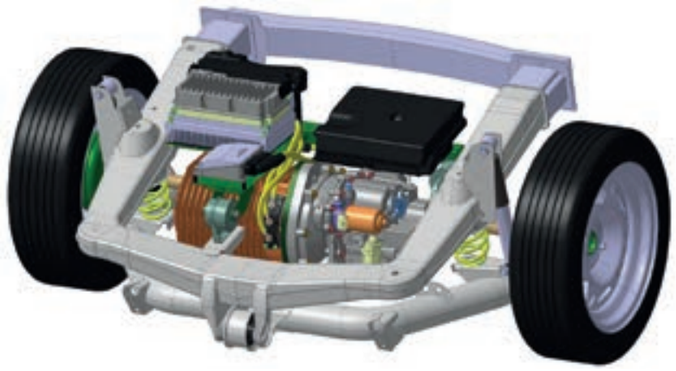
# GREENING

## Engineering for sustainable mobility

**GreenIng GmbH & Co. KG**

Blumenstrasse 54
71397 Leutenbach, Germany

**Year of establishment:** 2010



electric mobility south-west

livinglab BW mobil

**Contact**

Dr.-Ing. Uwe Kehn
Phone: +49 7195 97734 90
Fax: +49 7195 97734 91
uwe.kehn@greening.de

Our core competencies in engineering are powertrain technologies and lightweight engineering.

Our service portfolio ranges from efficiency technologies and the development of combustion engine systems to electric drive systems. In the area of lightweight engineering, our focus is to compensate for the additional weight of comfort and safety systems and added drive components. GreenIng's cooperation with university institutions results in unique synergies from basic research and practical serial development. We work under contract (concept examinations, design/construction), do consulting (assessment of technologies, training) and basic research. In our technology lab, we can build and validate vehicle prototypes. In addition, we use our e-test vehicle to test electric drive components. This 'open source' drive assembly carrier is built on an existing vehicle platform and equipped with the latest electric drive technology. The technology carrier is versatile and can be used for validating new systems and components for electric vehicles. It can also be used for manufacturer-independent training purposes.

**www.greening.de**

6.45

# ENERGETICALLY ORIENTED AHEAD TO THE FUTURE

## We offer suitable production solutions for your individual requirements

**Harro Höfliger**
**Verpackungsmaschinen GmbH**
Helmholtstrasse 4
71573 Allmersbach im Tal, Germany

**Year of establishment:** 1975
**Employees:** 700 (2012)
**Turnover:** EUR 120 million (2012)

electric mobility south-west

Are you still looking for a reliable partner who responds to your individual needs with regard to the research and production of batteries and fuel cells? Harro Höfliger offers outstanding technologies as well as customer-specific and turnkey project and system solutions. As a medium-sized enterprise we are able to fall back on a large development centre with more than 230 employees in our design and development sector.

We provide you with the basic technologies (web processing, filling, assembly and packaging) for the production of foil-based components for fuel cells and lithium-ion batteries of highest quality. As a partner, we accompany you from semi-automatic test equipment for process development and small-scale production up to fully automatic production machines.
We have been working for more than 20 years in this field, and have successfully realised various projects with leading manufacturers of lithium-ion batteries and fuel cells. Our focus is mainly on the development of innovative processes – exclusively for our customers 'from roll to stack'.

True to our motto 'ALL YOU NEED', we offer full-range support from consulting on first contact, up to after-sales services for the equipment.
If this has aroused your interest, we invite you to get to know us, your opportunities and benefits with Harro Höfliger as your partner.
**www.hoefliger.com**

**Contact**
**Division Leader Energy Storage**
Fritz Major
Phone: +49 7191 501 5116
Fax: +49 7191 501 5244
fritz.major@hoefliger.de



6.46

# CHARGING INFRASTRUCTURE MUST BE SAFE AND POWERFUL

## Heldele is your partner for complete infrastructure solutions

**Heldele GmbH**

Uferstrasse 40–50
73084 Salach, Germany

**Year of establishment:** 1964
**Employees:** 498 (2012)
**Turnover:** EUR 86 million (2012)

Modellregion Elektromobilität Region Stuttgart

electric mobility south-west

livinglab BW mobil

**Contact**

Georg Thomas
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Fax: +49 7162 4002 10
georg-thomas@heldele.de

Heldele is the leading service provider in electrical engineering and communication technology. For 50 years, Heldele's customers know we meet the highest quality standards and use the latest technologies. Almost 500 highly qualified employees work at our locations in Salach, Stuttgart, Munich, Singen, Eltville and Karlsruhe. They realise projects in the areas of building technology, IT & communication technology, automation and e-mobility, from concept to after-sales service. Heldele's core competence in e-mobility is the development, production, installation and maintenance of charging stations. Following a qualified analysis of the infrastructure, Heldele finds the best charging solution, then plans and carries out its installation. Heldele engineers take all the individual circumstances into consideration, including on-site conditions and model variants. This ensures the safe and efficient function of the charging infrastructure. Heldele's comprehensive, Germany-wide customer service gives peace of mind and ensures quick support where required. Widespread know-how in the field of electrical engineering and communication technology is a prerequisite for reliable and properly functioning systems. As a project partner in the 'Get eReady' fleet project, a subproject of 'Schaufenster Baden-Wuerttemberg', Heldele GmbH is responsible for the development and implementation of an integrated infrastructure concept. Under the 'EMiS Elektromobilität im Staufferland' project, Heldele's e-mobility specialists, together with regional project partners, examine which challenges and opportunities electric mobility entails in medium-sized cities.
**www.heldele.de, www.die-stromtankstelle.de**

6.47

# EFFICIENTLY ACHIEVING MORE

## Software solutions for increased added value and better work

**highQ Software Solutions GmbH**

Schwimmbadstrasse 26
79100 Freiburg, Germany

**Year of establishment:** 1996
**Employees:** 30 (2013)
**Turnover:** > EUR 2 million (2012)

highQ


electric mobility south-west
livinglab BW°mobil

highQ Software Solutions offers industry-specific software products and IT services, particularly for the public transportation industry, banks and financial institutions, hotels and the hospitality industry. For instance, highQ has developed electronic fare management systems for public transportation companies and classification software for the hotel star-rating.

Based on the current standards of the VDV core application and highQ's many years of experience in the public transportation sector, it has reached a leading position in the e-ticketing market. The Freiburg-based company relies on experience gained from various successful projects. In addition, highQ participates in government-sponsored R&D projects concerning e-ticketing and networking. Intermodal transportation (using different means of transport for one route) and multi-application systems are also key areas. In the future, the software company intends to strengthen its competencies and market position in the intermodal transportation sector.
Its wide product range in the area of public transportation includes not only TicketOffice, the award-winning electronic fare management system, but also the PlanB planning software, mytraQ – a control app with an integrated mobility assistant – and the IONGate networking solution. highQ stands for its excellent understanding of customer requirements combined with the latest development methods, resulting in software solutions for increased added value and better work.

**www.highQ.de**

**Contact**

Christophe Fondrier
Phone: +49 761 706040
Fax: +49 761 706044
info@highQ.de

6.48

# HUBER GROUP – CONTROLLERS FOR HYBRID AND ELECTRIC MOBILITY

## Automotive supplier of the future

**Huber Group**

Industrie- und Businesspark 213
73347 Mühlhausen im Täle, Germany

**Year of establishment:** 1983

huberGroup


Modellregion Elektromobilität Region Stuttgart
livinglab BW°mobil

Huber Group is a globally active Tier-1 system supplier with headquarters in Mühlhausen im Täle. For more than 25 years, the company has developed and produced environmentally friendly solutions for combustion engines and for alternative drives. The experienced full-service provider assists its customers in brainstorming, planning, development and even serial production of controllers, components and assembly groups, for example for exhaust gas treatment systems. With its in-house hardware and software development and electronics production, Huber Group provides the full range of services from function development to integration of control units into complete systems, design, prototyping, testing and production. Huber Group has developed solutions for electric drives since 2009. The focus here is on e-motor component integration, matching vehicle controllers and communication interfaces between driver and vehicle. The e-mobility and hybrid platform ECU 21, developed by Huber Group, is a hybrid controller that allows the integration of environmental solutions into vehicles, construction machinery and stationary motors. As part of the ELENA (ELectric ENgine Applications) network, Huber Group develops and distributes installation kits and even complete plug-in hybrid vehicles.

**www.huber-group.com**

**Contact**

Boris Langer
Phone: +49 733 592060
Fax: +49 733 59206199
info@huber-group.com

6.49

# BATTERY POWER

## HyLionTec provides customised energy storage solutions

**HyLionTec GmbH – Batteries for mobile and stationary applications**
Tübinger Strasse 7
70178 Stuttgart, Germany

**Year of establishment:** 2009
**Employees:** 5 (2012)


**Contact**

Martin Ziegler
Phone: +49 711 185785 94
Fax: +49 711 185785 42
info@hyliontec.com

HyLionTec GmbH Stuttgart manufactures innovative lithium-ion batteries for mobile and stationary applications in ranges from 3 to 1000 V. The extraordinary performance of these HyLionTec battery systems is achieved by combining electrical and mechanical high-performance components. High-strength aluminium housings enclose extremely powerful lithium manganese oxide cells. Cost-efficient lithium iron phosphate cells are also available. Battery management systems (BMS) developed in-house and product-based implementations of integration tasks – that's customised engineering. Modular and freely scalable system components allow attractive cost structures and early economies of scale. At the same time, this creates interesting upgrade options for your products. We are not bound by any brands and guarantee fair pricing due to large-volume direct cell imports. We are proud to report that HyLionTec's engineering expertise was recently verified by the VW Gold R500+ demo car. Other HyLionTec battery components can be found in drive systems for electric boats, power tools, pedelecs and stationary storage units for photovoltaic plants. Product variety and flexibility are crucial success factors. Thanks to our unique modular system, we can respond to urgent requests quickly. And we develop customer-specific battery systems. Electrochemistry, assembly technology and integrative knowledge is our know-how which we gladly pass on to our customers.

**www.hyliontec.com**



6.50

# THINK SAFE THINK ICS

## We safely get you where you want to go!

**ICS AG**

Sonnenbergstrasse 13
70184 Stuttgart, Germany

**Year of establishment:** 1966
**Employees:** 150 (May 2013)
**Turnover:** EUR 12.3 million (2012)


**Contact**

Dipl.-Ing. (FH) Martin Zappe
Phone: +49 711 21037 0
Fax: +49 711 21037 53
automotive@ics-ag.de

ICS AG is a medium-sized family-owned IT service and consulting company with about 150 employees in nine locations all over Germany. We have been developing intelligent solutions since 1966 for safety-critical IT environments. Our services cover the entire product life cycle, from design to system approval. Well-known companies from industry have come to know us as a reliable development partner and rely on our expertise.
We design intelligent and safe processes for complex environments. Our holistic approach covers availability, reliability, security and maintainability of software and systems. We specialise in aerospace and defence, automobile, industrial solutions and transportation.

Our first projects for the automobile industry in 1983 were in the development of test stands. ICS AG's competence centres design forward-looking software solutions for control units, communication platforms and multimedia architectures in vehicles.

Whether requirements engineering, systems engineering, software engineering or implementing safety-critical applications in accordance with ISO 26262 IEC 61508, we get our customers to their destinations safely.

ICS – THINK SAFE THINK ICS.

**www.ics-ag.de**

6.51

# IPDD – THE DESIGN COMPANY

## Electric mobility made in Stuttgart

**ipdd GmbH & Co. KG**

Calwer Strasse 11
70173 Stuttgart, Germany

**Year of establishment:** 1994
**Employees:** 20 (2012)

For more than 20 years, ipdd has provided creative solutions for product design and development and has become one of the leading German design studios. A team of 20 designers, engineers, electronics specialists and marketing experts designs innovative products for national and international companies from the most diverse of industries, ranging from electric mobility, investment goods and medical equipment to power tools, sports equipment, toys, lifestyle products and furniture.
In addition to custom projects in rehabilitation, medicine and automotive, these Stuttgart-based designers have gained recognition as a competent design and development partner with their own independent designs in the electric mobility sector.

The strategic use of these new drive types enables access to new markets and new applications. These new extraordinary products with high innovative prowess and unique characteristics offer their users measurable added value.

IPDD have impressively proven this with their own design projects – the Luxx vehicle for seniors and the ELMOTO e-bike. Both vehicles are not only impressive due to their innovative original design but also because they have been tailored to the specific needs of their target groups. This, we are proud to say, has set new standards in these sectors.

**www.ipdd.com**

**Contact**

Stefan Lippert
Phone: +49 711 3265460
Fax: +49 711 3265461
info@ipdd.com

6.52

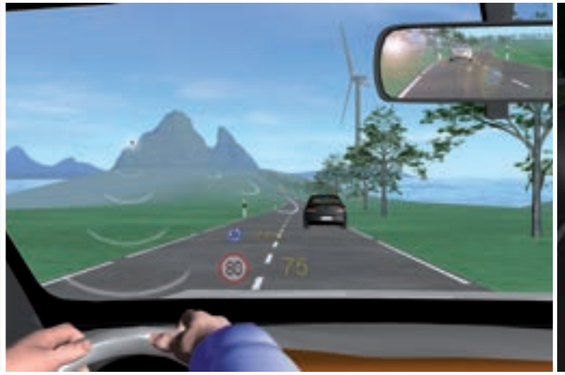
# TAKING YOU TO THE NEXT LEVEL –

## e-mobility and virtual test driving

**IPG Automotive GmbH**

Bannwaldallee 60
76185 Karlsruhe, Germany

**Year of establishment:** 1984




electric mobility south-west

The automobile and supplier industry are facing huge challenges these days: new electric drive concepts, shorter development cycles and ever-increasing product diversity all demand new powerful development tools. In this respect, simulation has long been counted among the leading technologies. Virtual test driving plays an important role here. IPG Automotive precisely reproduces real-life road tests 1:1 – long before the first prototype becomes available.

IPG Automotive's simulation solutions offer their users a highly efficient integration and test platform. The tools and methods of virtual test driving provide precise information on overall vehicle properties at a very early stage of development. New e-mobility concepts and forward-looking operating strategies, but also fuel efficiency, real fuel consumption and range, can be examined and evaluated during the simulation process. Optimisation potential can be identified long before serial production starts. It is also an efficient way to improve the entire development process. Further application fields include functional tests of complex control systems, in addition to the classic testing of vehicle dynamics and advanced driver assistance systems. The simulation tools of IPG Automotive as a technology and innovation leader are employed in almost all research and development centres of the well-known OEMs worldwide.

**www.ipg.de**

**Contact**

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Phone: +49 721 98520 0
Fax: +49 721 98520 99
info@ipg.de

6.53

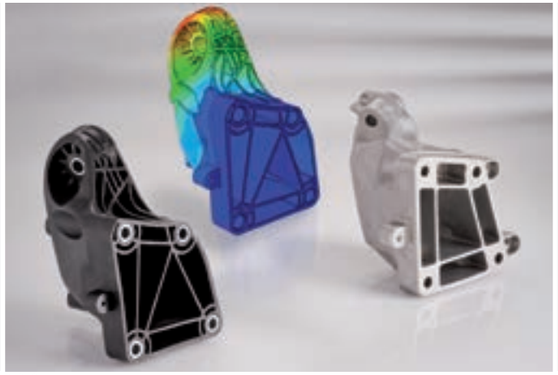
# JOMA-POLYTEC GMBH

## Step-by-step to success

**Joma-Polytec GmbH**

Höfelstrasse 17–19
72411 Bodelshausen, Germany

**Year of establishment:** 1958
**Employees:** 390 (2012)
**Turnover:** EUR 77.5 million (2012)



BASF SE

Joma-Polytec GmbH

electric mobility south-west

For more than 50 years, Joma-Polytec GmbH has supplied a wide range of products and services, technical plastic components and sophisticated solutions in the area of plastic technology, extrusion and hydro-mechanical pump technology. Joma-Polytec stands for high-quality technical plastic components and technology leadership.

Joma-Polytec is involved in numerous electric mobility projects with many different partners. Our strategic product portfolio in this area ranges from structural components (plastic as metal replacement), for example motor frames that are already used in series production, to lubrication-free vacuum pumps and design projects for fuel cells and battery boxes.

Taking small steps to success while maintaining a structured balance between the technologies of today and tomorrow: this is what Joma-Polytec goes by.

**www.joma-polytec.de**

**Contact**

Stefan Linz
Phone: +49 7471 706 1131
Fax: +49 7471 72661
stefan.linz@joma-polytec.de



6.54

# CHARGING STATIONS ARE MORE THAN MERE POWER OUTLETS

## Kellner Telecom – your innovative service provider

**Kellner Telecom GmbH**

Siemensstrasse 28
70825 Korntal-Münchingen, Germany

**Year of establishment:** 1983

KELLNER TELECOM

electric mobility south-west

livinglab BW e mobil

A charging station not only provides electrical power like a power outlet, but they also have to be intelligent and communicate with the vehicle or infrastructure. For example, they exchange data on battery status, current electricity rates and waiting times. Building a charging infrastructure requires thorough analyses of all the various charging types and requirements and specific technical know-how. To prevent later compromises during use, it makes sense to start with professional planning and installation. Kellner Telecom has already installed a multitude of different charging stations, which makes it one of the most experienced service providers in this young sector. The company specialises in electric mobility and should be your first choice in installing and operating charging infrastructures. Kellner Telecom offers a full range of services for a future-proof charging infrastructure: from obtaining permissions for public locations to feasible location planning and the delivery of charging stations (all makes). Our roll-out management and installation is provided by specifically trained and qualified staff. These services are complemented by maintenance contracts and a hotline for troubleshooting and replacement services. In addition, Kellner Telecom renders services such as charging operation analyses; individually or as a general contractor.

**www.kellner-telecom.de**

**Contact**

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Fax: +49 7150 9430 305
elektromobilitaet@kellner.de

6.55

# TECHNOLOGY LEADERSHIP IN STAMPING AND DIE-CASTING

## Kienle + Spiess offers a unique portfolio of stators and rotors

**Kienle + Spiess GmbH**

Bahnhofstrasse 23
74343 Sachsenheim, Germany

**Year of establishment:** 1935
**Employees:** 1,270 (2011)
**Turnover:** EUR 250 million (2011)

electric mobility south-west

The Kienle + Spiess group offers its customers the latest stamping and die-casting technologies for the production of efficient and energy-saving electric motors. Our portfolio is represented by a unique set of products – ranging from our innovative glulock® core building system and the Kienle + Spiess series of permanent magnet synchronous motors (KSPM) to copper die-cast rotors in the most diverse of sizes.

Furthermore, our customers profit from the comprehensive calculation, consulting and design services of the Dr.-Ing. Ernst Braun Institute which collaborates with the Kienle + Spiess group.

Our company's headquarters with attached tool shop has been located in Sachsenheim since its foundation in 1935. We also have three other production sites in Europe: Vaihingen/Enz, Tokod (Hungary) and Bilston (UK).

**www.kienle-spiess.com**

**Contact**

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Phone: +49 7147 29 0
Fax: +49 7147 29 1488
info@kienle-spiess.com



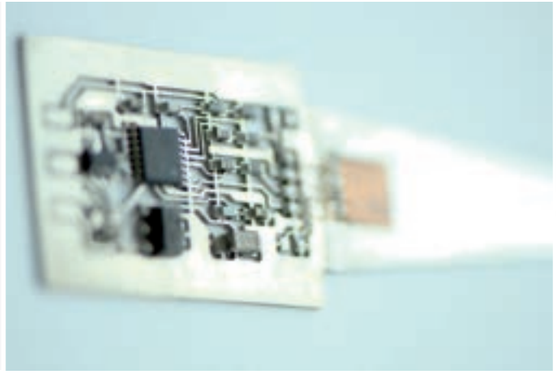
6.56

# PRODUCTS WITH A FUTURE

## KLEINER thinks solutions

**KLEINER GmbH**
**Pressing Technique**
Göppinger Strasse 2–4
75179 Pforzheim, Germany

**Year of establishment:** 1985
**Employees:** approx. 280 (2012)
**Turnover:** EUR 42 million (2011/2012)




**Contact**

Sonja Wiedmann
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Fax: +49 7231 6072 51381
sonja.wiedmann@kleiner-gmbh.de

KLEINER GmbH Pressing Technique has developed and produced tools and stamped parts for the automobile, plastics, electrical, medical engineering and electronic industries for more than 25 years. The company's research and development department got involved in the area of electric mobility and regenerative energy from its beginning. For example, KLEINER developed solutions for high-current contacting in photovoltaic systems and in hybrid and electric vehicles, which have been put into mass production.

When bus bars are produced for electric vehicles (thick copper parts for the high currents apparent in electric vehicles), it is important that these can be assembled effectively. That means that care must be taken when designing them so that they take up as little space as possible. Another development in the context of electric mobility is assembly groups using a specific film technology. This film technology is very special, as it combines three functions in one system: mechanical fixation, electric insulation and thermal conduction. In addition to stabilising the assembly group, it saves costs by eliminating the need to purchase additional parts.

In the meantime, electric mobility has found its way into the company fleet too. For some months now, KLEINER GmbH is the proud owner of an Opel Ampera which is being used by employees for business trips and test drives.

**www.kleiner-gmbh.de**

6.57

# KSPG RANGE EXTENDER

## Trailblazer for electric mobility


**KSPG AG**

Karl-Schmidt-Strasse
74172 Neckarsulm, Germany


**Year of establishment:** 1909
**Employees:** Around 12,000 (2012)
**Turnover:** Around EUR 2.3 billion (2012)



electric mobility south-west

KSPG has successfully developed a range extender for electric vehicles together with FEV GmbH as a pilot project. The test vehicle was handed over to KSPG ready for use and based on the FIAT 500. After initial test drives by renowned car manufacturers, customer feedback underlines what had been the intention for developing the unit: first priority had obviously been noise and vibration control for the V-type two-cylinder engine, which is kept extremely low by the FEVcom (Full Engine Vibration Compensation) system.

This range extender consists of a two-cylinder V-type Otto engine with a vertical crankshaft and two generators with gear drives. All components, except for fuel tank and radiator, are mounted on a ready-to-install support frame.

With a turnover of around EUR 2.3 billion, the KSPG group is among the top 100 automotive suppliers worldwide. The company has more than 30 production locations in Europe, the Americas, Japan, India and China, and employs about 12,000 people in total. Within the Rheinmetall group, KPSG AG is the leading company of the group's automotive division. This automotive supplier, with its three divisions Hardparts, Mechatronics and Motorservice, has been active in the global automotive market for more than 100 years.

**www.kspg.com**


**Contact**

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Fax: +49 7132 33 3100
juergen.niehues@kspg.com


6.58

# LAPP GROUP – 'RELIABLY CONNECTING THE WORLD'

## Your partner for electric mobility


**Lapp Gruppe**

Oskar-Lapp-Strasse 5
70565 Stuttgart, Germany


**Year of establishment:** 1959
**Employees:** 3,150 (2011/2012)
**Turnover:** EUR 860 million consolidated (2011/2012)


electric mobility south-west

livinglab BW e mobil

Lapp Group's system solutions are renowned worldwide for their top quality and reliability. Car manufacturers and suppliers benefit from our more than 50 years of experience in machine and plant engineering when they need to find the right cable connectors for hybrid and electric vehicles.
Lapp Systems GmbH, a Lapp Group company, can be considered a pioneer in e-mobility: Lapp was one of the first companies to design a complete charging system including cables and connectors, mass production ready, meeting VDE standards. This charging system was developed by Lapp Systems together with partners from the industry.
As an innovative solution for automotive charging systems, Lapp not only supplies traditional spiral cables but also the patented Helix cable. The Helix cable is a space-saving cable that uses less material but features the same maximum extension. You'll find a charging cable configurator on our website. With only a few entries you can configure a charging cable that meets your most varied requirements.

Lapp products are not only used for charging. Lapp offers patented high-voltage cables for supplying electric motors with energy. Renowned manufacturers trust in Lapp's many years of experience in energy storage systems and use Lapp cables and connectors for internal connections in their lithium-ion batteries.

**www.lappsystems.de**


**Contact**

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Phone: +49 711 7838 2186
Fax: +49 711 7838 86 2186
karl.knezar@lappsystems.de

6.59

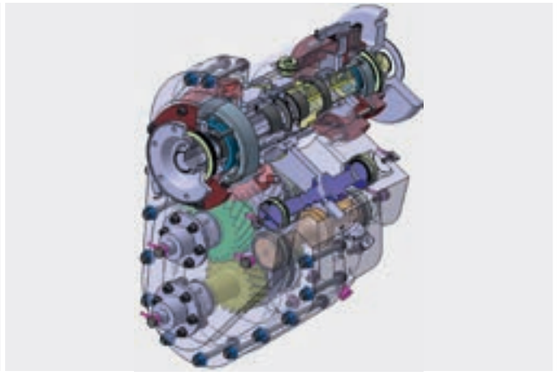
# INNOVATIVE AND SUSTAINABLE SOLUTIONS

## For mobility of the future

**Lauer & Weiss GmbH**

Höhenstrasse 21
70736 Fellbach, Germany

**Year of establishment:** 2000
**Employees:** 230 Group (2012)



Modellregion Elektromobilität Region Stuttgart

**Contact**

Simon Lang
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Fax: +49 711 52088920
info@lauer-weiss.de

Lauer & Weiss GmbH has a high reputation as a competence centre for all essential module developments in the automobile industry. We are the sought-after innovators for future-proof technologies worldwide, with our engineering team focused on premium products.
Our competence centre provides expertise in:

- Power-train/e-mobility
- Full vehicle integration
- Engines
- Body and structure
- Chassis/axles

Our teams are module experts specialising in the above disciplines. The project teams are comprised of highly qualified and experienced project managers, designers and calculation and testing engineers. We currently employ 230 staff at our locations in Fellbach, Weissach and São Paulo (Brazil). We develop innovative gear units and e-motor systems at our Power-train/E-Mobility Competence Centre.
We carry out highly complex development projects, ranging from first design concepts to calculation and simulation, prototyping and testing. Currently, we are designing a power-shift transmission for a Plug-In Hybrid Sprinter. The two-stage spur gear unit is installed between the front drive shaft. It features a dog clutch system synchronised by the electric motor. Its advantage is that it allows the drive mode to be switched between combustion engine, hybrid and electric while driving.

**www.lauer-weiss.de**



6.60

# BATTERY PRODUCTION AT GLOBAL MARKET LEVEL

## Competitive solutions for large-volume factories

**M+W Group**

Lotterbergstrasse 30
70499 Stuttgart, Germany

**Year of establishment:** 1912
**Employees:** 8,000 (2012)
**Turnover:** EUR 2.4 billion (2012)

**Contact**

Dr. Rudolf Simon
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batteries@mwgroup.net

M+W Group, a globally active manufacturer of production plant facilities with headquarters in Stuttgart, has been involved in the development, planning and realisation of lithium-ion battery cell production plants for international automobile and battery producers since 2008. The company provides assistance in reaching the goal of significant cost reductions in the production of lithium-ion batteries while meeting the highest demands on production quality, which is a prerequisite for a long service life and battery safety.

To this end, M+W Group developed a concept for competitive large-volume series production in a modular plant which bundles various production step modules. As a basis, this includes the production of coating material for the electrodes, the subsequent anode and cathode coating step, assembly of electrodes and separators and electrolyte filling. This is followed by the formation and conditioned ageing process. Individual production steps require extremely low humidity, constant temperatures and special fire protection measures.

For planning and realising their projects, M+W Group can rely on their knowledge and expertise gained in planning and building highly complex high-tech plants worldwide, for example in the semiconductor and photovoltaic industries.

**www.mwgroup.net**

6.61

# DRIVEN BY PERFORMANCE

## MAHLE – a name that stands for precision and trendsetting innovations

**MAHLE International GmbH**

Pragstrasse 26–46
70376 Stuttgart, Germany

**Year of establishment:** 1920
**Employees:** 48,000 (2012)
**Turnover:** EUR 6.16 billion (2012)


MAHLE stands for the development and production of high-quality components and systems in the international automotive and engine industry. With its business units Engine Systems and Components as well as Filtration and Engine Peripherals, MAHLE offers unique system competence. MAHLE's Industry business unit bundles industrial activities in the areas of large engines, industrial filtration as well as cooling and air conditioning systems.

Approximately 48,000 employees work for MAHLE at over 100 production plants and in seven R&D centres in Stuttgart, Northampton, Detroit (Farmington Hills), Tokyo (Kawagoe, Okegawa), Shanghai and São Paulo (Jundiaí). Around the world, approximately 2,400 development engineers and technicians are working on forward-looking concepts, products and systems for the ongoing development of vehicle power-trains
In the area of e-mobility, MAHLE develops, produces and sells future-oriented electric motor components, precision motors and generators. Relying on its current competencies in air and liquid management systems as well as in cooling and air conditioning systems, MAHLE develops and produces fuel cell components and modules.

**www.mahle.com**

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ralf.winterstein@mahle.com



6.62

# BE E-MOBILE WITH MANN+HUMMEL

## In the right direction towards the future!

**MANN+HUMMEL GMBH**

Hindenburgstrasse 45
71638 Ludwigsburg, Germany

**Year of establishment:** 1941
**Employees:** 14,575 (2012)
**Turnover:** EUR 2.6 billion

A well-known North American car manufacturer awarded MANN+HUMMEL a contract for the supply of battery frames. "This contract is very important for us and it makes us proud that our customer has placed their trust in us", says Manfred Wolf, head of the automobile and industry division. MANN+HUMMEL is already active in the field of electric mobility and has for example supplied battery frames for the Opel Ampera and GM Volt. MANN+HUMMEL invests considerably into research and development; a major portion of research funds is used for concepts, products and technologies for alternatively powered vehicles. The company is currently working on more than ten research projects in the area of e-mobility. In addition to battery and plug-in hybrid technology, fuel cell technology has also moved into focus. MANN+HUMMEL has transferred its expertise in filtration and separation technology to alternative drive systems and has developed products for these in cooperation with its partners in Europe, Asia and America. Examples are the cathode air filter and the ion exchange filter which are used in fuel cell-powered vehicles and combined heat and power plants.

With more than 900 researchers and developers worldwide, an average annual growth of a full nine per cent and more than 15 filter elements produced each second, MANN+HUMMEL looks back on more than seven decades in the filtration business. Quality, service and innovation has made the long-standing company a sought-after development partner and series supplier of the international automobile and mechanical engineering industries.

**www.mann-hummel.com**

**Contact**

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Phone: +49 7141 98 2242
Fax: +49 7141 98 18 2242
michael.harenbrock@mann-hummel.com

6.63

# MBTECH SUPPORTS CUSTOMER INNOVATION PROJECTS

## Services from development to testing

**MBtech Group GmbH & Co. KGaA**

Kolumbusstrasse 19 + 21
71063 Sindelfingen, Germany

**Year of establishment:** 1995
**Employees:** 3,300 (2012)
**Turnover:** EUR 370 million (2012)

Drive train test stand in Mönsheim

ektro concept car 'Link & Go'

**Contact**

Dr. Nico Hartmann
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Fax: +49 7031 686 3010
nico.hartmann@mbtech-group.com

MBtech Group is a globally leading engineering and consulting service provider with headquarters in Sindelfingen. Companies worldwide, such as those from the automobile, rail and aerospace industries, benefit from MBtech's integrated solutions. MBtech is a member of the AKKA Technologies Group. In 2012, the group generated a total turnover of around 925 million euros. AKKA employs roughly 11,000 engineers and consultants in more than 20 countries worldwide, 3,300 of which work for MBtech.

**Designing products, optimising processes and qualifying people**

This is the focus of our cross-industry services. We not only have competent staff with great expertise but also the latest technology and test centres all over the world. Our Electronics Solutions division is a reliable and specialised partner – from concept to serial product. We support OEMs and suppliers, no matter if they need components, systems or modules, or new design, integration or testing.

**Enabling innovations**

MBtech accompanies and supports their customers from the mobility industry in all phases of product development, helping them translate innovations into serial products quickly and reliably. By validating alternative drive systems at our unique drive-train test stands we promote electric mobility.

**www.mbtech-group.de**



6.64

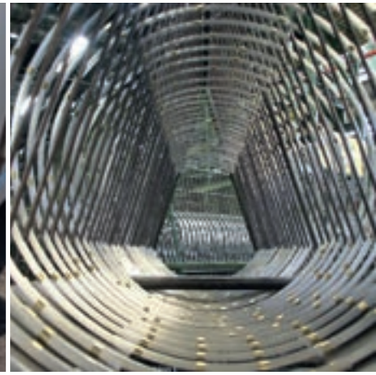
# INNOVATION AND HIGH-TECH COMBINED WITH TRADITION

## Expertise in sustainable mobility

**Michelin Reifenwerke AG & Co. KGaA**

Michelinstrasse 4
76185 Karlsruhe, Germany

**Year of establishment:** 1931
**Employees:** Around 1,200 (2012)
**Turnover:** EUR 1.57 billion worldwide (2012)

**Contact**

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Fax: +49 721 530 2200
ulrike.ferber@de.michelin.com

Michelin, tyre manufacturer with a global footprint, employs 115,000 and has sales organisations in over 170 countries. Spurred on by its vision of environmentally friendly mobility, the company develops, produces and sells tyres for almost all vehicle types. For the continuous development of its sophisticated products and technologies, Michelin operates several test and development centres in Europe, the US and Japan. The company has demonstrated its corporate responsibility in many ways, for example by organising the Michelin Challenge Bibendum – one of the largest forums for sustainable mobility worldwide – since 1998.

In 1931, Karlsruhe became Michelin's first production site in Germany. Today, this production facility is a recognised specialist for the production of lightweight truck tyres within the group. Its highly automated production lines are state of the art in the industry. Michelin produces a wide range of tyre sizes, primarily for the European market but also for Japan, Mexico and North America.

Innovations are first priority, which is one of the reasons for becoming a partner in the Rhein-Mobil project, a cross-border mobility model. The project, promoted by the Federal Ministry of Transport, Building and Urban Development, is to prove in a three-year international test that electric vehicles can be operated economically in certain applications.
**www.michelin.de**

6.65

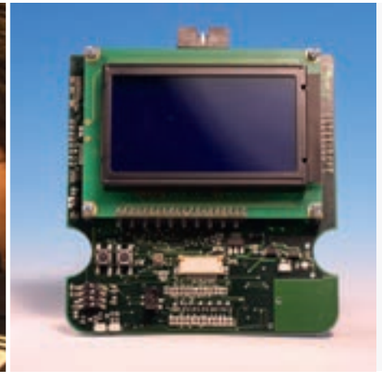
# ENGINEERING TEAM MSE GMBH

## Passion for electric mobility

**MSE GmbH**

Lange Strasse 10
71131 Jettingen, Germany

**Year of establishment:** 2000
**Employees:** 8 (2012)
**Turnover:** EUR 650,000 (2012)



**Contact**

Sven Kohler
Phone: +49 7452 88784 0
Fax: +49 7452 88784 199
info@mse-electronics.de

For more than ten years, the MSE team has been strongly involved in the development of electronic vehicle components. Our engineers have contributed to the development and design of a large number of new vehicles with their vehicle control units for xenon headlights, ultrasonic parking assistance systems, rear-view mirrors, compressed air controllers, tail lights and hybrid drives, to name just a few. We have assisted in the development of hardware and software products; in some we were responsible for only parts of the project, in others we acted as full-service suppliers to OEMs and/or their suppliers. In addition, we realised several test stands for design (hardware in the loop) and/or production (end of line). In the area of quality assurance, MSE GmbH has all the required tools and offers all design processes that correspond to current automobile and industry process models (CMMI, SPICE). As a member of a competence network, we helped develop an innovative electric vehicle concept that is independent of car manufacturer and tier-1 supplier. This is about finding new innovative solutions for future urban transportation as regards structures and environmental friendliness. MSE's field of responsibility in the development of this vehicle is the realisation of an innovative digital dashboard (TFT, 16.7 million colours) and the complete HMI, including full responsibility for data transmission within the vehicle as well as to and from intelligent external charging stations.

**www.mse-electronics.de**

6.66

# ENERGY SYSTEM FOR TOMORROW'S TRAFFIC

## Intelligent power enables electric mobility

**MVV Energie AG**

Luisenring 49
68159 Mannheim, Germany

**Year of establishment:** 1873
**Employees:** 5,500 (2013)
**Turnover:** EUR 3.9 billion (2011/2012)

electric mobility south-west

**Contact**

Matthias Wörner
Phone: +49 621 290 2031
matthias.woerner@mvv.de

For electric mobility to become reality, the energy infrastructure must be adapted to the new requirements. For several years now, the Mannheim-based utility company MVV Energie has worked on projects designing intelligent future-proof energy systems, always keeping the integration of electric vehicles in mind.

Vehicles of tomorrow will not only consume energy but will also be used as storage units in the long run. Thus, they potentially offer a more efficient use of energy from renewable energy sources like wind or solar energy. These energy sources are subject to strong fluctuations. Hence, grid-controlled power consumption is essential. This is the goal of the Smart Grid Integration research project headed by MVV Energie and embedded into the 'Leading-edge cluster Electric Mobility South-West'. It aims at developing concepts for an effective and efficient energy management system for e-vehicle charging stations, using the perspective of a grid service operator.

In the 'Future Fleet' project, MVV Energie and its partners explored the role of e-vehicles in future companies' car fleets. For this, the company designed, built and operated intelligent infrastructures at five different locations. A fleet of approximately 30 electric vehicles was reliably supplied with power solely from renewable energy sources.

**www.mvv-energie.de**

6.67

# SUSTAINABLE MOBILITY

## Nabern – technology location for fuel cell systems

**NuCellSys GmbH**

Neue Strasse 95
73230 Kirchheim/Teck-Nabern, Germany

**Year of establishment:** 2005
**Employees:** 160 (2012)
**Turnover:** EUR 50 million (2011)


NuCellSys GmbH is an affiliate of Daimler AG and a global leader in the development and production of fuel cell systems for vehicles. Within the fuel cell alliance between Daimler and AFCC (Automotive Fuel Cell Cooperation), NuCellSys is responsible for system development and design, component and software design and system validation. Furthermore, NuCellSys designed all components for the 700 bar hydrogen storage unit. In 2003, NuCellSys put a small series production unit into operation, for fuel cell systems for passenger cars and buses. Due to the continuous advancement of production technology, we now have the competence and capacity to provide an even more efficient production line for significantly higher volumes. NuCellSys develops its fuel cell systems in accordance with the strict process standards of the automotive industry and Daimler standards for high-volume serial production. Zero emissions and maximum efficiency – this is NuCellSys' motto for its development activities. Around 160 highly specialised employees work at the Kirchheim/Teck-Nabern site, developing fuel cell systems in interdisciplinary teams together with all technology and cooperation partners. NuCellSys owns approximately 700 individual patents, which emphasises its leading role in this technology development. Since 1997, fuel cell system development has been at the focus of the Nabern site near Kirchheim/Teck. And all partners work on integrated development with their own staff on site.

**www.nucellsys.com**

**Contact**

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Phone: +49 7021 89 4360
Fax: +49 7021 89 4110
massimo.venturi@daimler.com

6.68

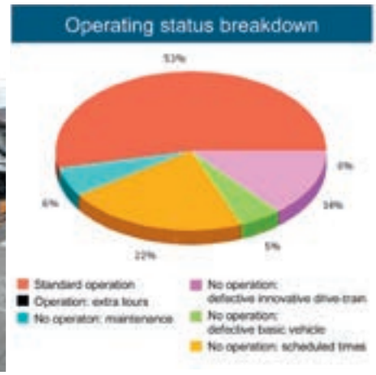
# NEW DRIVE TECHNOLOGIES

## Tested for environmental compatibility

**PE INTERNATIONAL AG**

Hauptstrasse 111–113
70771 Leinfelden-Echterdingen, Germany

**Year of establishment:** 1991
**Employees:** 220 (2012)
**Turnover:** EUR 24 million (2012)


Modellregion Elektromobilität Region Stuttgart

livinglab BW-mobil

Traffic on our roads has increased year by year and it is of utmost importance here, more than in any other sector, to separate growth from environmental impact. Which technology can be beneficial and should be used in practice?

PE INTERNATIONAL has provided answers to these questions for many years, with environmental analyses over the entire life cycle (Life Cycle Assessment, LCA) which assess mobility concepts, drive technologies and fuels. We draw up LCAs for single components, such as batteries, electric motors and fuel cells, but also for complete vehicles. These are for example new passenger car models and hybrid buses, including the ones used by the Stuttgart municipal transportation services (SSB). Currently, we use our experience and expertise for the 'Electric Mobility Pilot Region' and 'Showcase Region for Electric Mobility' programmes of the German federal government and carry out comprehensive analyses with respect to sustainability. We not only draw up LCAs for diesel hybrid buses, but also carry out acceptance analyses with passengers and operating companies.
For the working groups 'Innovative drive-trains', PE collects operating data on a daily basis with its SoFi webtool (fuel/power consumption, kilometrage, availability, etc.) for e-cars and hybrid buses used in the pilot regions. This monitoring allows precise analyses and provides answers to how new technologies prove in practice and to which extent they can reduce environmental impacts.

**www.pe-international.com**

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Fax: +49 711 34181725
m.faltenbacher@pe-international.com

6.69

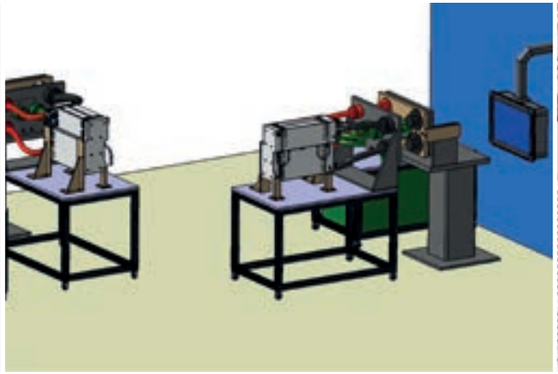
# YOUR TECHNICALLY COMPETENT SERVICE PROVIDER

## From concept to production plant

**plusdrei engineering team GmbH**

Bernhäuser Strasse 17
73765 Neuhausen auf den Fildern,
Germany

**Year of establishment:** 2000
**Employees:** 100 (2012)
**Turnover:** EUR 10.5 million (2012)



For more than 13 years, plusdrei engineering team GmbH has provided development services in the areas of electrical and electronic systems, automation technology, construction and testing for the southern German automobile industry.

With its team of about 100 employees, plusdrei develops innovative solutions together with its customers, covering these versatile areas:

- Individual services for OEMs and suppliers in the area of e-mobility
- Control unit networks and diagnosis
- CAN/LIN bus simulation
- Design and packaging for vehicles (for example cooling systems)
- Process technology / process design
- Testing technology, for example for fuel cells
- Production technology and production facilities (focus on robotics)

**www.plusdrei.com**

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info@plusdrei.com

6.70

# INNOVATIVE SOLUTIONS FOR THE FUTURE

## Engineering services by Porsche Engineering

**Porsche Engineering**

Porschestrasse 911
71287 Weissach, Germany

**Employees:** 680 (2012)

electric mobility south-west

livinglab BW-mobil

**Contact**

Frederic Damköhler
Phone: +49 711 911 89906
frederic.damkoehler@porsche.de

Creating forward-looking solutions was the standard set by Ferdinand Porsche when he started his design office in 1931. In doing so, he laid the foundation for today's engineering services by Porsche. Porsche Engineering's services range from the design of individual components to the execution of complete vehicle developments – in the automotive sector and beyond. Porsche Engineering has been addressing challenges in engineering for customers for more than 80 years. The engineers at Porsche Engineering have demonstrated their in-depth expertise in electric mobility, for example for the Boxster E research project in 2011 and in the development of the Seabob, a serial underwater scooter. They have also proven their competency in light-weight construction and in combustion engine efficiency optimisation. Porsche Engineering addresses each individual project with the goal to meet the highest demands in quality and to develop innovative concepts and customised solutions. All development projects that are being conducted around the world are managed through the Weissach-headquartered Porsche Engineering Group GmbH founded in 2001. However, the public knows very little about the development and design work done by Porsche Engineering. According to a policy of strict confidentiality, the product strategies and the brand identities of its customers are always protected with the greatest care. Only a few projects are made public, and then only with the client's express permission. After all, Porsche Engineering only succeeds if a customer returns. This maxim prevails to this day – as it has for more than 80 years.

**www.porsche-engineering.com**

6.71

# MOBILITY IN PRACTICE FOR THE FUTURE

## Mobility concepts for rural areas

**proconman**
**Projekte-Consulting-Management**
Pestalozzistrasse 100/2
70736 Fellbach, Germany

**Year of establishment:** 2007
**Employees:** 5 (2012)

Modellregion Elektromobilität Region Stuttgart

livinglab BW e mobil

**Contact**

Heinz Handtrack
Phone: +49 711 51080 05
Fax: +49 711 51080 04
handtrack@proconman.de

Following the motto of 'From practice for practice and the future', we work on mobility concepts for regional centres in rural areas. This includes large-scale events that run for several months, as well as regional and local events. Electric mobility with its now huge range of applications plays a major role here.
Our service portfolio comprises the analysis and design of charging station infrastructures for different types of electrically powered vehicles and technical services. We also provide the required training and qualification of personnel. All of our mobility concepts focus on local and regional development plans and on readily available technologies and scenarios for the near future. In our opinion, electric mobility has become just as favourable for rural areas as it is for the greater city centres and their suburban areas. Many different types of mobility concepts for urban and rural areas and existing system components must be integrated intelligently and improved.

Requirements and operations in production and logistics processes within existing value-added chains have changed with the development of electric mobility and its specific technologies. They need to be analysed, planned and implemented cost-efficiently and for sustainability. Another of our core competencies focuses on medium-sized companies, in the support of the development of innovation potentials through electric mobility.

**www.proconman.de**

6.72

# THE FUTURE IS 'E'

## Infrastructure, fleet management and value-added services

**PTV Group**

Haid-und-Neu-Strasse 15
76131 Karlsruhe, Germany

**Year of establishment:** 1979
**Employees:** 654 (2010/2011)
**Turnover:** EUR 84.1 million (2010/2011)

PTV GROUP
the mind of movement


electric mobility south-west

**Contact**

Matthias Hormuth
Phone: +49 721 9651 173
Fax: +49 721 9651 699
matthias.hormuth@ptvgroup.com

Currently, public charging stations for electric vehicles are usually built as pilot projects. The metropol-E research project, which was awarded the status of a lighthouse project by the German federal government, currently develops a municipal electric fleet concept for the city of Dortmund. PTV analyses demographic, structural and transport factors to work out location indicators for charging infrastructure in individual geographical zones.

Autolib' in Paris – the first carsharing project offering e-cars only – intends to provide its users with information on the battery status and charging stations in reach. In addition to the required geographical referencing, PTV developed navigation solutions and components which make e-mobility practical for everyday business.

PTV is also engaged in the iZeus project from IKT. The goal here is to integrate e-mobility in private and commercial urban transport. Additional intelligent services optimise the use of mixed company fleets or calculate the remaining range based on the state of the battery, vehicle parameters, route and weather conditions.
PTV also participates in three projects of the leading-edge cluster Electric Mobility South-West: I-eMM analysing demand in public urban transport with respect to linking e-mobility and information services for their users, eFlotte for managing e-vehicle fleets and the related charging infrastructure, and Green Navigation for planning and recommending individual energy-optimised routes for extending the range.

**www.ptvgroup.com**

6.73

# PVS-KUNSTSTOFFTECHNIK, NIEDERNHALL

## Innovations in plastics for electric motors and ventilation technology

**PVS-Kunststofftechnik GmbH & Co. KG**

Salzstrasse 20
74676 Niedernhall, Germany

**Year of establishment:** 1976
**Employees:** 350 (2013)
**Turnover:** EUR 45 million (FY 12/13)

electric mobility south-west

PVS-Kunststofftechnik, with headquarters in Niedernhall, produces technically sophisticated injection mouldings from high-grade plastic materials for the insulation of electric motors and for ventilation technology. The company employs a total of 350 employees in four locations: in Niedernhall (Germany), Huber Heights (USA), Celldömölk (Hungary) and Shanghai (China).

In 2012, the former production area of 7,500 m² in Niedernhall was extended to include a new production hall of 4,000 m². Together with the production sites located in Hungary, the USA and China, PVS produces plastic technical parts on an area totalling 19,000 m², with roughly 100 injection moulding machines (with 250 to 6,500 KN clamping force).

Increasing electrification in automobiles and EU energy saving directives make the electric insulation division of PVS the business unit with the highest growth rate. The Niedernhall plastics specialists place special emphasis on optimal insulation design, with respect to stator winding wall thickness and heat dissipation.

PVS's second core focus is the production of plastic fan blades, blower wheels and high-performance turbines, featuring optimal balancing values and circumference speeds of up to 800 m/s. Among the customers are leading companies from the automobile, telecommunications/IT, industrial drive technology, medical engineering and home appliance industries.

**www.pvs-plastics.net**

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Management
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Fax: +49 7940 9126833 70
j.frank@pvs-plastics.net



6.74

# FIELD CHECKS

## Research into e-mobility at Bruchsal's 'Technology Village'

**RA Consulting GmbH**

Zeiloch 6a
76646 Bruchsal, Germany

**Year of establishment:** 1989
**Employees:** 45 (2013)
**Turnover:** EUR 4.2 million (2013)

RA CONSULTING

electric mobility south-west

RA Consulting GmbH has been successfully active for more than 20 years in three core fields: Software Technology, Automotive and Embedded Systems. The Software Technology department concentrates on traditional IT services, focusing on developing technical database-driven applications (including the integration of mobile systems) for industry. The Automotive division focuses on the development of software products for diagnosing, calibrating and validating electronic controllers, mainly for use in the automobile industry. The Embedded Systems department develops diagnostic software for controllers, data loggers, telematics units and mobile devices (such as smartphones) and provides development services for industrial customers. For the Elise project of the 'Leading-edge cluster Electric Mobility South-West', supported by the German Ministry of Education and Research, researchers from the Karlsruhe Institute of Technology cooperate with the companies RA Consulting and CarMedialab. Elise examines the interactions between driver, vehicle and environment and incorporates data processing concepts for cars as well as independent charging units. Its goal is to make electric vehicles more reliable and economical, so as to ultimately establish e-mobility in the market.

**www.rac.de**

**Contact**

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info@rac.de

6.75

# REFUdrive's GREEN

## Sustainable drive technology for the world of tomorrow

**REFU Elektronik GmbH**

Marktstrasse 185
72793 Pfullingen, Germany

**Year of establishment:** 1965
**Employees:** 130
**Turnover:** EUR 30 million

Quality products from REFU Elektronik GmbH – a long tradition. For more than 40 years, high-quality power electronics have been developed and produced at the outskirts of the Swabian Alb region. Whether they are used in electric or diesel-electric drive systems, REFUdrive components stand for energy efficiency and reliability.

This contributes to environmental protection by:
- Improving energy efficiency
- Reducing $CO_2$ emissions
- Using resources sensibly
- Reducing operating and maintenance costs

With power electronics and energy storage systems from REFU Elektronik, e-mobility solutions can be implemented in a sustainable manner. Different fields of application are imaginable: mobile machines in construction, mining, in the maritime sector, and buses. REFUdrive components withstand the toughest environments and feature top standard performance.

The modular design of REFUdrive units allows mobile machines to be configured individually; by coupling generator and/or motor inverters, power system units and DC-DC converters, we can achieve energy-efficient drive systems. Energy storage systems, battery management systems and charging units complete our product range.

**www.refu-elektronik.de**

**Contact**

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Fax: +49 7121 4332 140
mail@refu-elektronik.de

6.76

# E-MOBILITY ON RAIL AND ROAD

## Public transport plays the pioneering role

**Rhein-Neckar-Verkehr GmbH**

Möhlstrasse 27
68165 Mannheim, Germany

**Year of establishment:** 2005
**Employees:** 1,880 (2011/2012)
**Turnover:** EUR 279.4 million (2011/2012)

electric mobility south-west

For Rhein-Neckar-Verkehr GmbH (RNV), electric mobility is not some futuristic vision – it is already reality. Around 125 million passengers trust in environmental e-powered public transport; they represent a good 80 per cent of all RNV customers. This core competence has a long tradition. The first electric trams served the Rhine-Neckar region as early as the beginning of the 20th century. The almost 200 kilometres of the RNV railway network, which is currently being extended too, are the backbone of public transport in this region today.
For its fleet, RNV consistently relies on modern technology as well. RNV was Germany's first public transport service to equip all of its new metropolitan trams with MITRAC Energy Savers developed by Bombardier Transportation. Thanks to modern high-performance capacitors which store braking energy and use it to support acceleration traction, energy consumption for the cars can be reduced by up to 30 per cent. On the road, RNV relies on electric mobility as well. A research project is currently preparing the use of induction-charged electric buses for regular service and of maintenance vehicles. In addition, RNV has continuously modernised its control centre, so that it can serve as a regional hub for new mobility models too.

**www.rnv-online.de**

**Contact**

Georg Nowak-Hertweck
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Fax: +49 621 465 3262
g.nowak-hertweck@rnv-online.de

6.77

# RICARDO – INNOVATION AND TECHNOLOGY SINCE 1915

## Your premium partner in the development of hybrid and electric vehicles

**Ricardo Deutschland GmbH**

Gueglingstrasse 66
73529 Schwäbisch Gmünd, Germany

**Year of establishment:** 1999,
1915 in UK
**Employees:** 2,300 (2012)
**Turnover:** EUR 270 million (2012)

**Contact**

Dr. David Gagliardi
Phone: +49 7171 9821 0
Fax: +49 7171 9821 400
info@ricardo.com

Aside from strategy consulting, Ricardo is a leader in product innovations, technology, engineering, prototyping and small-series production. We work for a large number of truly diverse customers, all of them with very individual requirements, at our state-of-the-art technology centres in Europe, the USA and Asia. Ricardo operates in various sectors, such as passenger cars, motorcycles, commercial vehicles, construction, agricultural and industrial vehicles, marine, defence, rail traffic and motor sports. Ricardo contributes its comprehensive experience in hybrid and plug-in technology, lightweight motor design and vehicle optimisation to the development of electric vehicles. Examples of this are the development of a serial range extender, integrated start-stop systems on a 48 V basis for passenger cars and numerous electric drives for a wide range of applications. Power-train engineering on a system-integrated level accomplish synergies in terms of thermal and acoustic characteristics. It boosts the efficiency of the whole system and reduces design costs as well as the cost of testing important components. This includes development projects for electric motors, power electronics, battery systems, transmissions and mechanical energy storage systems (flywheels).

**www.ricardo.com**



6.78

# INNOVATIVE VACUUM TECHNOLOGY FOR LITHIUM-ION BATTERY PRODUCTION

## The world of vacuum technology

**J. Schmalz GmbH**

Aacher Strasse 29
72293 Glatten, Germany

**Year of establishment:** 1910
**Employees:** Approx. 800 (2013)

**Contact**

Dr. Mathias Kunz
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mathias.kunz@schmalz.de

The high pressure to reduce costs forces producers of lithium-ion batteries to continually improve product quality, process reliability and output volumes in the production of these high-performance energy storage devices. The latter is achieved through innovative technologies in the area of automation and handling: electrodes, separators and entire cells must be stacked, buffered, fed and separated in pick and place processes. And this must occur quickly, reliably, reproducibly, exactly and free of contamination. Especially in the case of ceramic or synthetic components, conventional gripper systems quickly reach their limits. The vacuum grippers developed by Schmalz specifically for this purpose are perfectly suited for application with these sensitive battery components in high-speed processes; for exact positioning, free of damage and contamination. Design features like the large suction surface provide for a strong hold despite low vacuum levels required for handling such sensitive components. These features have successfully undergone contamination tests by Fraunhofer IPA in Stuttgart. The wide range of Schmalz's standard components allows the individual configuration of gripper solutions, for example using the low-marking and electrolyte-resistant grippers made of FPM. The high-performing compact ejectors from the SMPi series allow full process control and reliability. The SMPi, being the first vacuum generator on the market, features the future-proof IO-link technology.

**www.schmalz.com**

6.79

# SCHOPF TOW TRACTORS: THEY HAVE THE POWER

## Future market hybrid and electric drives

**SCHOPF Maschinenbau GmbH**

Parkstrasse 19–21
73760 Ostfildern, Germany

**Year of establishment:** 1948
**Employees:** 160 (2012)
**Turnover:** EUR 45 million (2012)

Modellregion Elektromobilität Region Stuttgart

livinglab BW mobil


**Contact**

Thomas Berger
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Fax: +49 711 34110 87
thomas.berger@schopf-gse.com


SCHOPF Maschinenbau GmbH, member of the Goldhofer AG Group since January 2013, designs, produces and sells vehicles for civil and military aerospace applications and for the mining and tunnelling industry. This includes a complete range of aircraft and cargo tractors for moving aircrafts or loads of any weight class. The spectrum of underground loaders for the mining and tunnelling industry ranges from load capacities of 3.5 to 18 tonnes.

SCHOPF products are equipped with the latest drive technology. They are available with diesel, gas, electric and power-hybrid drives. As early as 1982, SCHOPF supplied airlines worldwide with electric tractors, F356E and F246E. SCHOPF counts on e-mobility as the future market. The electric drive SCHOPF uses is highly efficient, low maintenance and perfectly adapted to the needs required in heavy-duty applications.

SCHOPF's successful F110 aircraft tractor is also available in an electric version, the F110 electric. This drive in connection with flexible battery management and innovative charging technology allows conventional aircraft tractors to be replaced by environmentally friendly technology.

The ZH4/ZH5 drive combines the economy and environmental friendliness of an electric motor and the power and reliability of a diesel engine. The hybrid drive develops optimal efficiency depending on its field of use.

**www.schopf-gse.com**

6.80

# ELECTRIC MOBILITY UNDERSTOOD!

## Automation makes technology profitable

**SCHUNK GmbH & Co. KG**

Bahnhofstrasse 106–134
74348 Lauffen N., Germany

**Year of establishment:** 1945
**Employees:** 1,900
**Turnover:** EUR 200 million (2012)

electric mobility south-west


**Contact**

Dr. Matthias Haag
Phone: +49 7133 103 0
matthias.dr.haag@de.schunk.com
m_haag@gmx.de


SCHUNK ensures safe and profitable grippers, for storage batteries for electric mobility as well. Because handling technology is a critical issue. Picking, stacking, feeding cells, forming packs and module assembly – all these operations are subject to the highest safety and quality requirements and short cycle times.

And what is essential here?

- Compactness: The goal is to keep the package space in electric vehicles as small as possible. As a consequence, during assembly, all components must be precisely placed and joined. SCHUNK helps.
- Safety and quality during the entire handling process: The component ready for installation is largely determined by the production process. And the quality of the complete system depends on the reliability of many highly sensitive components. SCHUNK gripping technology promotes these standards.
- Fast and profitable processes for mass production: The entire process must meet the requirements of the automobile industry as regards reliability, flexibility and cycle times. SCHUNK has translated these requirements into products – for more than 60 years. SCHUNK is a member of the Elektromobilität Süd-West cluster and, together with partners from industry and research, contributes to Germany's e-mobile future in the AutoSpEM project supported by the Federal Ministry of Education and Research.

**www.schunk.de**

6.81

# SEBASTIAN WIDER – ENGINEERING SERVICES

… your desire is clean transportation

**Sebastian Wider –**
**Engineering Services**
Gaußstrasse 42 A
70193 Stuttgart, Germany

**Year of establishment:** 2006
**Employees:** 2 (2013)


Modellregion Elektromobilität Region Stuttgart

Our engineering consultancy has been active in the Stuttgart Region, in Germany and worldwide since 2006, developing leading electric mobility and storage technologies.

We focus on project and business development in the area of e-mobility and electric storage technology as well as hydrogen as an energy carrier or fuel for fuel cell-powered vehicles.

We work on public and private industry projects in these areas and take over the responsibility for the project management of development, demonstration and serial projects. We also advise firms on how to use their existing and potential competencies in the growth markets of e-mobility and electrical storage technology.

Through our many years of experience in this field we have the capacity to develop cross-industry solutions and integrated ideas.

**www.sw-engineering-services.com**

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sebastian.wider@
sw-engineering-services.com

6.82

# SIEMENS – PIONEER IN ELECTRIC MOBILITY

Power for a mobile future

**Siemens AG**

Weissacher Strasse 11
70499 Stuttgart, Germany

**Year of establishment:** 1847

SIEMENS

livinglab BW mobil

From the first electric tramway and the ‘Elektromote’ electric trolley-bus to the first electric ‘Victoria’ car – Siemens has always been a pioneer in electric mobility.

Today, we have the technology and know-how required for innovative and comprehensive solutions to lay the groundwork for worldwide electric mobility. We are one of a few companies on the planet that cover the entire process chain of electric mobility – from infrastructure (energy generation and distribution), to charging technology and solutions for smart grid management, to electric car drives, controls and power electronics. We also supply various system management hardware and software packages (consumption data recording, processing of payment data, fleet management) and intelligent electronic ticketing systems that also integrate various means of transport.

Siemens also supports the efficient production of electric cars and mass production of batteries, with associated solutions along the entire value-adding chain. We provide the products and services that optimise each step in the production of electric vehicles and their core components, such as batteries, from automation and drive technology to production planning and design software.

**www.siemens.com/drivergy**

**Contact**

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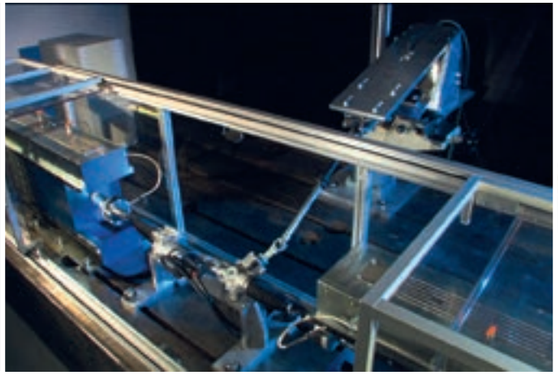
6.83

# TECHNOLOGY PROVIDER

## For safety-critical electronic systems

**SILVER ATENA Electronic Systems Engineering GmbH**
Industriestrasse 5
70565 Stuttgart, Germany

**Year of establishment:** 2008 (1998)
**Employees:** 250 (2012)



**Contact**

Thomas Schwarz
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Fax: +49 711 220 96 111
t.schwarz@silver-atena.de

As a technology provider and supplier of integrated systems SILVER ATENA offers a comprehensive product and service portfolio for the development of safety-critical electronic systems. SILVER ATENA realises project modules as well as complete hardware/software projects from requirements engineering (RE) to the serial production of complete systems. Their products such as test systems, test benches, simulators and development tools, complete the range.

**Technologies**
- Battery simulation
- Simulation models for electric machines
- Model-based software development for safety-critical systems
- X-by-wire technologies
- Development tools for verifying classified software
- Fuel cell, hydrogen

**Products and services**
- Safety-critical electronic systems
- Control units for drives and auxiliary units
- Power electronics
- Hybrid test benches / battery and e-motor simulation
- Mechatronic test benches
- Consulting and training in functional safety (ISO26262, IEC 61508)
- Requirement/model-based software engineering
- Hardware design / VHDL
- Auto code generation for safety-critical software
- EMC / environmental testing, qualification

**www.silver-atena.de**



6.84

# SITRONIC – ELECTRONICS AND SERVICES

## For climate-friendly mobility

**sitronic GmbH & Co. KG**

Robert-Bosch-Strasse 9
71116 Gärtringen, Germany

**Year of establishment:** 1969
**Employees:** 160 (2012)
**Turnover:** EUR 26.2 million (2012)

electric mobility south-west

**Contact**

Sven Easterbrook
Phone: +49 7034 272 340
Fax: +49 7034 272 399
easterbrook@sitronic.com

As a medium-sized company with a global footprint, we are in close contact with our customers – and not just because of our numerous locations. We develop and produce high-tech electronic products in our state-of-the-art production plants. Global megatrends in e-mobility drive the challenges for the supplier industry. One of the key issues in development projects is the reduction of consumption and emissions. Existing thermal management systems are not suitable for e-mobility. In the area of automobile electronics and based on its product strategy for passenger cars and trucks, sitronic has three answers for this:
- Optimisation of conventional electronic components
- Keep driver and passengers comfortable with a minimum of electrical energy using electronic components and elements that reduce energy consumption
- Integration of the thermal management system into the overall energy management system

More mobility using less energy – sitronic proves that this can be done. Even today, sitronic's electronic products considerably reduce fuel consumption and, as a consequence, $CO_2$ emissions. Our sensors are used to automatically control air conditioning systems, and at the same time improve the interior climate of the vehicle. However, it takes more to meet tomorrow's standards for $CO_2$ emissions: maximum use of energy is guaranteed by innovative technology and the interlinking of active electronic products by sitronic.

**www.sitronic.com**

6.85

# INTERCONNECTED MOBILITY –

## Stuttgarter Straßenbahnen AG


**Stuttgarter Straßenbahnen AG**

Schockenriedstrasse 50
70565 Stuttgart, Germany

**Year of establishment:** 1868
**Employees:** 2,900 (2013)

Modellregion Elektromobilität Region Stuttgart

livinglab BW[e]mobil

**Contact**
**Stuttgart Services**
Angela Maiolo
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angela.maiolo@mail.ssb-ag.de

**Contact**
**Vehicle projects**
Markus Wiedemann
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Fax: +49 711 78856200
markus.wiedemann@mail.ssb-ag.de

Stuttgart has been e-mobile since the launch of its tramway in 1895. For years, SSB has promoted sustainable transportation concepts and worked towards a sustainable vehicle fleet. Today, there are electrically powered buses, vans and cars with this low-emission technology in daily use. SSB attaches particular importance to the qualification of all of its employees when new types of vehicles are being introduced, and to the integration of these modern vehicles into existing maintenance processes. Another step towards the emission-reducing operation of buses is the usage of hybrid buses employing fuel cell technology, starting from the fourth quarter 2013.

The project Stuttgart Services accelerates the cross-linking of e-mobile services. Together with its partners, SSB is developing an access medium that will give users the opportunity to explore and enjoy the city: the Stuttgart Service Card. It is planned to become key to the city and region of Stuttgart, providing access to e-mobile services in public transportation, (e-mobile) car-sharing, public swimming pools and libraries. It even includes a payment function.

Using local public transport means ecological transport and saving energy – this is what SSB stands for. With its commitment to electric mobility SSB has once again demonstrated its ecological and innovative strategy and its mission to provide expeditiously its passengers the comfort of the latest technology.

**www.ssb-ag.de**

6.86

# THE FUTURE OF E-VEHICLE INFRASTRUCTURE

## SWARCO TRAFFIC SYSTEMS lays foundations for new business models


**SWARCO TRAFFIC SYSTEMS GmbH**

Adolf-Dambach-Strasse
76591 Gaggenau, Germany

**Year of establishment:** 1953
**Employees:** 1,000 employees, more than 100 locations

livinglab BW[e]mobil

**Contact**
Uwe Hahner
General Manager Parking and E-Mobility
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Fax: +49 7225 64654
parking@swarco.de

SWARCO TRAFFIC SYSTEMS is one of the leading suppliers of system solutions for traffic control and offers comprehensive expertise in the area of e-vehicle charging stations. Our Parking and E-Mobility business unit offers customised integrated solutions for parking traffic control, parking space management and e-vehicle charging infrastructure. SWARCO's wide range of solutions includes systems for vehicle and parking space detection, intelligent car-park routing systems, systems for managing on- and off-street parking spaces as well as e-vehicle charging connections, charging stations and battery exchange systems.
In the greater metropolitan area of Stuttgart, SWARCO is currently helping establish an economical charging infrastructure for e-vehicles with its newly developed charging station model.

Thus, SWARCO TRAFFIC SYSTEMS lays foundations for new business models within the 'Living-Lab BW[e] mobil' project sponsored by the Federal Ministry of Economics and Technology. The EnBW utility company ordered several hundred stations for use in the eCar2Go project (Daimler AG), the smart grid research project iZEUS (Karlsruhe Institute of Technology) and the pilot project for 'Integrated Fleet Charging'.
"Our projects in Baden-Wuerttemberg break new ground for new business models in e-mobility", explains Uwe Hahner, General Manager of Parking and E-Mobility at SWARCO TRAFFIC SYSTEMS. The new transport concepts are technically based on the SWARCO charging station; this integrated system allows the economic operation of an e-vehicle infrastructure 'right at the kerb'.
**www.swarco.com/sts**

6.87

# NOW IT IS POSSIBLE –

## Generate power, store it and drive

**SWE-Mobility UG**
**(haftungsbeschränkt)**
Gaußstrasse 42 A
70193 Stuttgart, Germany

**Year of establishment:** 2012
**Employees:** 2 (2013)

**Contact**

Adina Wider
Phone: +49 711 9933708 0
Fax: +49 711 6389690
adina.wider@swe-mobility.com

Our customers buy electric mobility because they want to drive emission-free, to enjoy driving and to save money. Our customers buy electric vehicles because they want to change their energy consumption. Because it feels good to drive without petrol or diesel, and to charge their cars with power they produce themselves from renewable energy sources. Our customers are consciously aware of the environment. They live their lives in accordance with the resources of this planet. Our customers are curious. They have fun exploring new things, in technology or in the outdoors. Our customers appreciate high quality. You are one of our customers.
SWE-Mobility specialises in the sale and operation of electrically powered vehicles and related technologies. We supply all products, from power generation to photovoltaic systems including battery storage for electric cars and boats. We let you test it, rent it and buy it.

- Photovoltaic systems with battery storage
- Pedelecs and S-pedelecs
- Electric scooters
- Electric boat motors
- Electric vehicles
- Vehicle rental
- Batteries and accessories
- Services around electric mobility

**www.swe-mobility.com**
**www.swe-mobility-shop.com**



6.88

# FROM START-UP TO HIGH-SPEED

## Flexible large-scale production of electric drive units

**teamtechnik Maschinen und**
**Anlagen GmbH**
Planckstrasse 40
D-71691 Freiberg, Germany

**Year of establishment:** 1976
**Employees:** 800
**Turnover:** EUR 145 million (2012)

**Contact**

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teamtechnik is an expanding internationally successful company in production technology. Over 800 highly qualified employees design and build turnkey and customer-specific assembly and test systems worldwide.
The company's three divisions have been aligned with the three megatrends of automotive, medical engineering and solar technology. Combining assembly and integrated testing technology in addition to their modular structure is a key characteristic of its plants. On an international scale, teamtechnik is considered the technology leader for modularly built assembly and test systems. These feature a high degree of flexibility. Innovation, research and development are high priorities at teamtechnik. teamtechnik closely cooperates with external research institutes and, in its automotive division, focuses on the electric mobility technologies of the future. Together with renowned Baden-Wuerttemberg enterprises and research institutes teamtechnik drives the various topics of e-mobility – for example within the framework of the leading-edge cluster programme of the Federal Ministry of Education and Research. In solar technology too, performance has been continually raised to increase volumes for solar module mass production. In the medical engineering area, the innovation focus is on the planning and design of flexible assembly systems and innovative process technologies for the assemblage of ever smaller components. The teamtechnik group has production locations in Germany, Poland, China and in the US. Its headquarters are in Freiberg, Germany.

**www.teamtechnik.com**

6.89

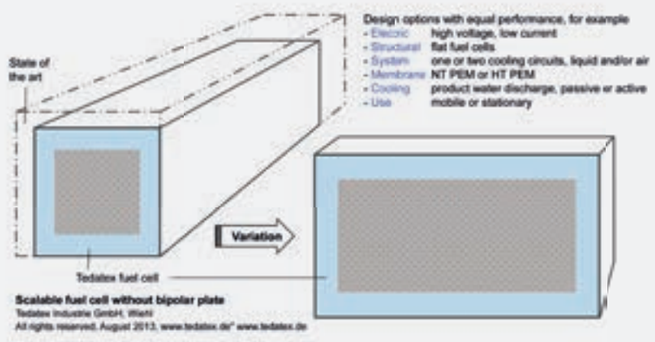
# FUEL CELL WITHOUT A BIPOLAR PLATE

## Scalable stack current and voltage

**Tedatex Industrie GmbH**

Eichhardtstrasse 59
51674 Wiehl, Germany

**Year of establishment:** 1981




The scalable fuel cell without the bipolar plates component is new and innovative: within certain limits and levels, stack current and voltage can be adapted to the application so that the familiar bipolar plate may be omitted. A laminate-based cooling and media module is applied in place of bipolar plates. This allows more freedom in the design of fuel cells, and provides new technical and, above all, economical options previously unimaginable. The overall system benefits if, with equal stack performance, the current is only 80 instead of 250 ampere, for instance, and if a stack voltage of 1000 volts or more is achieved in a local high-voltage grid. This results in lower costs for the fuel cell peripherals (NT or HT-PEM), conductors, converters and actors (electric machines, for example). Parasitic losses are minimised: depending on fuel cell design, an almost stoichiometric operation is made possible when the lower cost of operation is the goal. According to the state of technology, base and volume of a stack amount to approximately 70 per cent of a system. The product (stack) was designed for serial production; only reliably functioning technologies using stable and robust processes are used. Fuel cells and electrolyser stacks can be produced on one production line, for mobile and stationary applications.

**www.tedatex.de**

**Contact**

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Manager
Phone: +49 2262 750075
bernhard.bruene@tedatex.de

6.90

# TELEMOTIVE AG

## We drive your ideas

**Telemotive AG**

Breitwiesen
73347 Mühlhausen, Germany

**Year of establishment:** 2000
**Employees:** 460 (2012)
**Turnover:** approx. EUR 33 million


Telemotive AG specialises in complex integrated bus systems in automotive applications, for example Ethernet, MOST, FlexRay, CAN and LIN. Our range comprises a diverse product portfolio and services in the areas of infotainment, entertainment and telematics. We focus, among other things, on driver assistance systems, connectivity, diagnosis and electric mobility. Telemotive AG's product spectrum includes test tools for data collection and simulation for the automotive industry. In addition, the multi-bus blue PiraT and blue PiraT2 data loggers, the video tester blue AdmiraL, the CAN simulation box and the Power Line Communication (PLC) Tester are all part of the Telemotive product family. The PLC Tester allows the testing and recording of communication between vehicle and charging station.
Aside from customer-specific development projects, Telemotive's electric mobility activities include a study with respect to on-board architectures in electric and hybrid vehicles. This study provides an overview of all current serial bus systems (Ethernet, MOST, FlexRay, CAN and LIN) and defines increasing requirements for on-board structures which are relevant for the development of vehicles with alternative drive concepts.

**www.telemotive.de**

**Contact**

Sales
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Fax: +49 7335 18493 20
sales@telemotive.de

6.91

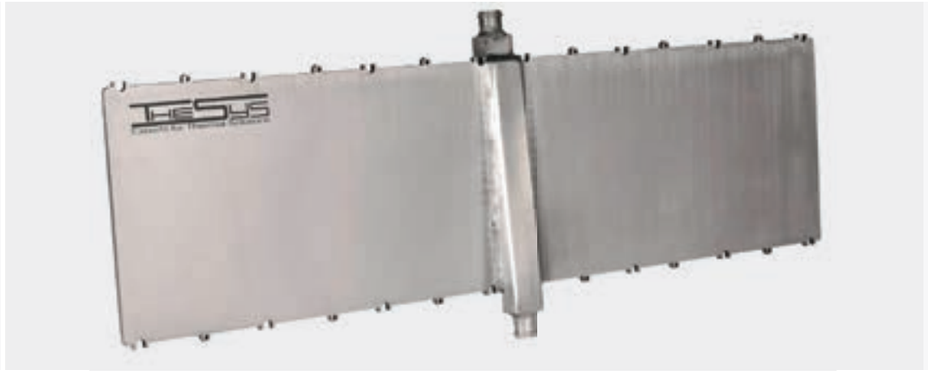
# BATTERY HEALTH FOR THE BATTERY

## Thermal management for battery cells – a job for battery coolers and radiator systems


**TheSys GmbH**

Einhornstrasse 10
72138 Kirchentellinsfurt, Germany


**Year of establishment:** 2009
**Employees:** 9 (2013)
**Turnover:** EUR 1,140.000 (2012)



Modellregion Elektromobilität Region Stuttgart

TheSys GmbH is an independent engineering services provider that designs cooling systems, air conditioning systems and heat exchangers. TheSys covers the entire field of thermal management in vehicle, railway, marine and industrial applications.

TheSys assists and advises customers in the design and assessment of cooling systems and related operational strategies on site. This includes the design and layout of cooling and air conditioning system components, the design of new heat exchangers in line with customer requirements, the supply of battery coolers in small series and measurements with heat exchangers and cooling systems. We also conduct vehicle testing and failure analyses for radiators, including tests regarding the ageing of coolants.

We support e-mobility by supplying battery coolers and designing battery cooling systems, especially low-temperature cycles, chillers and cold/heat stores. Our battery coolers feature extremely good surface temperature homogeneity of less than 1 Kelvin. This homogeneity of temperature distribution in the cell contact area does not involve any loss of heating capacity or pressure loss. In addition, our battery coolers are extremely slim and light. With our thermodynamic simulation method, we analyse hybrid and electric vehicles under transient driving conditions. This identifies the temperatures within a battery at any given point of time.

**www.thesys-engineering.de**


**Contact**

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Fax: +49 7121 696275 99
p.ambros@thesys-engineering.de



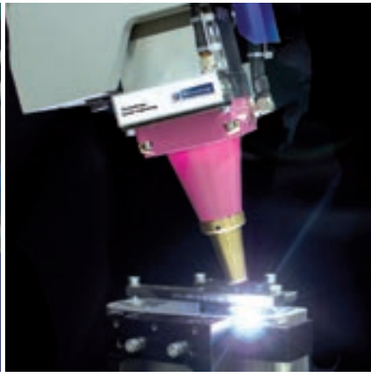

6.92

# BATTERY PLANT TECHNOLOGIES

## Plant automation for battery assembly


**ThyssenKrupp System Engineering GmbH**
Weipertstrasse 37
74076 Heilbronn, Germany


**Year of establishment:** 1900
**Employees:** 3,600 (worldwide)
**Turnover:** EUR 850 million (2012)



electric mobility south-west

As an established engineering partner for the automotive and aerospace industry, Thyssen-Krupp System Engineering became involved with battery technology in 2010. In the new business area 'Battery Plant Technologies', founded in Hohenstein-Ernstthal in Saxony, automatic assembly equipment is being developed and built for both the manufacturing of Li-Ion cells and the assembling of modules and battery packs. Also, system solutions for the quality assurance and performance testing of these products are being offered. Significant orders have already been placed both nationally and internationally. ThyssenKrupp System Engineering is thus a turnkey system supplier covering all areas of the manufacturing process of Li-Ion batteries. Production technologies for lithium-ion batteries are among the central research and development areas at ThyssenKrupp Industrial Solutions. A technical centre has therefore been founded in Pleissa near Chemnitz to examine these assembly and manufacturing steps.

ThyssenKrupp System Engineering is an internationally acting affiliate of ThyssenKrupp AG, a system partner for all important components of the car body and power-train process chains in the automotive industry. The new business portfolios include automation solutions for electrical storage and drive systems, solutions for innovative lightweight designs, as well as plants and test systems for the aviation industry. Thyssen-Krupp System Engineering is a strong and reliable partner to its customers, optimising their value-added chain and strengthening their efficiency.

**www.thyssenkrupp-systemengineering.com**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6.93

# THINK AHEAD IN MOBILITY AND ENERGY

## Linked business processes for e-mobility

**TransEnergyPartners GmbH**

Hirschstrasse 14
70173 Stuttgart, Germany

**Year of establishment:** 2009
**Employees:** 7 (2013)

electric mobility south-west

The efficient and sustainable transport of people and goods and unlimited mobility of the individual are the focus of TransEnergyPartners.

This being our goal, we provide consulting services to companies, from the development of sustainable business models and product and process definitions to their operative realisation. In addition, we provide support for restructuring sales organisations and deliver future-oriented solutions for IT infrastructures.

Our team of experts is not only able to control and implement individual projects as external partners but also to develop complex cross-system and cross-structural initiatives.

We are the specialists when it comes to preparing and launching battery-driven vehicles for the market. This includes of course the relevant renewable energy charging infrastructure. We supply decentralised IT management solutions for automated parking and charging, vehicle communication and smart grid applications.
When Prof. Johann Tomforde joined the company in 2013, electric mobility and infrastructure development became our key focus. In the capacity of project coordinator, in 2013 we were awarded the AUTOPLES – automated parking and electric vehicles recharging – project sponsored by the Federal Ministry of Education and Research.

**www.transenergypartners.de**

**Contact**

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Fax: +49 711 652904 21
marc.meiling@TransEnergyPartners.de



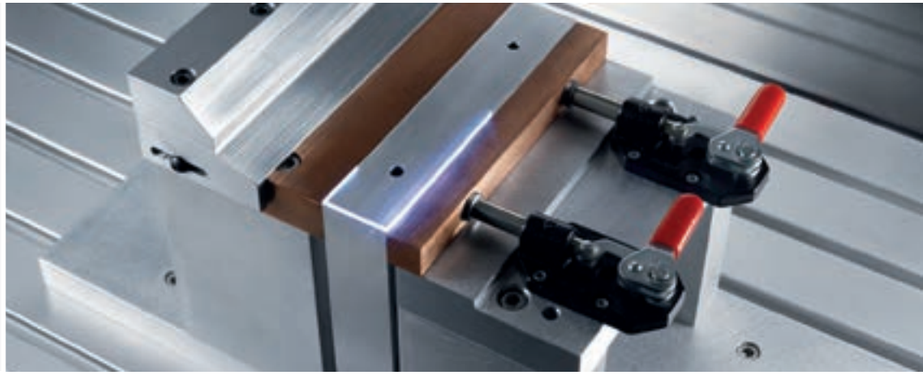
6.94

# LASER TECHNOLOGY

## The right tool for electric mobility

**TRUMPF Laser- und Systemtechnik GmbH**
Johann-Maus-Strasse 2
71254 Ditzingen, Germany

**Year of establishment:** 1988
**Employees:** 2,330 (2012)
**Turnover:** EUR 727 million (2012)



electric mobility south-west

Non-contact machining, such as the laser-welding of battery enclosures or cell connectors, prevents mechanical stress to the material. The locally limited and low input of heat ensures non-distorted seams. Lasers from TRUMPF produce high-quality welding seams which are accurately reproducible, as they are extremely precise. They significantly contribute to the production of ever smaller and more powerful battery block cells. Efficient production on laser machines with high productivity and the low cost of parts allows the production of large volumes at reasonable prices. Therefore, laser production facilities meet the demands of a broad end user market.

In the electric motors sector, laser machines are used for cutting stator sheets. Delicate contours are cut quickly and can be consistently and precisely duplicated. Reproducibility and non-distortion are critical factors in joining stator packs.

In addition to the applications above, laser machines offer various other options for applications and solutions in the area of electric mobility. The TRUMPF group is one of the leading production technology companies worldwide. The company is a technological and global market leader in the industrial lasers and laser systems sector. TRUMPF offers the full range of products and services that are required for cost-efficient, quick and high-quality automobile production: from laser systems to laser beam sources, beam guiding units and optics, control units and comprehensive services.

**www.trumpf-laser.com**

**Contact**

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Fax: +49 7156 303 930113
marc.kirchhoff@de.trumpf.com

6.95

# E-MOBILITY IS ON ITS WAY –

## We make the future safe

**TÜV SÜD AG**

Westendstrasse 199
80686 Munich, Germany

**Year of establishment:** 1866
**Employees:** > 17,000 (2012)
**Turnover:** EUR 1.68 billion (2011)

livinglab BW mobil

**Contact**

Volker Blandow
Phone: 0800 88844 44
e-mobility@tuev-sued.de

The mobility concepts of the future rely on electric drives: this is an important step that not only accounts for the stronger sense of responsibility for the environment. Electric and hybrid cars are much more resource- and climate-friendly than conventional drive concepts, especially if they use renewable energy sources. Local pollutant emissions are completely eliminated and noise pollution – especially in metropolitan areas – is reduced significantly. E-mobility makes individual mobility climate-friendly and independent of fossil fuel resources. Many regions of the world will have stricter environmental regulations and exhaust emission standards in the years to come.
Municipalities may even elect to prohibit vehicles with combustion engines in their urban centres. For many vehicle manufacturers and infrastructure operators, this is reason enough to get involved in the development of electric drive systems and charging infrastructures, and to design new competitive products worldwide. Not only in Europe, but also in Asia and the USA, manufacturers are working on new drive concepts. With ever increasing competition, quality and safety gain more and more importance.

TÜV SÜD clears the way for safe innovations – with their comprehensive expertise in all important key subjects and in cooperation with their customers. TÜV SÜD tests and certifies their customers' products in the area of electric mobility, with proven competence and long-standing experience.

**www.tuev-sued.de**



6.96

# INNOVATION IS WHAT DRIVES OUR BUSINESS

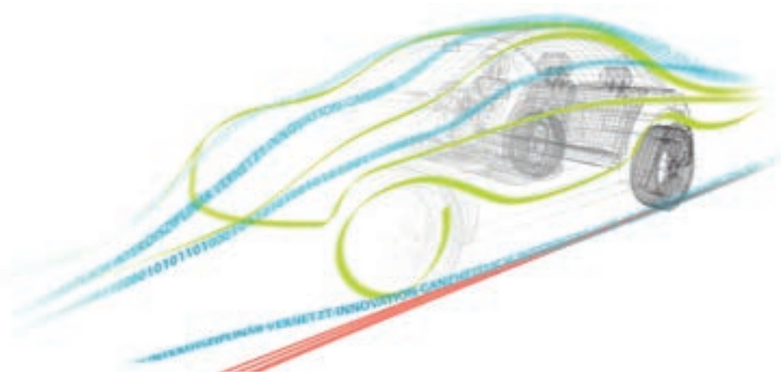
## Engineering and IT competence for tomorrow's mobility

**TWT GmbH Science & Innovation**

Ernsthaldenstrasse 17
70565 Stuttgart, Germany

**Year of establishment:** 1986
**Employees:** 230 (2012)

TWT GmbH
Science & Innovation



**Contact**

Dr. Stephan Blankenburg
stephan.blankenburg@twt-gmbh.de

TWT GmbH Science & Innovation offers a creative, far-sighted approach combined with critical attention to detail – across the entire portfolio, including engineering, software development, consulting and research. The company was formed in 1986 in Stuttgart, and now has facilities in Stuttgart, Munich, Friedrichshafen and Ingolstadt. Our focus remains the same: to turn something good into something even better.
TWT applies a holistic methodology to electric mobility. Our core competencies are energy management for the entire vehicle, operating strategy and driving behaviour. We are involved in a wide variety of projects: we assess consumption, comfort and heat management, and we optimise battery systems and power electronics. Our interdisciplinary approach enables us to take individual processes and technologies, and to apply them to an OEM's entire vehicle fleet. Modelling and simulation of relevant aspects of e-vehicles are also part of our activities, as well as technology assessments and IT solutions. Furthermore, TWT is involved in the BMWi-funded research projects iZEUS and Shared E-Fleet. In addition to the implementation of a range forecasting for electric vehicles and charging optimisation of vehicle fleets, TWT also realises cloud-based software architecture for safe fleet management.
TWT stands for the rapid translation of scientific insights into real-world products and services of exceptionally high quality, delivered via two divisions, Information Technologies and Engineering Technologies. Our pioneering role was confirmed in 2012 and 2013 when we took first place in the category 'Innovation' in the Top Automotive Industry Employers' Award organised by the Top Employers Institute.
**www.twt-gmbh.de**

6.97

# SOLUTIONS FOR E-MOBILITY

## Development tools, embedded software and services

**Vector Informatik GmbH**

Ingersheimer Strasse 24
70499 Stuttgart, Germany

**Year of establishment:** 1988
**Employees:** 1,200 (2013)
**Turnover:** EUR 224 million (2012)


Vector is the leading developer of embedded systems in vehicles of any type of drive technology. Our portfolio includes sophisticated products and competent services for future-oriented electric and hybrid vehicles and charging stations. The company's know-how involves products and comprehensive consulting services in the area of system and software engineering. The company is headquartered in Stuttgart and employs 1,200 worldwide.

**Product portfolio**
Simulation and test, measuring and calibration, diagnosis, AUTOSAR and embedded services, consulting

**Research**
Vector is actively involved in several research projects regarding electric drives.

**Smart charging-specific know-how:**

- **For vehicles**
  AUTOSAR basic software modules and tools for developing electronic control units for on-board charging – on the basis of power-line communication and TCP/IP in accordance with ISO15118 for AC/DC charging.
- **For charging stations / wall boxes**
  Software modules for ISO15118-based AC/DC communication
- **For testing charging communication systems**
  Vehicle and/or charging station simulation and analysis of ISO15118 messages for AC/DC charging.

**www.vector.com/ev**

**Contact**

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Fax: +49 711 80670 111
info@de.vector.com

6.98

# ALL MOBILE

## Launch of an interoperable e-ticketing system

**Verkehrs- und Tarifverbund Stuttgart GmbH (VVS)**
Rotebühlstrasse 121
70178 Stuttgart, Germany

**Year of establishment:** 1978
**Employees:** 79 (2012)
**Turnover:** EUR 420 million revenue from tickets sold (2012)


livinglab BW mobil

Verkehrs- und Tarifverbund Stuttgart (VVS, Transit and Tariff Association Stuttgart) is an organisation comprising public transport companies and municipalities; each hold a 50 per cent share in the GmbH (private limited company). Public transport company members are Stuttgarter Straßenbahnen AG (SSB), DB Regio AG and the GbR (private partnership under German civil law) between the cooperation partners of the Verband Region Stuttgart. Municipal partners are the Verband Region Stuttgart, the state of Baden-Wuerttemberg, the state capital of Stuttgart and the counties of Böblingen, Esslingen, Ludwigsburg and Rems-Murr.

VVS ensures uniform rates, schedules and customer information services within its territory. Furthermore, it sets the standards for ticket sales. In 2012, Verkehrs- und Tarifverbund Stuttgart counted a total of 338 million passengers. Income from tickets totalled EUR 420 million during this period.

**www.vvs.de**

**Contact**

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Fax: +49 711 6606 2400
krautz@vvs.de

6.99

# DEVELOPMENT PARTNER FOR HIGH-PERFORMANCE DRIVES

## High-end electric mobility from WITTENSTEIN

**WITTENSTEIN AG**

Walter-Wittenstein-Strasse 1
97999 Igersheim, Germany

**Year of establishment:** 1949
**Employees:** around 1,700 (2012/2013)
**Turnover:** EUR 241 million (2011/2012)

WITTENSTEIN

electric mobility south-west

As a successful partner in the field of mechatronic drive technology, WITTENSTEIN AG can rely on many years of practical know-how and expertise in the field of drive technology on an international scale. Its range of services includes design and production of customised low-backlash servo drives, actuator systems, electronic and software components, and high-performance motors.

This expert knowledge from other industries is systematically translated into innovative electric drive systems to meet the highest quality requirements of electric mobility. We do not intend to serve the mass markets, but instead focus on our niche, as an excellent and long-standing development partner in the field of electric drive technology. There is great potential in challenges met for racing, for example; such innovations may be used for series products, improving the performance of e-mobility drive concepts. WITTENSTEIN uses this know-how directly for developing close-to-production drive solutions for electric vehicles. As development and project partner, WITTENSTEIN, supplies a complete drive system to a renowned manufacturer, for powerful electric scooters or maxi-e-scooters.

**www.wittenstein.de**

**Contact**

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Fax: +49 7931 493 200
info@wittenstein.de



6.100

# THE ‘SCHWALBE’ CONQUERS THE SCOOTER MARKET

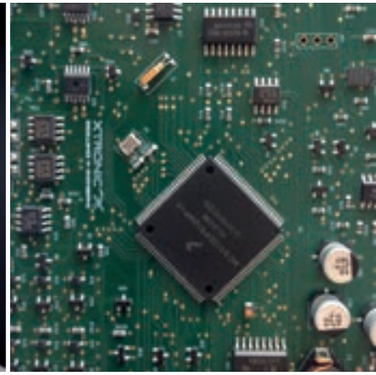
## The GDR cult scooter returns – with an electric motor!

**XTRONIC GmbH**

Blumenstrasse 44
71106 Magstadt, Germany

**Year of establishment:** 1999
**Employees:** approx. 120 (2013)
**Turnover:** EUR 9.5 million (2012)

XTRONIC



The ‘Schwalbe’ returns to the roads of Germany. It used to be THE cult motorcycle of the former German Democratic Republic, and is now back to take on the German scooter market. The newly established efw-Suhl GmbH awarded XTRONIC GmbH, in Magstadt near Stuttgart, the contract to develop the e-Schwalbe. The company can look back on many years of experience and expertise in the automobile sector for this project.

The project was initiated by the utility company ENTEGA. Since 2009, it has conducted expensive tests with respect to the everyday use of electric scooters. The results from these tests have been used for the design of the e-Schwalbe. This completely new vehicle is produced in Suhl, the historic production site of the ‘Schwalbe’ in Thuringia. Its production in Germany guarantees high quality as the e-Schwalbe is being produced in compliance with the strict standards of the automobile industry.

The e-Schwalbe combines the classic ‘Schwalbe’ design and a powerful electric drive concept. There will be three versions available: 25 km/h, 45 km/h and 80 km/h. Depending on the vehicle class and required range, different battery configuration options are available, reaching distances of up to 200 kilometres.

Strict environmental compatibility and sustainability are not only priorities in production processes, but also with regard to green energy.

**www.xtronic.de**

**Contact**

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Fax: +49 7159 420 842430
daniel.schmid@xtronic.de

6.101

# LOCALLY EMISSION-FREE AND ECONOMICAL

## Electric drives from ZF


**ZF Friedrichshafen AG**

Graf-von-Soden-Platz 1
88046 Friedrichshafen, Germany

**Year of establishment:** 1915
**Employees:** 75,000 (2012)
**Turnover:** EUR 17.4 billion (2012)



There are strong alternatives now for the conventional drive-train of combustion engine, gearbox and drive axle: these are hybrid drives and electric drives with batteries or fuel cells. ZF Friedrichshafen AG has made significant contributions to this new variety. In addition to the new development of purely electric drives, ZF is working on the further optimisation of parallel hybrid drives that are already available on the market. Whether passenger car or commercial vehicle – ZF makes a major contribution to resource and environmentally friendly mobility. And this not only in theory: ZF's products for drive-train electrification are economical, practical and ready for serial production. From electric machines to hybrid modules, control units, power electronics and complete hybrid drives. We supply it all. ZF uses its expertise in drive-train electrification; the technology company developed an electric drive for small and medium-sized passenger cars, which they customised for the future requirements of urban traffic – the central drive module located on the axle features 90 kW of mechanical power and high torque at low revolution speeds. The result is an acceleration potential that equals that of big combustion engines.

ZF demonstrates the potential in the special combination of electric mobility and lightweight construction in their innovative product for small cars. Lightweight chassis components complement the electric axle drive and power inverter, which simultaneously extend range and improve the driving dynamics of the electric vehicle.

**www.zf.com**


**Contact**

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info@zf.com




6.102

# CITY BUS OF THE FUTURE

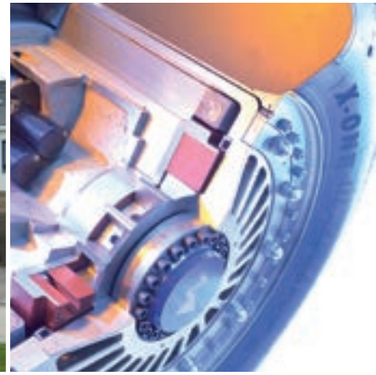
## Clean and silent through the city – with gearless electric drive


**Ziehl-Abegg**

Heinz-Ziehl-Strasse
74653 Künzelsau, Germany

**Year of establishment:** 1910
**Employees:** 3,150 (2012/2013)
**Turnover:** EUR 371 million (2012)






**Contact**

Harald Ludescher
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Mobile: +49 151 4260 8516
harald.ludescher@ziehl-abegg.de


Ziehl-Abegg (Künzelsau) with more than 100 years of experience in building electric motors has become an established market leader. Until now, Ziehl-Abegg motors could be found in elevators, fans and in special purpose vehicles. It has always been our goal to reduce energy consumption, minimise noise and build durable and reliable high-quality motors.
For the forward-looking concept of the in-wheel hub drive system, Ziehl-Abegg uses its expertise as technology leader in the development of electric motors – targeting maximum performance with minimum power consumption within an extremely compact design.
Our solution for a city bus to be a serially designed gearless hybrid vehicle (or electric vehicle with single-wheel drive) is to implement an electric motor on the basis of a synchronous motor, with an external rotor, integrated electronics and water cooling.
Since the synchronous motor with external rotor (as in-wheel hub drive) operates without a gearbox or differential, it greatly increases the efficiency of the in-wheel hub drive compared to conventional gearbox solutions.
Reliable data from measurement values from long-term field tests examining range extender buses in operation in the Netherlands and fully electric buses in Sweden document this efficiency.

**www.ziehl-abegg.com**

Chapter 7

# OCCUPATIONAL TRAINING, RESEARCH INSTITUTES, UNIVERSITIES

7.1

# EDUCATION TODAY – FUTURE TOMORROW

## E-mobility at Bildungsakademie

**Bildungsakademie der Handwerkskammer Region Stuttgart**
Holderäckerstrasse 37
70499 Stuttgart, Germany

**Year of establishment:** 1982
**Employees:** 45 (2013)

Handwerkskammer Region Stuttgart
Bildungsakademie

livinglab BW e mobil

Bildungsakademie is the centre of education for the Handwerkskammer Region Stuttgart, the Stuttgart Region chamber of craft trades. Its name has stood for the successful training of technical and business experts for more than 30 years. It offers companies qualified training measures, from vocational training to professional development. In a joint project between the Freiburg chamber of craft trades and the Berufliche Bildungsstätte Tuttlingen GmbH, Bildungsakademie's vehicle technology division has developed from a vocational training centre to a centre of excellence and, together with its cooperation partners, has founded the Kompetenzzentrum Fahrzeugtechnik Baden-Wuerttemberg. In addition to vocational training courses, the motor vehicle centre of excellence offers new course models, attractive advanced training programmes in excellently equipped machine shops and highly qualified trainers. Due to its close cooperation with guild and trade associations, and its excellent contacts to industry and research institutes, Bildungsakademie stands for modern and market-oriented training in vehicle technology. During the course of its development into a centre of excellence, course programmes in electric mobility were expanded. These are being continuously improved and advanced. Skilled workers receive optimal high-voltage systems training that strictly adheres to statutory guidelines and provisions.

**www. bildungsakademie-stuttgart.de**
**www.innomotion-fahrzeugtechnik.de**


**Contact**

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Fax: +49 711 1657670
stefan.muellerschoen@hwk-stuttgart.de


7.2

# INNOVATIVE VEHICLE CONCEPTS FOR ROAD AND RAIL

## Moving ideas

**German Aerospace Center (DLR) – Institute of Vehicle Concepts**
Pfaffenwaldring 30–40
70659 Stuttgart, Germany

**Year of establishment:** 2002
**Employees:** 65 (2012)

DLR

electric mobility south-west

livinglab BW e mobil

The Institute of Vehicle Concepts at the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt, DLR) addresses the development of future technology systems of road and rail vehicles. The institute's research fields range from study, concept and design, calculation and simulation to the presentation of research demonstrators, components and vehicles.

**Emission-free drives –** Hybrid drives, fuel cell systems and electricity from waste heat increase energy efficiency to pave the way to zero-emission transportation. Our patented free-piston generator, for all types of fuel, will soon be able to power vehicles electrically, for lower fuel consumption and reduced emissions. The TÜV-certified climatised all-wheel roller dynamometer supports the development of alternative drives with state-of-the-art testing technology.

**Efficient vehicles employing lightweight construction –** The institute transfers DLR's aerospace competencies in lightweight and hybrid concepts for road and rail. The work is based on the use of multi-material composites and new types of hybrid strategies; reducing weight reduces fuel consumption without compromising vehicle safety.

**Holistic concepts –** The institute brings together various technologies to create innovative and sustainable vehicle systems and evaluates them according to environmental and cost criteria. For example, rail transportation research focuses on producing more climate-friendly, cost-effective, lighter and more comfortable high-speed trains.

**www.dlr.de/fk**


**Contact**

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Fax: +49 711 6862258
horst.friedrich@dlr.de

7.3

# BADEN-WUERTTEMBERG COOPERATIVE STATE UNIVERSITY

## Studying for the future

**Baden-Wuerttemberg Cooperative State University (DHBW)**
Friedrichstrasse 14
70174 Stuttgart, Germany

**Year of establishment:** 1974 University of Cooperative Education Baden-Wuerttemberg, 2009 Duale Hochschule Baden-Wuerttemberg


electric mobility south-west

**Contact**

Prof. Dr.-Ing. Sven Schmitz
Phone: +49 621 4105 1052
Fax: +49 621 4105 1317
sven.schmitz@dhbw-mannheim.de

The Baden-Wuerttemberg Cooperative State University (DHBW) is the first university in Germany to integrate academic studies with workplace training. Founded on 1 March 2009, it is based on the successful 'dual learning' concept of studies that was pioneered by the Berufsakademie (University of Cooperative Education) in Baden-Wuerttemberg almost 40 years ago.
At its eight locations and four campuses, DHBW offers nationally and internationally accredited bachelor degree programmes in the fields of economics, technology and social studies, in cooperation with about 9,000 selected companies and social institutions all over Germany. Recently, the course programme was extended by master degree programmes as professional development for students in employment. With about 31,000 current students and more than 120,000 alumni, DHBW is the biggest university in the state. DHBW is able to respond to current and future demand for qualified engineers in its commitment to electric mobility. The mobility industry is a leading generator of jobs – in Germany and other important industrial nations. Electric drive systems in addition to combustion-engine-based mobility are a large part of this future-oriented industry. Therefore DHBW students learn about the challenges of electric mobility in study and research projects. DHBW Mannheim has set up a laboratory for electric mobility and starts in the winter semester of 2013/2014 a course programme with this special focus.

**www.dhbw.de**



7.4

# ELEKTRO TECHNOLOGIE ZENTRUM

## Full power towards e-mobility

**Elektro Technologie Zentrum**

Krefelder Strasse 12
70376 Stuttgart, Germany

**Year of establishment:** 1975
**Employees:** 60 (2013)
**Turnover:** EUR 4.8 million (2012)

livinglab BW mobil

**Contact**

Fritz Staudacher
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Fax: +49 711 95591655
staudacher@etz-stuttgart.de

E-mobility holds an enormous potential for the electric and IT trades. The emerging change from conventional motors to electric and fuel cells along with supply infrastructure availability represent major challenges. Battery-operated vehicles are very much dependent on a tightly woven power supply network. It requires the building of a huge network of charging stations in the near future. Qualified specialists are needed to plan the charging stations. This includes system, power and network components, establishing a decentralised power supply, and power conversion systems on the basis of renewable energy sources to guarantee service security, and to install the necessary power supply and communication systems. In the field of system electronics and mechanical engineering, there are more jobs for service providers in e-mobility component maintenance and service. This includes analysing defective drive systems, for example, or the maintenance of electric motors and drive assemblies, and the diagnosis and troubleshooting of electronic units. As a well-established training service provider, Elektro Technologie Zentrum integrates e-mobility training content into the curricula of related electric and IT trades and in this way makes a valuable contribution, with its advanced training courses, to the realisation of e-mobility.

**www.etz-stuttgart.de**

7.5

# TOMORROW'S WORLD OF ENERGY – TODAY

## Modelling and simulation of energy systems for electric mobility and future technologies

**Energy Solution Center (EnSoC)**

Haid-und-Neu-Strasse 7
76131 Karlsruhe, Germany

**Year of establishment:** 2009

livinglab BW mobil

The Energy Solution Center (EnSoC) carries out application-oriented research projects in energy management and energy technology, utilising high-performance information technology. The Energy Solution Center is supported by its members from research and industry, including Energie Baden-Wuerttemberg (EnBW), Hewlett-Packard, the Karlsruhe Institute of Technology (KIT), SAP, Siemens, T-Systems, bridgingIT and ITVT. EnSoC uses this powerful network to bundle the competencies of its partners focusing on energy management, energy technology, IT and solution methods.

EnSoC's focus is on the simulation of operations and processes in the energy industry, in a wide range of applications, including electric mobility. A simulation environment created by EnSoC examines the interaction of electric vehicles, their drivers and the charging infrastructure and an upstream load management system for power supply. These simulations are completed by integrating further elements of power supply, in the areas of smart grids and smart homes.

For further information, see **www.ensoc.de.**

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info@ensoc.de

7.6

# RESEARCH IN MOTION

## Electric mobility at the FKFS

**Research Institute of Automotive Engineering and Vehicle Engines Stuttgart**
Pfaffenwaldring 12
70569 Stuttgart, Germany

**Year of establishment:** 1930
**Employees:** 155 (2012)
**Turnover:** EUR 17.7 million (2012)

Modellregion Elektromobilität Region Stuttgart

electric mobility south-west

livinglab BW mobil

**Contact**

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michael.grimm@fkfs.de

The Research Institute of Automotive Engineering and Vehicle Engines Stuttgart (FKFS) is an independent institute and carries out research and development projects for the international automobile and supplier industry and closely cooperates with the Institute for Internal Combustion Engines and Automotive Engineering (IVK) of Stuttgart University.

In e-mobility, FKFS follows a holistic and interdisciplinary approach in the areas of information technology, power engineering and vehicle technology. Innovative component and system test stands, a comprehensive subject pool, the latest charging infrastructure and an electric vehicle fleet allow automobile research at the highest level. Especially the Stuttgart driving simulator, the largest and most powerful system of its kind at a European research institution, is available for research projects in the field of electric mobility. Its core competencies cover the areas of drive-trains, driver assistance systems, simulations and tests.

**Public research projects (examples):**
Energetic optimisation of operating strategies for electric vehicles; ZuSE: reliability and safety of electric vehicles; ELENA 2: electrification upgrade of the drive-trains of commercial vehicles; BiPoLplus: bidirectional inductive position-tolerant charging of electric vehicles; DiNA: diagnosis of hybrid and electric vehicles; EFA 2014/2: energy-efficient driving 2014 phase II; full vehicle simulation of a battery-powered electric vehicle.

**www.fkfs.de**

7.7

# RESEARCH FOR THE MOBILITY OF TOMORROW

## From technical innovation to business model

**Fraunhofer Institute for Industrial Engineering IAO**
Nobelstrasse 12
70569 Stuttgart, Germany

**Year of establishment:** 1981
**Employees:** 500 (2012, including IAT at the University of Stuttgart)
**Turnover:** EUR 31.8 million (2012, including IAT at the University of Stuttgart)

Fraunhofer IAO

© Victor S. Brigola

Photograph: Christian Richters, © Fraunhofer IAO, UNStudio, ASPLAN

Modellregion Elektromobilität Region Stuttgart

electric mobility south-west

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The work of Fraunhofer IAO is based on the idea that in times of global competition, running a company successfully means using new technological potentials in a profitable way. In its close cooperation with the Institut für Arbeitswissenschaft und Technologiemanagement (IAT, institute of work science and technology management) of the University of Stuttgart, Fraunhofer IAO brings together fundamental research at a university with applied sciences and business practice.

In our research area of 'Mobility Innovation', around 30 scientists from different disciplines work on solutions for the mobility of tomorrow. Their focus is on commonly used mobility systems, new vehicle concepts, integrated fleet and charging management and the charging infrastructure in urban areas. Fraunhofer IAO supports companies turning technical innovations into business models in the automobile, construction, energy and IT industries.

Within joint research projects – such as FutureCar, Elektromobile Stadt, Gemeinschaftliche Mobilitätssystem and Micro Smart Grid – Fraunhofer IAO and partners from industry and municipalities research issues of significant relevance pertaining to future mobility.

**www.iao.fraunhofer.de**
**www.mobilityinnovation.iao.fraunhofer.de**



7.8

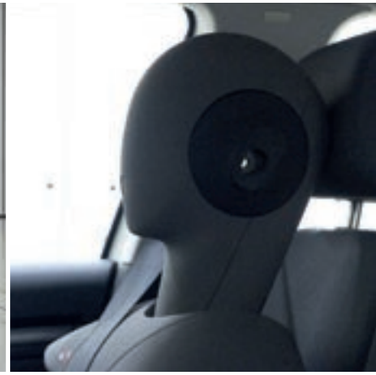
# THE SOUND OF E-MOBILITY

## NVH analysis and sound design for best vehicle acoustics

**Fraunhofer Institute for Building Physics IBP**
Nobelstrasse 12
70569 Stuttgart, Germany

**Year of establishment:** 1929
**Employees:** 200 (2012)
**Turnover:** EUR 25 million (2012)

Fraunhofer IBP



electric mobility south-west

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akustik@ibp.fraunhofer.de

Electric vehicle acoustics research is central at the Department of Acoustics of the Fraunhofer Institute for Building Physics. The focus is on psychoacoustics and mechanisms for managing the sound and vibration of individual components, and the vehicle as a whole. Main research encompasses the study of driver and passenger perception and acceptance of electric vehicles and its influence, as well as e-mobility's effect on the environment. Fierce debate surrounds the problems associated with pedestrians failing to notice electric cars, particularly in busy inner-city areas. However, integrating audible signals, to warn both occupants and others, is one possible answer.
New types or substitute components deployed in e-vehicles generate different kinds of sounds. As the usually dominant noise from a combustion engine is no longer present, sounds and vibrations created by auxiliary units and other parts not associated with the power-train are perceived differently. Wind and tyre noise will play a more significant role in e-vehicles than is the case with conventional vehicles. Moreover, different drive types (for example, wheel hub motors) open up new possibilities in vehicle design. These in turn give rise to new ideas for insulating sound and vibration, and for interior acoustics.

Vehicle acoustics is an important and complex field that must be taken into account if e-mobility is to become a sustainable, long-term success.

**www.ibp.fraunhofer.de/akustik**

7.9

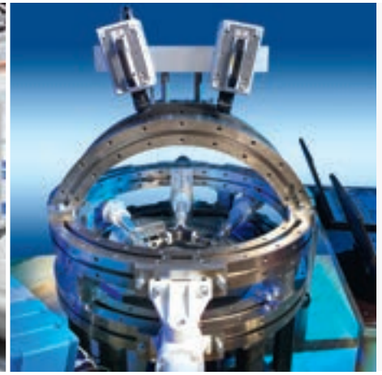
# DYNAMICS FOR SAFETY

## Fraunhofer EMI

**Fraunhofer Institute for High-Speed Dynamics, Ernst-Mach-Institut, EMI**
Eckerstrasse 4
79104 Freiburg, Germany

**Year of establishment:** 1959
**Employees:** 305 (2012)
**Turnover:** EUR 22 million (2012)

Fraunhofer EMI



electric mobility south-west

For electric mobility to be successful, vehicle weight, safety and reliability play an important role. The Fraunhofer Institute for High-Speed Dynamics, Ernst-Mach-Institut, EMI, located in Freiburg im Breisgau and Efringen-Kirchen, is working on making future electric cars lighter, safer and more reliable for everyday use and under extreme conditions.
For this, our Fraunhofer Crash Center comes to good use, with full-vehicle and component crash test facilities, tomography lab and a battery test stand for destructive dynamic tests of electrical energy storage units. In addition to these research competencies, Fraunhofer EMI has proven expertise in the numerical simulation of dynamic loading processes for materials of all kinds – from steel to CFRP and textile materials.

The combination of these capacities allows for the development of innovative vehicle designs and safety concepts for passengers and energy storage units for electric vehicles. The latest high-performance materials for lightweight construction are characterised and improved, and lithium-ion battery processes are analysed, using innovative sensors and the most precise of measurement technology.

In addition, scientists conduct safety and reliability analyses (for example, on battery management systems and high-voltage drive-trains), applying lean methodology to determine requirements, system design and verification.

**www.emi.fraunhofer.de**

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7.10

# FRAUNHOFER IPA – FUTURE MANUFACTURING IS OUR BUSINESS

## Innovative solutions for sustainable production

**Fraunhofer Institute for Manufacturing Engineering and Automation IPA**
Nobelstrasse 12
70569 Stuttgart, Germany

**Year of establishment:** 1959
**Employees:** 585 (2012)
**Turnover:** EUR 50.25 million (2012)

Fraunhofer IPA

Source: STORZ Medienfabrik GmbH

Source: Werner Sobek Stuttgart

electric mobility south-west

We realise highly innovative sustainable production solutions for our customers in the innovative high-tech industries of Germany. We promote the technical competencies and interdisciplinary teamwork of our employees, as a motivator for qualitative growth; our systematic development work puts the needs of our customers as its first priority.

Fraunhofer Institute for Manufacturing Engineering and Automation IPA in Stuttgart undertakes research in 14 specialist departments. Our research focuses especially on the automotive industry, mechanical and plant engineering, electronics and microsystem technology, the energy sector, medical technology and biotechnology. Fraunhofer IPA is a leading partner in the FSEM project, a project for system research in electric mobility. In the construction and infrastructure cluster, Fraunhofer IPA is primarily responsible for the development of new technologies for electric mobility. As a partner of industry in the ‘Leading-edge cluster Electric Mobility South-West’, Fraunhofer IPA develops process-modular production concepts for e-motors in collaboration with leading automotive partners. “Fraunhofer IPA develops technical solutions for modular processes that are quantity and variation flexible”, explains Martin Naumann, IPA’s project manager. These new developments allow an economic production of electric motors for e-mobility applications.

**www.ipa.fraunhofer.de**

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bernhard.budaker@ipa.fraunhofer.de

7.11

# THE NEW ENERGY ERA FOR MOBILITY

## Fraunhofer ISE develops solutions for sustainable mobility

**Fraunhofer Institute for Solar Energy Systems ISE**
Heidenhofstrasse 2
79110 Freiburg, Germany

**Year of establishment:** 1981
**Employees:** 1,272 (2012)
**Turnover:** EUR 77 million (2012)

©Fraunhofer ISE/Photo: Guido Kirsch

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The Fraunhofer Institute for Solar Energy Systems (Institut für Solare Energiesysteme, ISE) develops materials, components and processes for sustainable energy supply based on renewable energy sources. In the area of electric mobility, we work on innovative solutions for the integration of electric vehicles into the power grid and, together with partners from the automobile and utility industries, components and systems for energy management at the vehicle-to-grid interface, as well as power electronics and controllers for bidirectional charging systems. We also develop battery and fuel cell systems for electric and plug-in vehicles. Current research projects address the grid-compliant integration of vehicles and the support for grid stability within an environment of highly fluctuating renewable energy sources. We also work on intelligent interfaces to building energy management systems and the appropriate communication technologies and protocols.

**The institute's key areas are:**

- Model-based grid simulation
- Energy management software and operating control algorithms
- Smart charging infrastructure components for future-proof grid integration
- Highly efficient conductive and inductive charging systems
- Bidirectional grid integration of mobile storage units for improving grid stability
- Innovative and efficient battery systems for stationary and mobile applications and battery management systems
- Testing, modelling and simulating battery and fuel cell systems
- Smart grid information and communication technologies
- Electrolysis and hydrogen filling stations

**www.ise.fraunhofer.de**



7.12

# SYSTEM RESEARCH FOR THE MOBILITY OF TOMORROW

## Development and evaluation of innovative solutions

**Fraunhofer Institute for Systems and Innovation Research ISI**
Breslauer Strasse 48
76139 Karlsruhe, Germany

**Year of establishment:** 1972
**Employees:** 230 (2013)
**Turnover:** > EUR 21 million (2012)


Modellregion Elektromobilität Region Stuttgart

livinglab BW^e mobil

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The Fraunhofer Institute for Systems and Innovation Research (Fraunhofer Institut für System- und Innovationsforschung, ISI) researches the short and long-term developments of innovative processes and the social effects of new technologies and services. The subject of electric mobility plays a major role in this regard. We provide our customers from industry and politics with recommendations and perspectives based on our research work. Our competencies are our sound academic expertise and interdisciplinary and systematic research approach. Accordingly, we look at the subject of electric mobility from different angles. This involves battery and vehicle development, user perspective and acceptance, charging infrastructure, ecological assessment and its effect on the energy sector, the automobile and IT industries, including its effect on employment and value adding.

Our participation in the 'Innovationscluster REM 2030' project is a good example of this. It is one more step towards the mobility concepts of tomorrow and is guided by the leitmotif of efficient, regional and individual mobility. Together with other Fraunhofer institutes, the institutes of the Karlsruhe Institute of Technology and partners from industry, we develop and evaluate innovative e-mobility solutions integrated into one holistic vision of mobility.

**www.isi.fraunhofer.de**

7.13

# INCREASE THE EFFICIENCY

## of mobile and stationary drive systems

**Fraunhofer Project Group**
**New Drive Systems – NAS**
Rintheimer Querallee 2
76131 Karlsruhe, Germany

**Year of establishment:** 2010
**Employees:** 25 (2012)

Fraunhofer

electric mobility south-west

livinglab BW-mobil

The Fraunhofer project group for new drive systems (NAS) was established in Karlsruhe in 2010. The project group's main focus is application-based research and development to increase the efficiency of drive systems. The NAS project group is the outcome of a cooperation between two Fraunhofer institutes: the Institute for Chemical Technology (ICT) in Pfinztal and the Institute for Mechanics of Materials (IWM) in Freiburg. In addition, the NAS project group maintains close scientific cooperation with the institute for reciprocating engines (IFKM) at the Karlsruhe Institute of Technology (KIT). The research and development work of the NAS project group is reflected in the following fields of work:

- Energy converters / combustion engines
- Hybrid drives
- Thermal management
- Test methods
- Combined heat and power units
- Systems for utilising residual heat
- Lightweight construction in drive-trains

To manage the projects in these fields of work, the NAS project group relies on its internal capacities in the areas of construction, simulation and testing. They use the latest software tools, such as CATIA V5 for design and GT Power, MatLab Simulink and CFD calculations for simulation and design. To test close-to-series concepts, we have highly flexible engine test stands at our Karlsruhe site.

**www.ict.fraunhofer.de/de/komp/nas.html**


**Contact**

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7.14

# RESEARCH FOR THE CAR OF TOMORROW

## FZI researches integrated and intermodal mobility

**FZI – Research Center for Information Technology at the Karlsruhe Institute of Technology**
Haid-und-Neu-Strasse 10–14
76131 Karlsruhe, Germany

**Year of establishment:** 1985
**Employees:** 180 (2011)
**Turnover:** EUR 16.4 million (2011)

FZI



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livinglab BW-mobil

The Research Center for Information Technology at the Karlsruhe Institute of Technology (FZI) is an independent non-profit institution for application research and technology transfer in the field of computer science. Its object is to make the latest academic findings in information technology available for companies and public institutions. In cooperation projects and on behalf of its partners, FZI produces prototypes of concepts, software, hardware and system solutions. With its FZI House of Living Labs, the FZI has a suitable research environment for practical research.

In the field of electric mobility, the FZI researches, develops and evaluates mobility concepts and functions for electrically powered vehicles. This includes methods targeting range optimisation, integrated mobility concepts for tomorrow and the integration of (for example, fee-based) future e-mobility concepts into the transport and energy infrastructure.

The FZI has a specially customised electric vehicle which, in addition to innovative drive components, features a comprehensive, fully accessible energy management system. This allows the development of new drive, operating and recuperation strategies.
In addition, a mobility platform is available for integrated and local e-mobility and a building energy management system for the optimal planning of electric vehicle charging operations.

**www.fzi.de**


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strand@fzi.de

7.15

# NEW TECHNOLOGIES FOR ELECTRIC MOBILITY

## Power for the region of Eastern Wuerttemberg

**Hochschule Aalen –**
**Technik und Wirtschaft**
Beethovenstrasse 1
73430 Aalen, Germany

**Year of establishment:** 1962
**Employees:** 464 (2013)


**Contact**

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Moritz.Gretzschel@htw-aalen.de


With more than 5,000 students and 150 professors, Hochschule Aalen is among the leading research-driven universities of applied sciences in Baden-Wuerttemberg. The Advanced Materials and Manufacturing division conducts R&D projects in the field of e-mobility in cooperation with renowned regional and national enterprises. At the Institute of Material Research new magnetic phases are isolated and further analysed and the ageing process of lithium-ion batteries characterised in great detail. In the area of light-weight construction, the Aalen Casting Technology division has established innovative metal die- casting technologies functionally integrating electronic components as well as methods for producing hybrid materials. In the field of power electronics, new types of copper graphite composites for commutators and new electric drives are developed. In addition, interdisciplinary approaches for the thermal management of the entire vehicle are followed up. The Hochschule Aalen participates in the BMBF-funded research consortium 'Scalable drive and axle modules for e-mobility' and the IGF network for the development of novel magnets in electric drives. ZAFH SPANTEC-light, a recently established research network coordinated by Hochschule Aalen, focuses on carbon-fibre-reinforced lightweight materials. Furthermore, a chair was recently established for e-mobility as well as an in-service master degree programme for e-mobility, coordinated by the Hochschulföderation Süd-West network.

**www.htw-aalen.de**



7.16

# TECHNOLOGY WORTH RESEARCHING

## Electric mobility at the Heilbronn University of Applied Sciences

**Hochschule Heilbronn**

Max-Planck-Strasse 39
74081 Heilbronn, Germany

**Year of establishment:** 1961
**Employees:** 550 (2012)


**Contact**

Prof. Dr.-Ing. Andreas Daberkow
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Fax: +49 7131 25 24 70
andreas.daberkow@hs-heilbronn.de


The Heilbronn University of Applied Sciences has dedicated its research to the examination and optimisation of future-proof electric mobility and conducts practical studies in this field.

The 'Electric Mobility in Urban-Regional Areas' project, for example, examines applications for electric vehicles and related infrastructure requirements. The Heilbronn University of Applied Sciences has therefore operated a battery-driven test car for research purposes since 2010, funded by the future investment programme of the State of Baden-Wuerttemberg. This vehicle has sufficient safety, range and suitability for regional commuter and highway driving and related testing.

The sponsored Emission-free Range Extending (EREX) project was launched to bypass the slow acceptance of electric vehicles due to insufficient battery capacity. Some vehicle manufacturers are currently offering additional internal combustion engines as range extending units. The EREX project investigates how the range of electric vehicles can be enlarged by mechanical flywheel storage units. Further university research focuses on an all-electric drive-train testbed and electromobility for bicycles.

**www.hs-heilbronn.de**

7.17

# PRACTICE-ORIENTED UNIVERSITY TRAINING

## Master programme in electric mobility qualifies students in innovative technologies

**Ulm University of Applied Sciences**

Prittwitzstrasse 10
89075 Ulm, Germany

**Year of establishment:** 1960

Technik
Informatik & Medien
Hochschule Ulm
University of
Applied Sciences

Practice-oriented academic courses combined with application-based research and accompanied by cooperation with regional industry have an over 50-year tradition at the Ulm University of Applied Sciences (Hochschule Ulm). We are dedicated to providing our students with academic training to be successful in their future jobs. E-drive technology has been a part of this for some time now. Our master's programme 'Electrical Energy Systems and Electric Mobility' qualifies young engineers very specifically in the core disciplines of electric mobility, for example electric drive and storage technologies. We supply industry with specialists in this innovative field of technology – and the demand is increasing. In three semesters, master students are not only taught vehicle-specific competencies but they also gain knowledge in renewable energies (for example photovoltaics and intelligent grids), to realise holistic electric mobility concepts. Some of the courses and lectures are held in cooperation with external partners such as EnBW, a utility company, and 'Zentrum für Sonnenenergie und Wasserstoff' (ZSW, centre for solar energy and hydrogen technology). The curriculum is always based on current demands in industry. At the same time, students gain practical skills and competencies in labs, for example in fuel cell or battery technology, in line with the latest research findings.

**www.hs-ulm.de/elektrotechnik**


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kroeger@hs-ulm.de




7.18

# INSTITUTE OF AUTOMOTIVE BUSINESS (IFA)

## Electric mobility as an economic challenge

**Institut für Automobilwirtschaft (IFA) der Hochschule für Wirtschaft und Umwelt, Nürtingen-Geislingen (HfWU)**
Parkstrasse 4
73312 Geislingen an der Steige, Germany

**Year of establishment:** 1995

ifa
institut für
automobilwirtschaft

livinglab
BW mobil

Institut für Automobilwirtschaft (IFA) is an academic institution at the University of Applied Sciences for Economics and the Environment of Nürtingen-Geislingen (HfWU).

Its focus is on industry-oriented and practical research in the areas of automotive sales, retail and wholesale, and mechanics. IFA ponders practical issues using scientific methods and at the same time it promotes the application and implementation of generic economic findings in industry. Thus, the institute takes on an important transfer function between theory and practice.

The institute's employees all have sound academic and practical business qualifications, and as a rule apply their professional experience from the automotive industry.
Institute director and initiator is Professor Dr. Willi Diez. Associate director is Professor Dr. Stefan Reindl, who also organises the bachelor and master programmes in 'Automotive Business' (B.A.) and 'Automotive Management' (M.A.) at HfWU. The Nürtingen-Geislingen University of Applied Sciences, with its more than 400 students in automotive-business-related courses of study and more than 20 professors and lecturers with an automotive business background, represents the largest competence centre for automotive business studies among German universities.

**www.ifa-info.de**


**Contact**

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Fax: +49 7331 22 450
mail@ifa-info.de

7.19

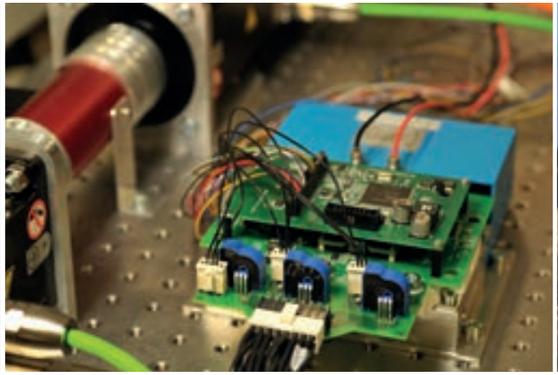
# ENERGY-EFFICIENT MOBILITY RESEARCH CAMPUS

## R&D network for science and industry

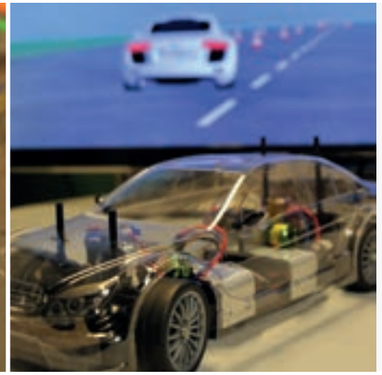
**Institute of Energy Efficient Mobility (IEEM)**
Moltkestrasse 30
76133 Karlsruhe, Germany

**Year of establishment:** 2012
**Employees:** approx. 15 (2013)

IEEM Institut für Energieeffiziente Mobilität



Development of e-motor controller electronic, Photograph: Muntean/Christ



Miniature e-car, Photograph: Muntean/Christ

electric mobility south-west

**Contact**

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reiner.kriesten@hs-karlsruhe.de

The research campus of energy-efficient mobility, established in 2012 on the site of the former International University in Bruchsal near Karlsruhe, is a constantly growing R&D cooperation.

It is the goal of the research campus to foster a common centre for efficient mobility. Participants are the Hochschule Karlsruhe, represented by the IEEM institute (Institute of Energy Efficient Mobility), industry, and research partners. The type and manner of cooperation is individually organised and depends on various factors. This addresses small and medium-sized enterprises, as well as larger suppliers and OEMs.

The Hochschule Karlsruhe's IEEM institute specifically concentrates on the functional development of mobility systems, and energy systems of mobility as a whole. Due to the continually increasing integration of functions and intelligence in vehicles and its connectivity, the necessary skills for energy efficiency are interdisciplinary and being addressed by the IEEM by three of its professors, especially in the fields of functional and software development, in electronics, e-drives and power-train concepts. In addition, the tight cooperation with the master studies 'Sustainable mobility for automotive engineering' at the University of Applied Sciences, Karlsruhe, leads to a suitable concept to integrate students and young professionals at the research campus.

**www.ieem.de**



7.20

# SUSTAINABLE ENERGY TECHNOLOGY AND MOBILITY

## Cross-faculty core programme at the Esslingen University of Applied Sciences

**Institut für Nachhaltige Energietechnik und Mobilität (INEM) der Hochschule Esslingen**
Kanalstrasse 33
73728 Esslingen, Germany

**Year of establishment:** 2012
**Employees:** 9 professors and 11 research assistants (2012)

inem Institut für Nachhaltige Energietechnik und Mobilität


Franz Untersteller, Minister of the Environment, Climate Protection and the Energy Sector, tests the plug-in hybrid distribution vehicle, a joint project of INEM and SMEs of the Stuttgart Region


E-City – Buggy, an INEM student project

Modellregion Elektromobilität Region Stuttgart

livinglab BW e mobil

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ferdinand.panik@hs-esslingen.de

Universities are encountering a challenging field involving the processes of social change, ecological issues and rapidly changing technologies. None of these topics can be isolated from each other. The answers to questions regarding our future have to be found in the interaction of all these disciplines. Based on this knowledge, Hochschule Esslingen views itself as a body that works on the close collaboration between its faculties and disciplines. To work out a clear profile that is also recognised by external parties, Hochschule Esslingen concentrates on topics that are of relevance specific to the economy and society: a changing society and sustainable energy technology and mobility.
This was the intention for founding the Institut für Nachhaltige Energietechnik und Mobilität (INEM, Institute of sustainable energy technology and mobility) in April 2012, a cross-faculty unit which currently comprises five faculties – vehicle technology, fundamentals, mechanical engineering, supply engineering and environmental technology, and mechatronics and electrical engineering.
INEM embraces the broadest cross-sectoral tasks in sustainable mobility and energy systems with a focus on energy storage and transformation. This also involves energy management, system integration of fuel cells, batteries, power electronics in drive-trains and supply systems, and technologies and systems for generating renewable energy. The latter means, for example, photovoltaics, wind power and biomass, which includes hydrogen systems and storage.

**www.hs-esslingen.de**

7.21

# NEW PRODUCTION METHODS FOR IMPROVED BATTERIES AND DRIVES

## Cost benefits through the KIT research lab

**Karlsruhe Institute of Technology (KIT)**

Kaiserstrasse 12
76131 Karlsruhe, Germany

**Year of establishment:** 1825 (university), 1956 (large-scale research institution)
**Employees:** 9,260 (2012)

livinglab BW mobil

At the Karlsruhe Institute of Technology (KIT), more than 250 researchers work in 26 institutes in the battery research and electric mobility area. Within the Competence E project, KIT bundles all its activities regarding the storage of electrical energy for mobile and stationary applications. The project targets the implementation of a systematic development concept with respect to economically promising products and production methods. Its integrated approach begins at the molecule and continues with the battery and electric motor (with power electronics) to end with a fully functioning electric drive system. At the same time, new production methods for the cost-efficient production of these batteries and e-drives are being developed and presented by means of prototyping. For this, KIT built the first freely accessible 'research factory' to close existing gaps in the innovation and value-adding chain.

In addition, KIT's mobility systems division merges and bundles comprehensive competencies in the field of mobility research at KIT, to gain new ideas and inspiration for land-based mobility, for the future transportation of people and goods. Researching electric drive and storage concepts is a major focus.

**www.kit.edu**

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7.22

# KIT-ETI – COMPETENT IN ELECTRIC DRIVE TECHNOLOGY

## Electric drives and power electronics, hybrid electric vehicles

**Karlsruhe Institute of Technology (KIT) – Institute of Electrical Engineering (ETI)**
Kaiserstrasse 12, Gebäude 11.10
76128 Karlsruhe, Germany
**Year of establishment:** 1895
**Employees:** 35 (2013)

HEV Hybrid Electric Vehicles

electric mobility south-west

The Institute of Electrical Engineering (ETI) at the Karlsruhe Institute of Technology (KIT) stands for electric drive competence – in e-mobility applications and in industrial drive technology.

Together with a staff of around 25 research assistants and many students, two professors in the fields of 'Electric drives and power electronics' and 'Hybrid electric vehicles', Professors Braun and Doppelbauer, research and develop new, powerful concepts for the future of electric drive technology.

In numerous projects with well-known partners from science and industry, including almost all major German OEMs, we analyse and realise inverters, voltage converters, drive motors and the necessary control methods and systems, in any topological variation. For this, we utilise the latest industry-standard software and hardware tools. The detailed acausal simulation of the electric drive-train, from battery to wheel-road contact, allows the precise adjustment of power electronics and electric motors to the specific application. The prototypes built in our sophisticated electromechanical workshop are then gauged and verified on test stands we designed.

**www.eti.kit.edu**

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7.23

# FAST: THE VEHICLE AS A SYSTEM

## Researching vehicle concepts of the future

**Karlsruhe Institute of Technology (KIT) – Institute of Vehicle System Technology, Chair of Vehicle Science (FAST)**
Kaiserstrasse 12, 76131 Karlsruhe, Germany
**Year of establishment:** 1825 (university); 2009 (KIT) **Employees:** 38 (FAST-LFF); 9,261 (KIT) – 2012 **Turnover:** University: EUR 397 million; large-scale research institution: EUR 392 million – 2011

electric mobility south-west

Comprehensive expertise in vehicle system technology and a competent partner of industry – these are the qualifications of the FAST institute for vehicle system technology at the Karlsruhe Institute of Technology (KIT). Passenger cars, commercial vehicles, mobile machinery and rail vehicles are at the centre of our future vehicle concept research. The department of vehicle technology, chaired by Prof. Gauterin, provides a widespread and in-depth understanding of systems, methods and processes required to master the complexity of vehicle design. We utilise different technological approaches to improve vehicle functions. Modern vehicles have become safer, more comfortable and efficient over time – but because of added electronic, electric and mechatronic systems they have also become even more complex. Our state-of-the-art labs and the latest equipment, comprising modern full vehicle and component test stands, allow a wide spectrum of research work and tests. In the field of alternative drive concepts, FAST has been involved in many projects, including providing scientific support to the cross-border CROME e-vehicle fleet test programme. 'Projekthaus e-drive' is an innovative cooperation model in e-mobility, which addresses basic research issues as well as application-oriented projects.

**www.fast.kit.edu**

**Contact**

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thomas.meyer@kit.edu

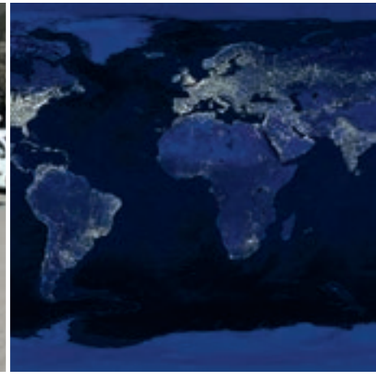
7.24

# WHERE DOES THE ELECTRICITY COME FROM?

## And who will be driving electric vehicles?

**Karlsruhe Institute of Technology (KIT) – Institute for Industrial Production (IIP)**
Kaiserstrasse 12, 76133 Karlsruhe, Germany

**Year of establishment:** 1982 (IIP)
**Employees:** 9,261 (KIT) – 2012
**Turnover:** University: EUR 397 million, large-scale research institution: EUR 392 million (2011)



livinglab BW-mobil

The IIP (Institute for Industrial Production) was established in 1982. It emanated from the then Institute for Manufacturing and Industrial Science and Technical Economics group of the University of Karlsruhe (TH). The DFIU (German-French Institute for Environmental Research) was founded in 1991 and has cooperated closely with the IIP ever since. The chair of energy economics (headed by Prof Dr. W. Fichtner) at the IIP analyses techno-economic issues along the entire energy value chain, from primary energy production to energy conservation, energy transport, energy distribution and use. The transport and energy research group at the chair of energy economics examines the effects of electric vehicles on energy systems and mass flows as well as user acceptance in this field. These multifaceted research issues are examined taking an interdisciplinary approach. It contains the analysis of effects on low-voltage systems or changes in power plant dispatch and extensions, the estimation of load-shifting potentials through demand-side management activities, for example through delayed charging processes of electric vehicles, as well as further issues in the context of electric mobility.

**www.iip.kit.edu**

**Contact**

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7.25

# NO COMBUSTION ENGINE? NO WAY

## Electric mobility as a combination of combustion engine and electric motor

**Karlsruhe Institute of Technology (KIT) – Institute of Reciprocating Engines (IFKM)**
Rintheimer Querallee 2
76131 Karlsruhe, Germany

**Contact**

Prof. Dr. sc. techn. Thomas Koch
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Fax: +49 721 608 48519
thomas.a.koch@kit.edu

The Institute of Reciprocating Engines (Institut für Kolbenmaschinen, IFKM) at the Karlsruhe Institute of Technology (KIT) has worked for many years on various issues involving combustion engine improvement. As a matter of fact, combustion engines will continue as an essential element of partially electric drive-trains (range extender, serial hybrid). In the development of combustion processes, for example, we optimise in-engine processes to reduce fuel consumption and polluting emissions. This always requires the consideration of existing exhaust gas treatment systems as they strongly interact with the combustion engine. These issues are examined at IFKM as well. For this, IFKM carries out experimental examinations at state-of-the-art combustion engine test stations. This includes, in addition to comprehensive exhaust gas analyses, various endoscopic optical analysis methods which are minimally invasive and can be used in series engines too. Combustion engines are also simulated using the latest calculation methods in order to interpret experimental data in more detail and make forecasts for modified operating conditions. Combining combustion engines with electric motors means a significant change in the operating conditions of engines because, for example, the more frequent start and stop operations may lead to unfavourable conditions for exhaust gas catalytic converters.

**www.ifkm.kit.edu**

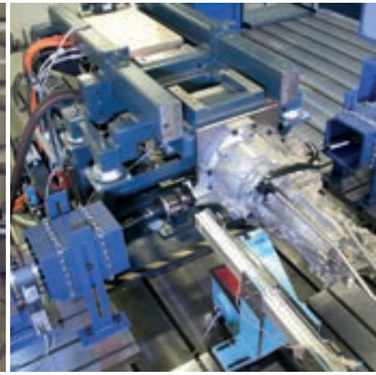


7.26

# SUSTAINABLE SOLUTIONS FOR DRIVE SYSTEMS AND MOBILITY

## New challenges for product development

**Karlsruhe Institute of Technology (KIT) – Institute of Product Engineering (IPEK)**
Kaiserstrasse 10, 76131 Karlsruhe, Germany
**Year of establishment:** 1825 (Uni), 2009 (KIT)
**Employees:** 86 – IPEK; 9,261 – KIT (2012)
**Turnover:** University: EUR 397 million, large-scale research institution: EUR 392 million (2011)

electric mobility south-west

**Contact**

Sascha Ott
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sascha.ott@kit.edu

The IPEK Institute of Product Engineering at the Karlsruhe Institute of Technology (KIT) has its core competencies in academic research and application-oriented engineering in the areas of product development methods and processes, drive technology systems and components as well as sustainable mobility solutions. With its team of currently 90 employees headed by Professor Albers, the IPEK institute acts as a research and development partner for many well-established strategic partnerships (OEMs, systems suppliers and SMEs) from the automobile industry. In numerous projects directly related to practical applications, the focus is on solutions and methodical approaches that make a measurable contribution to value-adding and to the industrialisation of innovative technologies in sustainable mobility.

The IPEK institute researches e-mobility issues utilising knowledge and model-based approaches with a focus on electric energy storage and drive systems. It also searches for new mobility concepts and validation methods and processes, with the aim of balancing the aspects of energy efficiency, driving behaviour, NVH and safety. In addition to high-voltage energy storage devices which are designed from the sketch up and multi-criteria optimised, the institute also examines vehicle system requirements investigating its interactions with system components. The institute also designs innovative subsystems and finalises them for industrial realisation.

**www.ipek.kit.edu**

7.27

# EASY USE OF ELECTRIC VEHICLES

## We develop the right services

**Karlsruhe Institute of Technology (KIT) – Karlsruhe Service Research Institute (KSRI)**
Kaiserstrasse 12, 76133 Karlsruhe, Germany
**Year of establishment:** 1825 (Uni), 2009 (KIT), 2008 (KSRI)
**Employees:** 9,261 (KIT) – 2012
**Turnover:** University: EUR 397 million, large-scale research institution: EUR 392 million (2011)

livinglab BW-mobil

The Karlsruhe Service Research Institute (KSRI) at KIT was founded in 2008, as an interdisciplinary industry-on-campus initiative. It is one of the leading European research institutes in the service science area. Together with its industry partners IBM and BOSCH, KSRI is part of a comprehensive strategic network of globally active research and industry partners. KSRI develops concepts, methods and technologies for innovators and decision-makers, to promote the creation of shared value in an IT-based and service-oriented economy. The Service Innovation & Management research group is involved in the IT support of e-mobility services that allow the interaction of different stakeholders and the integration of different processes and systems. The energy economics research group analyses e-mobility user acceptance as well as the effects of electric vehicles on the energy industry. The results are published in the scientific community and may support companies, for example utility companies, car manufacturers, charging station manufacturers and mobility service providers, in the development and successful launch of their products and services. In addition, the research group provides assistance in designing service business models and their evaluation in field tests with electric vehicles.

**www.ksri.kit.edu**

**Contact**

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patrick.jochem@kit.edu



7.28

# HOW DO WE MOVE?

## Mobility models

**Karlsruhe Institute of Technology (KIT) Institute for Transport Studies**
Kaiserstrasse 12
76131 Karlsruhe, Germany
**Year of establishment:** 1825 (Uni), 2009 (KIT) **Employees:** 15 (IfV), 9,261 (KIT) – (2012) **Budget 2012:** University sector: EUR 407 million, large-scale research sector: EUR 378 million (2012)

electric mobility south-west

livinglab BW-mobil

The Institute for Transport Studies (Institut für Verkehrswesen (IfV)) at the Karlsruhe Institute of Technology (KIT) is a part of the Faculty of Civil Engineering, Geo and Life Sciences and the KIT Mobility Systems Center. The institute was founded in 1962 and is currently headed by Prof. Dr. Peter Vortisch. The IfV addresses all issues surrounding the transportation of persons and goods. This ranges from planning concepts for societies to technical transportation solutions.

IfV aims to efficiently and sustainably design transport under consideration of all means of transport with its interdisciplinary concept. Basic methods to this end range from analytical approaches to complex simulations. Our key areas of research are:

**Empirical mobility research**
Analysis of individual behaviour displayed while undertaking various activities and their associated required means of mobility, and the research of their effects and causes
**Transportation planning**
Development of microscopic models of transportation demand to demonstrate effects of future conditions (for example, demographics, available means of transportation, e-mobility) on traffic
**Traffic engineering and telematics**
Modelling and simulation of traffic flow and control based on a broad range of measurement data (video, counting boards, radar, licence plate number recording)

**www.ifv.kit.edu**

**Contact**

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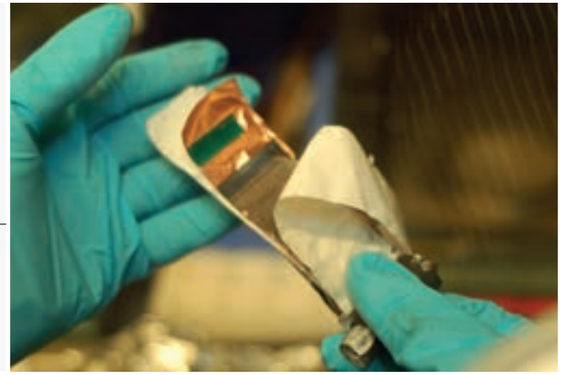
martin.kagerbauer@kit.edu

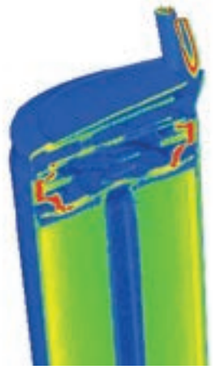
7.29

# LONG SERVICE LIFE AND SAFE ENERGY STORAGE SYSTEMS

## From material testing to lifetime modelling

**Karlsruhe Institute of Technology (KIT)**
**Institute for Applied Materials –**
**Energy Storage Systems (IAM-ESS)**
Hermann-von-Helmholtz-Platz 1
76344 Eggenstein-Leopoldshafen,
Germany
**Year of establishment:** 1825 (Uni), 2009 (KIT) **Employees:** 25 (IAM-ESS); 9,261(KIT) – 2012, **Turnover:** KIT: EUR 789 million (2011)





electric mobility south-west

The points of focus of the IAM-ESS (Institute of Applied Materials – Energy Storage Systems) at the Karlsruhe Institute of Technology (KIT) are the development of new types of materials for lithium-ion cells and the understanding of material property relationships. The institute, headed by Prof. Ehrenberg, has outstanding and long-term expertise in the examination of materials for energy storage systems. It has all the necessary equipment required for this in their labs and large-scale research facilities. The cost-efficient use of energy storage systems, in applications such as wind or solar energy storage as well as electric mobility, can only be reached over a long operating time. Accordingly, it is absolutely critical here to precisely determine material-related degradation mechanisms via in operando and post mortem material analyses and then derive life-span models from these. Based on this material characterisation and respective life-span models of energy storage systems, projects are carried out with partners from industry and other research institutes.

Other points of interest at the IAM-ESS are the development of new types of energy storage systems, material development and characterisation for redox flow systems, and the development of powerful methods for in operando material examinations of complete energy storage units under real operating conditions.

**www.iam.kit.edu/ess/**

**Contact**

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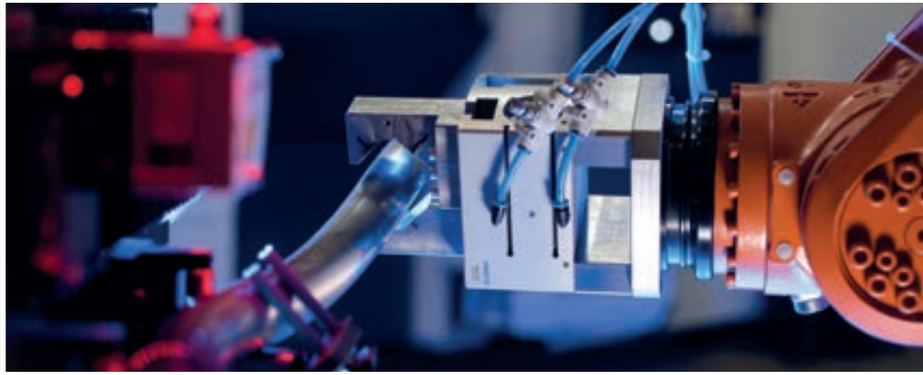
7.30

# PRODUCTION

## Turning an idea into a real product

**Karlsruhe Institute of Technology (KIT) –**
**wbk Institute of Production Science**
Kaiserstrasse 12
76131 Karlsruhe, Germany



electric mobility south-west

wbk Institute of Production Science at the Karlsruhe Institute of Technology (KIT), with close to 100 employees, is part of the department of mechanical engineering.

It is divided into three divisions:
- Manufacturing and Materials Technology
- Machines, Equipment and Process Automation
- Production Systems

They are headed by Prof. Dr.-Ing. habil. Volker Schulze, Prof. Dr.-Ing. Jürgen Fleischer and Prof. Dr.-Ing. Gisela Lanza. All three of them focus on practical research, teaching and innovations in the area of production engineering at KIT.
In addition to conducting research in the conventional fields of mechanical and plant engineering, wbk concentrates on production engineering and enabling technologies, for example for electric mobility and lightweight construction. The institute investigates if and how the new materials can be processed using conventional production technologies and systems. It also examines the upscaling and design of future production facilities and their global networks.

Together with partners from industry, wbk works on solutions for the broad field of production engineering and develops the methods and processes for the production of tomorrow.

**ww.wbk.kit.edu**

**Contact**

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gisela.lanza@kit.edu

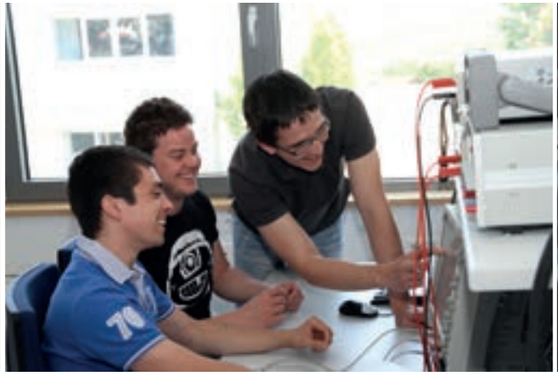
7.31

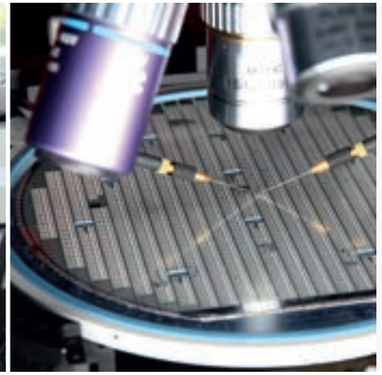
# ROBERT BOSCH CENTER FOR POWER ELECTRONICS

## Study and research that moves you

**Robert Bosch Center**
**for Power Electronics**
Postal address:
Hochschule Reutlingen
Alteburgstrasse 150
72762 Reutlingen, Germany

**Year of establishment:** 2009





Hybrid and electric vehicles and photovoltaic systems for the efficient use of renewable energies require innovative components and circuits. Their development presents growing challenges for power and micro electronics. The Robert Bosch Center for Power Electronics (rbz) was newly established in 2009 to improve and expand research and teaching in a network comprised of the Bosch Group, Reutlingen University and the University of Stuttgart. This unique cooperation is the first of its kind in Germany. It prepares young engineers for the new challenges that lie ahead in developing technology for the electric mobility and renewable energy industries of the future.
The research focus of the University of Stuttgart is on components, semi-conductors and drive technology. At Reutlingen University of Applied Sciences the research includes computer-based circuit design, power electronics components and integrated circuits. In order to set up and operate the rbz, the Bosch Group, the state of Baden-Wuerttemberg and the universities are to invest a total of more than EUR 30 million by 2020 for new academic chairs and infrastructure. At the start of 2013, a new institute was founded at rbz's University of Stuttgart location, in addition to the two existing academic chairs. rbz has its own site in Reutlingen, with lecture rooms and labs on about 1,300 m² – excellent conditions for teaching and research.

**www.rbzentrum.de**

**Contact**

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Fax: +49 7121 907090
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7.32

# ELECTRIC MOBILITY TAKES US TO THE FUTURE

## Reach goals faster with TAE

**Technische Akademie Esslingen e.V.**

An der Akademie 5
73760 Ostfildern, Germany

**Year of establishment:** 1955
**Employees:** 50 (2012)

livinglab BW mobil

For more than 60 years, Technische Akademie Esslingen (TAE) has been the first stop for vocational training and qualification in the fields of technology and economics.

It has always been appreciated for its innovative course programmes. This includes specialist seminars on electric mobility which are of specific importance today.

TAE can rely on a strong network of experienced lecturers and trainers from industry, education and research. TAE's training content and methods are precisely tailored to meet the requirements of the specialists and managers who need to apply in practice what they have learned, quickly and target-oriented.

TAE is a partner in the Schauwerkstatt project. This workshop project is exemplary when it comes to equipment and tools and is perfectly suited for training courses relating to e-mobility.

**www.tae.de**

**Contact**

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Fax: +49 711 34008 65
roland.bach@tae.de

7.33

# FIT FOR THE FUTURE

## Fit for the job

**Technische Akademie für berufliche Bildung Schwäbisch Gmünd e.V.**
Lorcher Strasse 119
73529 Schwäbisch Gmünd, Germany

**Year of establishment:** 1987
**Employees:** 15 (2013)
**Turnover:** EUR 2 million

livinglab BW[e] mobil


**Contact**

Michael Nanz
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Fax: +49 7171 314229
info@technische-akademie.de


Since its foundation more than 25 years ago, Technische Akademie für berufliche Bildung Schwäbisch Gmünd e.V. (TA) has organised vocational training and advanced training programmes, mainly in the technical and commercial fields. Special events covering different topics supplement the service range in order to provide practical, customised educational programmes for industry. In addition, by developing demand-oriented retraining measures, TA provides for the transfer of technology to the benefit of industry. In the future, especially children and adolescents are to be introduced to technology at an early stage, by experimenting, trying and testing on their own, in order to contribute to talent development in the region. Fit for the job – this motto describes TA's philosophy and its attitude with regard to its participants. Its staff have strong educational competence and many years of experience in vocational training for various target groups. In its work, TA Schwäbisch Gmünd follows the gender mainstreaming approach which considers the different life plans of young men and women, different starting positions and ways of tackling ideas.

Our intention is to reduce non-equal opportunities and to plan and realise individual and custom-tailored support programmes, especially for participants with migration backgrounds.

**www.technische-akademie.de**

7.34

# SUSTAINABLE MOBILITY ENGINEERING

## Practical research for sustainable mobility concepts

**University of Stuttgart – Institute of Business Administration (BWI)**
Keplerstrasse 17
70174 Stuttgart, Germany

**Year of establishment:** 1829
**Employees:**
Around 5,000 (2012)
About 24,600 students
(winter semester 2012/13)

Universität Stuttgart


livinglab BW[e] mobil


**Contact**

Prof. Dr. Georg Herzwurm
Phone: +49 711 685 82385
Fax: +49 711 685 82388
herzwurm@wius.bwi.uni-stuttgart.de


The chair of general business administration and information systems II at the University of Stuttgart conducts its research specifically in the fields of requirement engineering, cloud computing business models, software platforms, software ecosystems and software product management.

Practical research takes place within the advanced manufacturing, smart software business and sustainable mobility clusters. The latter sustainable mobility cluster focuses on the engineering-based identification of requirements for implementing information systems supporting mobility services. Other fields of activity are scalable IT services for use with mobile devices and the examination of future-oriented business models. Sustainable mobility concepts must be a well-balanced triad of economic, ecological and social aspects. For this, organisational and technological issues as well as management and leadership aspects must be taken into consideration when designing mobility service information systems. In the context of the 'LivingLab BW[e] mobil' projects involving electrically powered community buses for public transport, the chair examines the aforementioned issues and aspects and pays special attention to the social aspects.

**www.wius.bwi.uni-stuttgart.de**

7.35

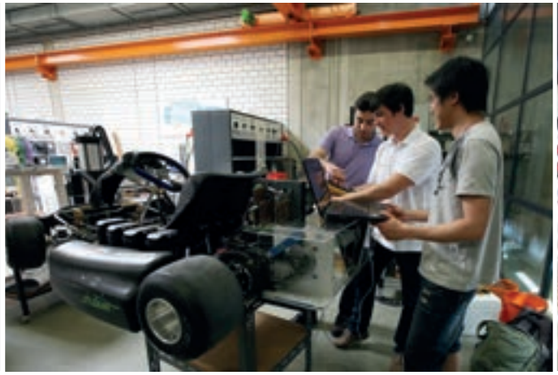
# IMPLEMENT INNOVATIONS AND REALISE VISIONS

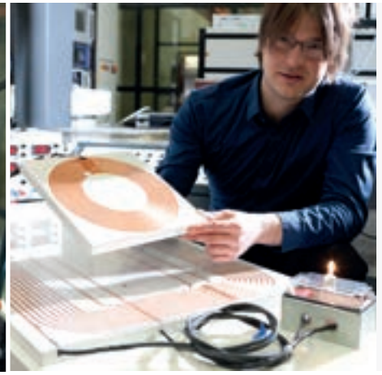
## From e-drive to wireless charging

**University of Stuttgart – Institute of Electrical Energy Conversion (IEW)**
Pfaffenwaldring 47
70569 Stuttgart, Germany

**Year of establishment:** 2011
**Employees:** 14 (2012)
**Turnover:** EUR 500,000 (2012)

iew
Institut für Elektrische Energiewandlung





Modellregion Elektromobilität Region Stuttgart

electric mobility south-west

**Contact**

Prof.Dr.-Ing. Nejila Passpour
Phone: +49 711 685 67819
Fax: +49 711 685 67837
passpour@iew.uni-stuttgart.de

Electric mobility is a key focus of research at the Institute of Electrical Energy Conversion (Institut für Elektrische Energiewandlung, IEW) at the University of Stuttgart. Research is split into two areas: electrical machines and inductive energy transfer. The scientists research the design of electric motors with extremely high torque densities and position-tolerant inductive charging stations. Their goal is the development of highly efficient components for the electric vehicles of the future.

Due to their good controllability, their wide spectrum of use and their excellent efficiency, electric motors are perfectly suited for reducing primary energy consumption. Electric mobility requirements have shown that it is not sufficient to just adapt standard technologies to new fields of use. Drive systems optimised for use in electric vehicles, particularly wheel hub and direct drives, are the research focus of the IEW.

It is essential to make a widespread charging infrastructure available first to be able to increase the number of electric vehicles in use. Inductive charging systems allow the wireless charging of electric vehicles and, at the same time, automate the charging operations so that, for example, cars can be charged on inner-city parking lots. This measure is definitely suited to increasing the range of electric vehicles. In this regard, IEW currently researches position-tolerant charging systems with an efficiency factor of more than 90 per cent.

**www.iew.uni-stuttgart.de**



7.36

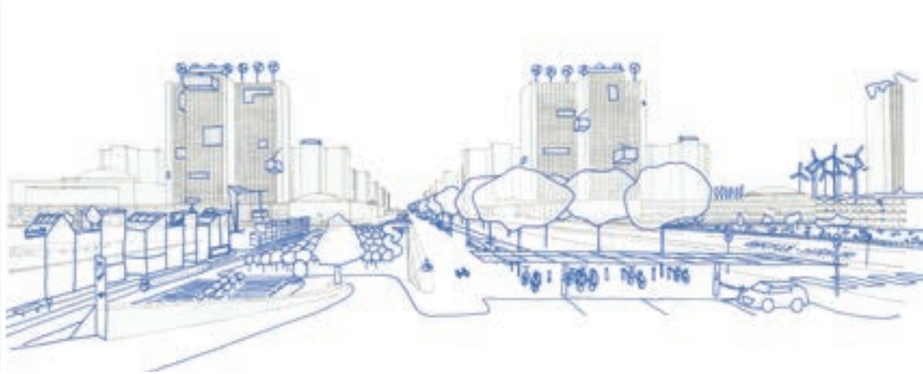
# RESEARCH GROUP CITY – MOBILITY – ENERGY

## Institute for Urban Planning and Design at the University of Stuttgart

**University of Stuttgart – Institute for Urban Planning and Design**
Keplerstrasse 11
70174 Stuttgart, Germany

**Year of establishment:** 1967
**Employees:** 60

SI Städtebau-Institut Universität Stuttgart



Modellregion Elektromobilität Region Stuttgart

electric mobility south-west

livinglab BW mobil

**Contact**

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Fax: +49 711 6858 3356
wolfgang.rid@si.uni-stuttgart.de

The research group City – Mobility – Energy analyses areas where societal systems and systems of the built environment meet and overlap. It examines the potential of sustainable urban mobility concepts based on an integrated analysis of the user perspective, and their interfaces with urban structures, transportation and energy models. Within several consortium projects and together with municipal partners and companies in the Stuttgart Region, practical and innovative approaches are applied for evaluating e-mobility, to see if the targets of urban development and climate protection are being met. Cities are encountering a growing number of technical innovations whose potential for contributing to municipal targets can hardly be guessed at this point. System analyses can help identify the interrelations between users and the benefits from such innovations.

In the implementation of efficient urban management, empirical, sociological and spatial methods are applied to develop strategies and recommendations for sustainable urban development. The range of methodologies involves quantitative and qualitative methods from empirical social research combined with spatial planning methods on the municipal or regional level.
These include ‘stated preference and discrete choice’ approaches and various workshop methods and pooling geographical information systems analyses.

**www.uni-stuttgart.de/si/**

7.37

# EFFICIENT AND SAFE

## Research for the mobility of tomorrow

**Ulm University – Institute of Measurement, Control and Microtechnology**
Albert-Einstein-Allee 41
89081 Ulm, Germany

**Employees:** 40 (2012) plus students and external Ph.D. students

electric mobility south-west

Emission-free mobility and accident-free driving are two visionary aims at the Institute of Measurement, Control and Microtechnology (Institut für Mess-, Regel- und Mikrotechnik) at Ulm University. Research and development of modern methods for measurement, control, signal processing and (real-time) optimisation are done as a basis to reach these aims. These methods are applied to applications in the areas of electric mobility, driver assistance and mechatronic systems. We attach great importance to practical applicability in our research in that we use our own test vehicles, for example a four-wheel-drive electric car and an Elmoto moped.

The algorithmic focus of the electric mobility workgroup is the data-based derivation of complex system and component models suitable for ECU application within model-based control and diagnosis algorithms. Examples are the model-based on-board diagnosis of fuel cells and lithium-ion batteries as well as the monitoring of electrical machines. Another focus is laid on the control of vehicle dynamics and energy management, not only for electrically powered passenger cars with different power-train configurations, but also for all-wheel-drive electric motorbikes. In addition, as a member of the 'Cluster Nutzfahrzeuge Schwaben' (commercial vehicles cluster), the electrification of main and auxiliary drives in special purpose and commercial vehicles also represents a primary concern.
**www.uni-ulm.de/in/mrm/forschung/elektromobilitaet.html**

**Contact**

Dr.-Ing. Michael Buchholz
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Fax: +49 731 50 12 26334
michael.buchholz@uni-ulm.de

7.38

# WBZU

## Continued education as success factor for electric mobility

**Weiterbildungszentrum Ulm für innovative Energietechnologien e.V. (WBZU)**
Helmholtzstrasse 6
89081 Ulm, Germany

**Year of establishment:** 2002
**Employees:** 5 (2013)


livinglab BW mobil

The WBZU (Education and Training Centre Ulm for Innovative Energy Technologies) was founded in 2002 to provide public relations work and vocational and advanced training in the field of renewable energy technology. Renowned stakeholders from industry and trade as well as research and education cooperate within this association and its networks.

WBZU offers training courses and seminars in innovative energy technologies with a focus on electric mobility and energy storage. Theoretical and practical training specifically centres on the aspects of lithium-ion batteries, fuel cells, hydrogen and block heating stations. The vocational and advanced training course programme targets different groups:

- Seminars, workshops and symposia for industry, trade and science experts
- Advanced training for teachers and lecturers at schools and universities
- Lectures and practical training for students
- Lectures and information events for students, teachers and the general public

In addition, WBZU is actively involved in projects on a state, federal and EU level and provides independent information to decision-makers in politics and industry, and also to most members of society.

**www.wbzu.de**

**Contact**

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Fax: +49 731 1 75 89 10
info@wbzu.de

7.39

# ENERGY WITH A FUTURE

## Key technologies for electric mobility

**Centre for Solar Energy and Hydrogen Research Baden-Wuerttemberg (ZSW)**
Helmholtzstrasse 8, 89081 Ulm, Germany
Industriestrasse 6, 70565 Stuttgart, Germany
**Year of establishment:** 1988
**Employees:** 221 employees, 120 research assistants, interns (2012)
**Turnover:** EUR 26 million (2012)

electric mobility south-west

**Contact**

Prof. Dr. Werner Tillmetz
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Fax: +49 731 95 30 666
info@zsw-bw.de

Renewable energies are increasingly affecting our everyday lives in so many areas, from the supply of power to all facets of mobility. The clean and efficient conversion and storage of energy play a major role. Powerful, reliable and cost-efficient batteries, super capacitors and fuel cells are key technologies – for hybrid drives, battery electric cars (BEV), fuel cell-powered cars and innovative power supply units.

ZSW has the technology for developing powerful batteries and fuel cells for future e-mobility: a test centre, technology for lithium-ion battery and fuel cell production, simulation and modelling systems, material synthesis, and analytic and inspection methods. This enables innovative technologies to be integrated fully developed into industry. Our cooperation partners come from the chemical, automobile and supplier, and power supply industries as well as various others.

ZSW, with locations in Ulm, Widderstall and Stuttgart, is a leading international institute for photovoltaic, battery and fuel cell technology. Other research focuses on the generation of renewable fuels such as hydrogen and energy-related system analyses. ZSW successfully transfers research results into applications which are equally beneficial for both environment and economy.

**www.zsw-bw.de**

Chapter 8

# INITIATIVES AND ORGANISATIONS

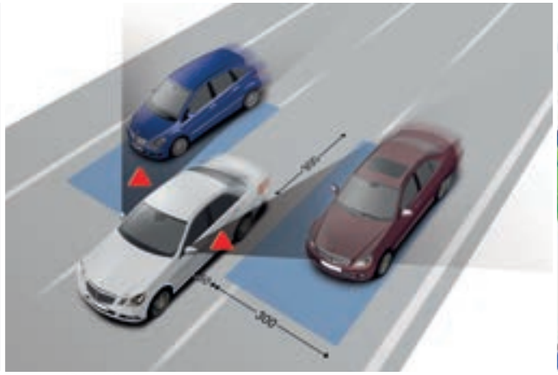
8.1

# GREEN CAE – FOR TOMORROW'S MOBILITY

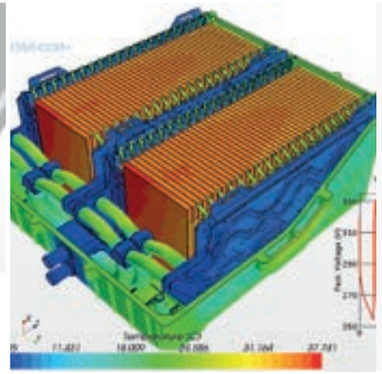
## asc(s provides full-range services

**Automotive Simulation Center Stuttgart e.V.**
Nobelstrasse 15
70569 Stuttgart, Germany

**Year of establishment:** 2008
**Employees:** 7 (2013)



By courtesy of Daimler AG



By courtesy of Behr GmbH & Co. KG

electric mobility south-west

**Contact**

Dipl.-Ing. Alexander F. Walser
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Fax: +49 711 699659 29
alexander.walser@asc-s.de

Automotive Simulation Center Stuttgart – asc(s e.V. – is a transfer platform setting trends for the interaction of science and industry in Europe. It offers its members a full range of services and a transfer of know-how which is beneficial for each individual project member. Its goal is to drive future-oriented vehicle development by utilising CAE simulation and optimisation processes. Especially in the field of $CO_2$ reduction, these cooperation projects enable important improvements for the entire automobile industry. The key fields of asc(s' activity can be ascribed to the following four knowledge areas:

1. Automobile & Environment
2. Modelling & Simulation
3. Numerics & Mathematics
4. Information & Communication

asc(s supports its members in the realisation of their projects from beginning to end. asc(s takes on project coordination and control, checks if targets are reached and ensures the implementation of developed methods in industry. Projects are handled as cooperations between project partners and asc(s.

The main aspects regarding the development of CAE simulation processes are the optimisation of flow and combustion processes in engines, reduction of vehicle weight through innovative lightweight body structures, assessment of new aerodynamic improvements for reducing tractive resistance, and layout and optimisation of e-mobility drive and vehicle concepts.

**www.asc-s.de**

8.2

# HELPING OTHERS TO HELP THEMSELVES

## CCIs support companies in innovation projects

**Baden-Wuerttembergischer Industrie- und Handelskammertag – Federführung Technologie**

c/o IHK Karlsruhe
Lammstrasse 13–17
76133 Karlsruhe, Germany

Modellregion Elektromobilität Region Stuttgart

livinglab BW e mobil

**Contact**

Dr. Stefan Senitz
Phone: +49 721 174 164
Fax: +49 721 174 144
stefan.senitz@karlsruhe.ihk.de

The Baden-Wuerttemberg chambers of commerce and industry (CCI) support companies in their innovation processes and provide the framework necessary for a successful transfer of knowledge and technology between research and industry.

In individual initial consulting sessions or at information events, CCIs provide information on issues relating to innovation projects, for example on industrial property rights, policies and directives (e.g. the CE label), support programmes, innovation management, opportunities for cooperation with research institutions and the design, manufacturing and marketing of inventions. Through their technology transfer representatives and/or the Innovationsallianz für die Technologie-Region Karlsruhe (innovation alliance for the Karlsruhe technology region, www.innoallianz-ka.de), the CCIs connect companies and academic institutions for cooperative innovation projects.

The newly established TOP-Wissenschaft search portal (www.top-wissenschaft.de) allows companies to find the right contacts in research institutes themselves.

Additionally, the IHK Technology Exchange (www.technologieboerse.ihk.de), the IHK Cooperation Exchange (www.ihk-kooperationsboerse.de) and, for pan-European technology offers, the CCI-supported EEN Technology Market of the Enterprise Europe Network (www.enterprise-europe-bw.de) are made available for companies free of charge.

**www.karlsruhe.ihk.de**

8.3

# INNOVATION IN ENERGY

## Fuel cell and battery competence

**Fuel Cell and Battery Alliance Baden-Wuerttemberg – BBA-BW**
Wankelstrasse 1
70563 Stuttgart, Germany

**Year of establishment:** 2001
**Mitglieder:** 70

Brennstoffzellen + Batterie-Allianz Baden-Württemberg
BBA-BW

**Contact**

Bernhard Wolshofer
Phone: +49 711 72230 487
Fax: +49 711 72230 491
bernhard.wolshofer@bba-bw.de

BBA-BW – Brennstoffzellen- und Batterie-Allianz Baden-Wuerttemberg – is a network for the promotion and the development of sustainable and environmentally friendly energy generation and storage technologies, on the basis of fuel cells and batteries in mobile, stationary and portable applications, including related infrastructure.
BBA-BW supports its members from industry, science and administration with respect to demonstrating and industrialising their products and preparing them for the market. It also represents members in dealings with political boards and other organisations. BBA-BW regularly organises industry events on topics concerning 'Who does what in the fuel cell and battery sector' and 'Fuel cell and battery meeting point'. The network also advises and assists its members in filing funding applications or in their public relations work. In addition, it organises workgroups on electric vehicles, stationary applications, infrastructure, technological research, specific markets and production technology. As the only association for fuel cell, battery and hydrogen technology in Baden-Wuerttemberg, BBA-BW is the largest representative body for industry and science in Baden-Wuerttemberg and open for all relevant applications and technologies.

**bba-bw.de**

8.4

# MAKE TOMORROW'S SMART CITY AVAILABLE TODAY

## Hands-on e-mobility

**eMobilitätszentrum Karlsruhe**

Heinrich-Wittmann-Strasse 23
76131 Karlsruhe, Germany

**Year of establishment:** 2011

eMOBILITÄTSZENTRUM KARLSRUHE
www.emobilitaetszentrum.de

electric mobility south-west
livinglab BW mobil

**Contact**

Uwe Timrott
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Fax: +49 7721 133 7309
timrott@karlsruhe.de

As early as 2010, partners from industry, science and politics agreed to promote e-mobility as their contribution to 'intelligent mobility' and launched the SmarterCity Karlsruhe initiative. eMobilitätszentrum Karlsruhe is a key partner within the SmarterMobility/intelligent mobility component of the SmarterCity initiative.

eMobilitätszentrum Karlsruhe provides information about the entire value-adding chain of e-mobility. From energy generation to services around the world of research and vehicles already on the market with two, three or four wheels.
In addition, it showcases projects involving the Karlsruhe region.

**Goal No. 1: Promoting B2B synergies** – Sharing the same location results in synergies for common projects and activities. The spatial bundling of the stakeholders works as a catalyst here. First co-operations have already been formed. Joint events as well as events organised by the Automotive Engineering Network support this process.
**Goal No. 2: B2C e-mobility to touch and test** – The purpose of eMobilitätszentrum is to allow 'users' or customers to touch and experience electric mobility (vehicles, infrastructure, usability), to provide a clear picture of the rather diffuse topic of e-mobility to the public. Almost all vehicles can be tested, rented or purchased on site.
**www.emobilitaetszentrum.de**

8.5

# NEW MOBILITY: ECONOMICAL. ECOLOGICAL. SOCIAL.

## Integrated with the future

**e-mobil BW GmbH –**
**State Agency for Electric Mobility and Fuel Cell Technology Baden-Wuerttemberg**
Leuschnerstrasse 45
70176 Stuttgart, Germany

**Year of establishment:** 2010
**Employees:** 13 (2013)

e-mobil BW
State Agency for Electric Mobility and Fuel Cell Technology Baden-Wuerttemberg GmbH


Modellregion Elektromobilität Region Stuttgart

electric mobility south-west

livinglab BW e mobil

**Contact**

Franz Loogen
Phone: +49 711 892385 0
Fax: +49 711 892385 49
info@e-mobilbw.de

e-mobil BW, Baden-Wuerttemberg's State Agency for Electric Mobility and Fuel Cell Technology, is the central point of contact for all issues surrounding sustainable mobility solutions and alternative drive technologies. This innovations agency brings together relevant stakeholders from industry, science and research as well as public authorities. And it provides special support for small and medium-sized companies exploring new fields of business in electric mobility. All of e-mobil BW's activities are based on the principle of sustainability: ecological and reasonable mobility solutions must be developed in the long term, which need to be economically successful and acceptable for society. e-mobil BW is also engaged in activities involving location marketing and industrial settlement and supports the creation of favourable framework conditions as regards infrastructure, training and education, and the promotion of talent.

Its activities target the establishment of Baden-Wuerttemberg as an important development and production location, and as a relevant market for the mobility of the future. By coordinating the sponsoring projects launched by the federal government – 'Electric Mobility Pilot Region', the 'Leading-edge cluster Electric Mobility South-West', and the 'Showcase Region for Electric Mobility LivingLab BW e mobil' – and in its contribution to the 'Fuel Cell BW' cluster, it strives to reach these goals. As an important industrial location, Baden-Wuerttemberg already provides favourable conditions for electric mobility, integrated vehicles and intermodal transport.

**www.e-mobilbw.de**



8.6

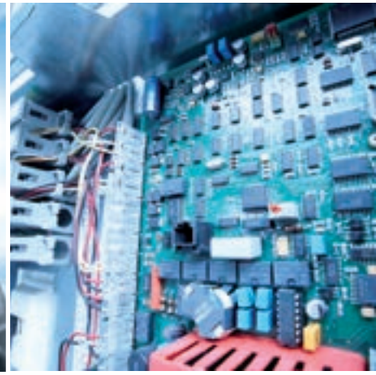
# ELECTRONICS TRADE GOES E-MOBILE

## Safe charging infrastructure through experts from the electronics trade

**Fachverband Elektro- und Informationstechnik Baden-Wuerttemberg**

Voltastrasse 12
70376 Stuttgart, Germany

**Year of establishment:** 1954
**Employees:** 12 (2013)



electric mobility south-west

livinglab BW e mobil

**Contact**

Petra Schulze
Phone: +49 711 95590666
Fax: +49 711 551875
info@fv-eit-bw.de

Acceptance of electric mobility not only depends on the vehicle range, but also on infrastructure and services. The charging infrastructure must be absolutely safe to use by non-experts and it must be continually available. However, each charging station for electric vehicles that is to be installed depends on the state of the existing electrical system and on customer-specific add-ons. Such individual requirements cannot be met by standard processes. The companies of the electrical and IT trades in Baden-Wuerttemberg have the knowledge, skills and qualifications to install the facilities required for charging battery-operated electric vehicles and safety systems at the customer interface – whether at home or at public stations. "Only trained experts can assure this", says Thomas Bürkle, chairman of the electrics and IT association of Baden-Wuerttemberg (Fachverband Elektro- und Informationstechnik Baden-Wuerttemberg).

According to Bürkle, electric mobility can only be sustainable when the necessary power for electric vehicles originates from regenerative resources. For this too, companies from the electrics trade can offer practical solutions. Electrics experts have the necessary know-how to integrate locally generated regenerative energy into charging processes for electric vehicles via 'Smart Home' or to use electric vehicles as interim storage devices for regenerative energy – this means that they become part of the 'smart grid'.

**www.fv-eit-bw.de**

8.7

# WE KNOW QUITE A BIT ABOUT MOBILISATION

## Electric mobility and employment

**IG Metall Bezirksleitung**
**Baden-Wuerttemberg**
Stuttgarter Strasse 23
70469 Stuttgart, Germany

**Year of establishment:** 1950
**Employees:** 31 (2013)

Bezirk Baden-Württemberg

livinglab BW mobil

Mobilisation is our core competence. And not only when it comes to securing jobs. Employee competence and commitment have made vehicles with conventional drive-trains bestsellers worldwide. We, at IG Metall Baden-Wuerttemberg, want to make sure that the cars of the future are not only produced on computers, but are manufactured here as well.

Within the Schaufenster Elektromobilität project, we prepare workers for the changes coming in the working environment, together with many other strong partners. The Schauwerkstatt project, for example, endeavours to raise worker awareness of the technology change lying ahead of us and provides training and qualification.
IG Metall Baden-Wuerttemberg represents the interests of almost half a million union members. Our members work in more than 2,000 companies in the metal and electrical industries, in the craft trades, textile and clothing industries, and in the timber and plastics industries. Twelve thousand elected work council members are members of the IG Metall union and stand for the interests of their workforces.

Our 'Future Strategy: Employment – safe and fair' is our contribution to an ecologically and socially sustainable future. This includes good working conditions and secure jobs. So that electric mobility not only opens up markets but also creates jobs. This is our goal.

**www.bw.igm.de**

**Contact**

Christa Lang
Phone: +49 711 16581 71
Fax: +49 711 16581 30
christa.lang@igmetall.de

8.8

# LANDESNETZWERK MECHATRONIK BW

## From an industry point of view – clever and smart

**Landesnetzwerk**
**Mechatronik BW GmbH**
Manfred-Wörner-Strasse 115
73037 Göppingen, Germany

**Year of establishment:** 2001
**Employees:** 8

Landesnetzwerk Mechatronik BW



Modellregion Elektromobilität Region Stuttgart

Landesnetzwerk Mechatronik BW is a cooperative network of powerful partners from industry, the service sector, research and education, and it is growing continuously. The focus of this network is on mechatronics, realised by the interaction of mechanics, electronics and information technology. This includes the advance and marketing of up-to-date, technically diverse and innovative topics, such as e-mobility. And this requires the integration of mechanical with plant engineering, as well as their electronics, drive engineering and assembly groups. Mobility is a very complex field and Landesnetzwerk Mechatronik BW initiates projects in the areas of agriculture, aviation and navigation, too. Broadly designed solutions and interdisciplinary approaches provide great benefits for project partners.

Products and applications become more and more complex along the advance of reliability and flexibility.
At the same time, the markets demand ever shorter innovation cycles and intelligent marketing strategies. Based on their detailed knowledge and expertise, the network's innovation managers develop, adapt and advance e-mobility solutions. Embedded in a huge network of global leaders and their suppliers from the most varied industries, our network's foremost objective is the provision of groundbreaking solutions, processes and services.

**www.mechatronik-ev.de**
**www.mechatronik-bw.de**

**Contact**

Volker Schiek
Phone: +49 7161 965 9500
Fax: +49 7161 965 9505
info@mechatronik-ev.de

8.9

# SUSTAINABLE MOBILITY IN THE STUTTGART REGION

## A region in transition

**Stuttgart Region Economic Development Corporation**
Friedrichstrasse 10
70174 Stuttgart, Germany

**Year of establishment:** 1996
**Employees:** 50 (2012)

Stuttgart Region Economic Development Corporation

Modellregion Elektromobilität Region Stuttgart

livinglab BW^e mobil

**Contact**

Holger Haas
Phone: +49 711 22835 14
Fax: +49 711 22835 55
holger.haas@region-stuttgart.de

**Heading for a mobile and sustainable Stuttgart Region.** Whether the f-cell conference and trade fair, the Fuel Cell Centre of Excellence or Stuttgart as a pilot region for electric mobility: if it's about new drive technologies, the Stuttgart Region Economic Development Corporation (Wirtschaftsförderung Region Stuttgart GmbH, WRS) is always at the forefront. And this is true for any normal work day too: today, all WRS employees drive electric vehicles. The whole company fleet is electric – whether on two or four wheels. Currently, WRS manages the 'Showcase Region for Electric Mobility LivingLab BW^e mobil' together with e-mobil BW (State Agency for Electric Mobility Baden-Wuerttemberg), which is one of the largest demonstration projects within Europe. The Stuttgart Region, with its own 'Model region for sustainable mobility' programme, is also a sponsor. Each year, interested parties can submit projects pertaining to sustainable mobility. It not only sponsors electric vehicle carsharing projects but also pedelec hiring systems at train stations and an overhead cable bus project. WRS's engagement in the area of sustainable mobility is not a coincidence; over recent decades, a cluster of companies and institutions from the vehicle industry has gathered in this region. Car manufacturers, system and component suppliers, engineering consultancies and many research institutes bundled their competencies in the region, with 180,000 employed in this cluster. That means that conditions in the Stuttgart Region are already set for developing new solutions for the mobility of people and goods.

**www.ecars.region-stuttgart.de**
**www.nachhaltige-mobilitaet.region-stuttgart.de**



Chapter 9

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- CarMedialab GmbH
- comemso GmbH
- CTC cartech company GmbH
- Daimler AG
- Deutsche ACCUmotive GmbH & Co. KG
- Eberspächer Climate Control Systems GmbH & Co. KG
- E-CAR-TECH Consulting GmbH
- ELMOTO – ID-Bike GmbH
- ElringKlinger AG
- FXX CYCLES Flötinger Chainworxx
- GETRAG Corporate Group
- gobaX GmbH
- Huber Group
- HyLionTec GmbH – Batteries for mobile and stationary applications
- ipdd-GmbH & Co. KG
- Joma-Polytec GmbH
- Kienle + Spiess GmbH
- KLEINER GmbH pressing technique
- KSPG AG
- Lapp Gruppe
- MAHLE International GmbH
- MANN + HUMMEL GmbH
- Michelin Reifenwerke AG & Co. KGaA
- NuCellSys GmbH
- PVS-Kunststofftechnik GmbH & Co.KG
- REFU Elektronik GmbH
- SCHOPF Maschinenbau GmbH
- sitronic GmbH & Co. KG
- Vector Informatik GmbH
- WITTENSTEIN AG
- ZF Friedrichshafen AG
- Ziehl-Abegg

**Research and development**

- Areus Engineering GmbH
- AtTrack GmbH Gesellschaft für Mobilität
- Automotive Simulation Center Stuttgart e.V.
- Berger Elektronik GmbH
- Competence & Design Center for Mobility Innovations
- German Aerospace Center (DLR) – Institute of Vehicle Concepts
- Energy Solution Center (EnSoC)
- Research Institute of Automotive Engineering and Vehicle Engines Stuttgart (FKFS)
- Fraunhofer Institute for Industrial Engineering IAO
- Fraunhofer Institute for Building Physics IBP
- Fraunhofer Institute for High-Speed Dynamics, Ernst-Mach-Institut, EMI
- Fraunhofer Institute for Manufacturing Engineering and Automation IPA
- Fraunhofer Institute for Solar Energy Systems ISE
- Fraunhofer Institute for Systems and Innovation Research ISI
- Fraunhofer Project Group New Drive Systems – NAS
- FZI – Research Center for Information Technology at the Karlsruhe Institute of Technology
- GreenIng GmbH & Co. KG
- Hochschule Aalen – Technik und Wirtschaft
- Institute of Energy Efficient Mobility (IEEM)
- Institut für Nachhaltige Energietechnik und Mobilität (INEM) der Hochschule Esslingen
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- Karlsruhe Institute of Technology (KIT) – Institute for Industrial Production (IIP)
- Karlsruhe Institute of Technology (KIT) – Institute of Reciprocating Engines (IFKM)
- Karlsruhe Institute of Technology (KIT) – Institute of Product Engineering (IPEK)
- Karlsruhe Institute of Technology (KIT) – Karlsruhe Service Research Institute (KSRI)
- Karlsruhe Institute of Technology (KIT) – Institute for Transport Studies
- Karlsruhe Institute of Technology (KIT) – Institute for Applied Materials – Energy Storage Systems (IAM-ESS)
- Karlsruhe Institute of Technology (KIT) – wbk Institute of Production Science
- Lauer & Weiss GmbH
- plusdrei engineering team GmbH
- RA Consulting GmbH
- SILVER ATENA Electronic Systems Engineering GmbH
- University of Stuttgart – Institute of Business Administration (BWI)
- University of Stuttgart – Institute of Electrical Energy Conversion (IEW)
- University of Stuttgart – Institute for Urban Planning and Design
- Ulm University – Institute of Measurement, Control and Microtechnology
- XTRONIC GmbH
- Centre for Solar Energy and Hydrogen Research Baden-Wuerttemberg (ZSW)

**Information and communication technology**

- Ametras rentconcept GmbH
- Bosch Software Innovations GmbH
- ENERGY4YOU GmbH – An Atos Worldgrid Company
- Daimler FleetBoard GmbH
- highQ Software Solutions GmbH
- IPG Automotive GmbH
- Kellner Telecom GmbH
- PTV Group
- Telemotive AG

**Mobility providers**

- car2go Europe GmbH
- Rhein-Neckar-Verkehr GmbH
- Stuttgarter Straßenbahnen AG
- SWE-Mobility UG
- Verkehrs- und Tarifverbund Stuttgart GmbH (VVS)

**Production engineering**

- Dürr AG
- FAUDE GmbH
- Festo AG & Co. KG
- Harro Höfliger Verpackungsmaschinen GmbH
- M+W Group
- J. Schmalz GmbH
- SCHUNK GmbH & Co. KG
- teamtechnik Maschinen und Anlagen GmbH
- ThyssenKrupp System Engineering GmbH
- TRUMPF Laser- und Systemtechnik GmbH

Chapter 10

# E-MOBIL BW STUDIES

### System analysis BW$^{e}$ mobil

The 'System analysis BW$^{e}$ mobil: ITC and energy infrastructure for innovative mobility solutions in Baden-Wuerttemberg' study goes beyond the 'Structure study BW$^{e}$ mobil 2011' study examining the challenges and opportunities for the automobile industry in Baden-Wuerttemberg. It researches the areas of information and communication technology (ICT) and energy infrastructures for innovative mobility solutions and comprehensively examines the required system competencies for Baden-Wuerttemberg's change to become an electric mobility location. (Available in German only)

### Structure Study BW$^{e}$ mobil 2011 – Baden-Wuerttemberg on the way to electric mobility

'Structure Study BW$^{e}$ mobil 2011 – Baden-Wuerttemberg on the way to electric mobility' provides a comprehensive insight and outlook to the various technologies and aspects of electric mobility, and shows that Baden-Wuerttemberg is in a great position to secure a leading position in this future market. This study is available free of charge at www.e-mobilbw.de.

### Hydrogen infrastructure for sustainable mobility – development stage and research requirements

This study gives a comprehensive overview of the current state of hydrogen infrastructure and the available technological concepts and components at filling stations. In addition, it includes recommendations for further research and actions for industry, associations and the public authorities. (Available in German only)

### Energy resources of the future – potential of hydrogen technology in Baden-Wuerttemberg

The study gives an overview of the state of the art, it presents the structure of the value-adding chain, including member competencies, within the state of Baden-Wuerttemberg, and it provides an estimate of the future sales and employment potential. In addition, the study includes a guideline for enterprises with respect to hydrogen and fuel cell technology in Baden-Wuerttemberg. (Available in German only)

### Academic qualification – analysis of the educational landscape with regard to sustainable mobility

This comprehensive study gives companies an overview of Germany's educational institutions with regard to sustainable mobility. Furthermore, it lists what companies expect from universities and graduates, and it includes recommendations on how administrations can contribute to more effective information and communication processes between universities and companies. (Available in German only)

You may download these publications as PDF files. For this, simply scan the respective QR code with your smartphone.
Or you can view them as an e-paper at our website at www.e-mobilbw.de, under 'Service > Publikationen'.

### New options for communities

With our publication 'New options for communities – electric mobility as a building block of future-proof municipal development in Baden-Wuerttemberg', responsible officers in the state's communities are introduced to the topic of sustainable mobility. Practical examples show how electric mobility can be realised in their local communities for the benefit of their inhabitants. It presents options for activities, concepts and ideas for communities that support them in initiating and expanding e-mobility programmes. (Available in German only)

### Machining of lightweight materials – introduction and overview

This potential analysis examines the technological specifics of lightweight materials in respect of their machining. And it considers the health-related aspects of machining these lightweight materials. (Available in German only)

### Lightweight construction in mobility and production – Ecological aspects

The study examines the subject of sustainability in lightweight construction under the aspect of ecology and health. In addition to the eco-balance, taking into consideration the effects on the environment, health aspects also play an important role in the production and utilisation of lightweight construction products. (Available in German only)

### Lightweight construction in mobility and production – Opportunity for Baden-Wuerttemberg

This study provides a comprehensive overview of all technological aspects of lightweight construction and it shows the relevance of this key technology for Baden-Wuerttemberg. It lists opportunities and risks and identifies the industries which have already strongly invested in their development. It describes construction methods and materials in lightweight construction and provides insights into the developments of the different industries. (Available in German only)

### Lightweight construction in Baden-Wuerttemberg – Sourcebook

This sourcebook presents Baden-Wuerttemberg's research competencies in the area of lightweight construction in a bundled form. It provides insights into the complexity and diversity of this topic and introduces the different competence centres and their main fields of research. It presents 11 non-academic research institutes, 28 university institutes and 13 universities of applied sciences whose activities and competencies are required for the development and production of lightweight structures. (Available in German only)

Chapter 11

# MORE LITERATURE ON THE SUBJECT OF ELECTRIC MOBILITY (AVAILABLE IN GERMAN ONLY)

- **ATZ agenda – Mobilität von morgen: Ideen und Konzepte (ATZ agenda – mobility of tomorrow: ideas and concepts)**
  Oktober 2012; Springer Verlag

- **Aufbau der Wertschöpfungskette für Batteriesysteme in der Region Stuttgart**
  **(Establishing the value-adding chain for battery systems in the Stuttgart Region)**
  Dr. Bernhard Schaible u. Werner Nendwich; 2011; Download at http://www.bba-bw.de

- **Autoelektrik/Autoelektronik (Vehicle electrics/electronics)**
  Robert Bosch GmbH (Hrsg.); 2007; 5. Auflage; Friedr. Vieweg & Sohn Verlag Wiesbaden; ISBN 978-3-528-23872-8

- **Batterien, Bordnetze und Vernetzung (Batteries, vehicle power systems and integration)**
  Konrad Reif (Hrsg.); 2010; Vieweg+Teubner Verlag Wiesbaden; ISBN 978-3-8348-1310-7

- **Ein Portfolio von Antriebssystemen für Europa: Eine faktenbasierte Analyse –**
  **Die Rolle von batteriebetriebenen Elektrofahrzeugen, Plug-in Hybridfahrzeugen und Brennstoffzellenfahrzeugen**
  **(A portfolio of drive systems for Europe: a fact-based analysis – the role of battery-powered electric vehicles, plug-in hybrid vehicles and fuel cell-powered vehicles)**
  Download at http://www.now-gmbh.de

- **Elektromobilität – Aspekte der Fraunhofer-Systemforschung (Electric mobility – aspects of Fraunhofer systems research)**
  Ulrich Buller u. Holger Hanselka (Hrsg.); Fraunhofer Verlag Stuttgart; ISBN 978-3-8396-0410-6

- **Elektromobilität – Potenziale und wissenschaftlich-technische Herausforderungen**
  **(Electric mobility – potential and challenges under science and technological aspects)**
  Reinhard F. Hüttl, Bernd Pischetsrieder u. Dieter Spath (Hrsg.); Springer Verlag Berlin Heidelberg; ISBN 978-3-642-16253-4

- **Handbuch Elektromobilität (Electric mobility manual)**
  Reiner Korthauer (Hrsg.); Verlag EW Medien und Kongresse GmbH Frankfurt am Main; 2013; ISBN 978-3-8022-1064-8

- **Handbuch Kraftfahrzeugelektronik – Grundlagen, Komponenten, Systeme, Anwendungen**
  **(Vehicle electronics manual – basics, components, systems, applications)**
  Henning Wallentowitz u. Konrad Reif (Hrsg.); 2006; Fried. Vieweg & Sohn Verlag Wiesbaden; ISBN 978-3-528-03971-4

- **Handbuch Leichtbau – Methoden, Werkstoffe, Fertigung (Lightweight construction manual – methods, materials, production)**
  Frank Henning u. Elvira Moeller; 2001; Hanser Verlag München Wien; ISBN 978-3-446-42267-4

- **Lithium für Zukunftstechnologien: Nachfrage und Angebot unter besonderer Berücksichtigung der Elektromobilität**
  **(Lithium for future technologies: supply and demand under special consideration of electric mobility)**
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