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CATCH-MR (Cooperative approaches to transport challenges in Metropolitan Regions) is an INTERREG IVC project running from January 2010 until December 2012 with a total budget of approximately Euro 2 million.

**Workshop from 14 to 16 March 2012 in Berlin.
Renewable Energy in Transport**

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Renewable Energy in Transport – 6th Workshop in Berlin

Transportation continues to be highly dependent on fossil fuels, which, due to the shrinking availability of resources, will someday be too costly and unreliable. At the same time, transportation is responsible for a significant share of the total CO2 emissions in Europe. Thus, in addition to reducing energy use in transport, a shift towards renewable energy sources is regarded as an important requirement for a sustainable transport system in the future.

The integration of renewable energy sources in the transport sector in metropolitan regions in Europe was the topic of the sixth workshop of the project CATCH-MR, which took place in Berlin from 14 to 16 March 2012. The workshop addressed three aspects of the topic:

- *renewable energy in motorized individualized transport*
- *renewable energy in public transport*
- *regional production of renewable energy.*



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Welcome to Berlin

The Berlin workshop (14–16 March 2012) was opened by state secretaries Tina Fischer and Ephraim Gothe. They pointed out that the capital region is heavily engaged in increasing the use of renewables in transport. More green energy in transport means less greenhouse gas emissions, a better quality of life for everyone and a greater competitive edge at both the national and European level. The state secretaries highlighted the importance of information exchange and wished all participants a pleasant and productive stay in Berlin.

During two intensive workshop days the participants discussed the options for securing “carless mobility” in the metropolitan regions, means for increasing the share of renewables in public transport, and approaches by which the city and region could work together in a regional energy partnership.

The site visits included the Efficiency House Plus, which generates its own energy as well as power for two e-cars exclusively from renewable resources. At the EUREF campus, pedelecs, e-cars and a smart grid were available for testing by the participants.

As Berlin has more to offer than seminar rooms and PowerPoint presentations many participants availed themselves of the opportunity and stayed for the weekend in Berlin. To the delight of everyone spring arrived overnight and Berlin presented itself in the best light.

It was a pleasure having you with us! See you again in Ljubljana in May 2012 and in Rome for the final conference in November 2012.

Frank Segebade

June 2012

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Renewable Energies in Transport – Results from the Berlin Workshop

During the CATCH-MR workshop, three topics were discussed by the participants from the partner regions: renewable energy in motorized individual transport, likewise in public transport, and the production of renewable energy – particularly at the local level – within the metropolitan regions themselves. In the present article, some results of the workshop are highlighted.

Motorized Individual Transport

Workshop participants shared the opinion that the backbones of sustainable and environmentally friendly transportation in metropolitan regions are the collective public transportation systems, which should be maintained and further developed. Nevertheless, it was acknowledged that collective transportation alone cannot cater to every mobility need; thus a significant portion of the population will rely on individual modes of transportation, at least additionally. The experts from the participating metropolitan regions therefore discussed the option of using alternative technologies (with electricity, hydrogen or gas) suitable for the deployment of renewable energy and their potential regarding individual transport solutions. Considering the specific pros and cons of various alternative propulsion systems, workshop participants did not favour any one technology but rather felt that a plurality of concepts should be pursued. Participants from the partner regions were in favour of different technologies – electric cars and biogas being the most common so far.

Furthermore, new mobility concepts, such as electric car sharing in combination with public transportation, were identified as viable solutions for future transportation needs. Findings from various studies demonstrate a growing share of transport users with multimodal travel patterns, using both collective and individual forms of transportation, as needed and appropriate. This multimodal mobility is addressed by innovative mobility concepts, often integrating the use of renewable energies. The project BeMobility, presented during the workshop, tests concepts for multimodal mobility routines in Berlin, including the use of electric vehicles (see page 6).

Public Transport

Regarding the use of renewable energies in public transport, discussions of practices as well as technologies and challenges were held in two groups, one with the focus on rail-based public transport and one on bus transport. Rail-based transport is often electrified and therefore would seem to offer a quick and easy option for using renewable energy. Hence, the main question discussed was how to promote this change to green electricity, which raises questions concerning regional supply and “green washing”. The



main challenge to the use of renewable energy in buses concerns the purchase and use of buses with alternative propulsion systems. Important promotional factors for their introduction in the partner regions have been air quality standards, mitigation goals and noise reduction. The various technologies for making use of hydrogen, electric power, or gas in buses each have specific advantages and disadvantages. Trolley buses, for instance, might be a good solution where they are already in use (e.g. Budapest); building up new networks, however, is too expensive. Battery-powered electric vehicles, on the other hand, are still quite heavy and not suitable for long-range usage. High-speed charging, however, could make electric buses more suitable for bus lines in the near future, as demonstrated in the example of a new feeder bus system in the Gothenburg region.

A common topic for rail-based systems and buses is the greater costs associated with the use of renewable energies as well as for the purchase of buses with alternative propulsion systems. This is especially the case for Budapest, where the whole fleet needs renewal over the next few years. Additional financial means could be obtained by making conventional transportation more expensive (e.g. by means of toll rings for cars and more restrictive parking regulations in the city centre) – thus gaining revenues to subsidize public transport. Experiences from Oslo and Gothenburg show that a transparent distribution of revenues in a sustainable transportation system helps to increase public acceptance for these measures.



Renewable energy production

The discussion of production and sourcing of renewable energy dealt mainly with grid-based energy and overall electric power. The share of renewable energy used for electrified transportation systems such as metro, tram, rail, e-cars and e-bikes may increase with the general rising share of renewable energy in the grid. To foster the expansion of renewable energy production, users of private cars and bicycles as well as public transport companies can furthermore purchase green electricity or directly invest in renewable energy plants. The workshop addressed the potential for renewable energy production in the partner regions and the question of whether the origin or production location of renewable energy is of importance. Participants stated that regional production of energy could

positively affect its acceptance among the population, because it creates jobs and generates value added at the regional level. Regional studies from two CATCH-MR partners presented at the workshop indicate that in Berlin-Brandenburg and Vienna/Lower Austria, respectively, the potential for renewable energy production in the less densely populated areas surrounding the metropolises is great enough to cover the energy demand of the entire region. However, due to source fluctuations, a large renewable energy share can also cause problems (see page 8ff). An innovative concept to store excess capacity and make the production of renewable electricity more reliable was presented at the workshop (see page 7).

Reflections from Rome

by Emanuela Bea and Dario Esposito



The journey to Berlin was of great interest in terms of historical, cultural, architectural and social aspects. We found really interesting the use of iron and glass in new buildings and the renovation of old ones; also impressive was the extensive urban renewal plan. Equally remarkable was the workshop organization that stimulated discussion and debate on various renewable energy technologies and their use in transport systems.

Thanks to relevant contributions to the debate it was possible to understand and experience the importance of an integrated approach for the entire field of mobility, energy production and urban planning.

It was also interesting to see the renewal and transformation of the old Gasometer into a place of research, study, experimentation and entertainment, focused on

new technologies for sustainable mobility – a technological hub of great vitality, making visible the effort to innovate mobility choices and share them with citizens.

Regarding the new propulsion systems in public transport, topics to be explored are: availability of new technologies, costs, geographical distribution and policies for implementation.

From a preliminary analysis of these issues and in order to reach targets already achieved in the cities of Gothenburg and Oslo, we note that the most available and effective technology is the production of biogas to be used in automotive vehicles.

To facilitate the realization of plants it will be necessary to have in place a clear political commitment, which can facilitate and simplify the authorization procedures for plants that, through waste management and the use of biomass, will produce biogas.

It is clear that similar choices are influenced by the real possibility of identifying sites for the plants and the ability to control the entire cycle of waste management.

The public administrations could support this choice by replacing existing fleet vehicles with bio-fuel vehicles and implementing a policy of Green Public Procurement (GPP). At the same time it is necessary to allocate resources for research and development of innovative technologies such as, for example, hydrogen.

Reflections from Gothenburg

by Georgia Larsson



Which were the highlights of the workshop?

The site visit at the EUREF Campus was both interesting and inspiring. Experiencing the full scale project “intelligent city” provided an understanding of the integrated approach to renewable energies through electric mobility.

A good example of learning by doing was the interactive game of the energy flow within the campus. It was also valuable to have the opportunity to try out

the electric bicycles and cars. The personnel in place were helpful and knowledgeable and managed to guide us through a quite complex field. This site visit was very educational and a great learning experience.

Another highlight from the workshop were the presentations connected to the first block “Living without a car/how to change attitudes”. To follow the trend and behavioural changes over time can be one of the significant drives towards different mobility planning strategies. Being able to identify on-going changes concerning behavioural patterns is one key factor for achieving better solutions. Also interesting is the shift of attitudes concerning the car, from “owning” to “using”.

What was of special interest for your metropolitan region?

Definitely the “Berlin mobility card”. The concept of putting the commuter in focus by providing easy access to all transport modes is an excellent example of how to create flexible mobility without actually owning a car. We realised that in the Gothenburg region we have quite a long way to go in this particular issue and we will absolutely take this example with us. Hope that the “Berlin mobility card” will go from a 3-month test to a permanent offer in the near future.

Regarding the use of renewables in transport did you make any special observation on this in Berlin?

One observation was the importance of locally produced energy for covering the local needs of Berlin. Raising public awareness concerning energy issues is a pedagogical necessity. It then becomes obvious that energy must have a place where it is produced. As planners we need to see the most efficient solutions in a more holistic context. Connecting different kinds of energy grids offers flexible and energy-efficient solutions. For example, can excess heat in industry be used in heating water in a district heating system? It was also very interesting to hear about the possibility to store wind energy in the gas grid using electrolytic conversion.

Best Practice: the EUREF Campus / BeMobility

The German government has recently changed its energy policy away from nuclear power and is aiming to achieve a sustainable and secure energy supply based on an expanded use of renewable energies. In an apparently unrelated measure, the government also set a goal of having one million electric cars on the road by 2020. The deployment of electric vehicles as part of a public car sharing fleet, integrated in public transport, and connected to the energy grid supports the concept of sustainable urban mobility and at the same time contributes to achieving Germany's national energy policy goals.

European Energy Forum (EUREF)

Ideas for integrating transport and energy are being demonstrated on the EUREF campus in Berlin, which was visited by workshop participants. On a site that was used for gas production in the 19th century, a new urban business area is being developed. To date five small wind turbines, three photovoltaic systems and a large-scale battery for energy storage have been installed. All new buildings meet LEED Gold standards, an internationally recognised certificate for "leadership in energy and environmental design".



BeMobility Project

The project BeMobility offers a fleet of 40 electric vehicles as part of a public car sharing system that is integrated into Berlin's public transport network. In order that participants might easily experience all modes of transport (e.g. public transport, car sharing, bike sharing) a mobility card was introduced in 2011. A single ticket allowed for unlimited travel via virtually all public transport modes, including a € 50 credit for car sharing and 30 minutes of free bicycle use per booking.



Since 2010 a so-called eMobility Platform has been in operation and likewise located on the EUREF campus. eMobility involves partners from the transport,

energy, infrastructure, information and communication sector, as well as public authorities, and is coordinated and evaluated by the Innovation Centre for Mobility and Societal Change (InnoZ). The eMobility Platform offers a first point of contact on topics concerned with energy, mobility and infrastructure and serves as a central exhibition space and testing ground. The main energy suppliers participating in the project have installed a number of charging stations throughout Berlin that are available to the public and car-sharing participants. The eMobility Platform itself features approximately twenty stations using different types of technology.

Micro Smart Grid

Besides the intelligent linkage of electric mobility and public transport, the further development of BeMobility involves integration with the power grid. With this in mind, a wind measurement system has been installed that links the local wind turbines with the charging stations and an energy control room. All energy flows within the micro smart grid are controlled and technical energy management for the electric vehicle fleet and buildings is achieved from this control room. In addition to electricity from the national grid, locally produced renewable energy can now be used as power for the electric vehicles.

The structure and content of the project BeMobility is unique in Germany. Within the pilot region Berlin/Potsdam the project is financially supported by the Federal Ministry of Transport, Building and Urban Development. Its further development was a key aspect of Berlin-Brandenburg's successful application for becoming an „Electro-Mobility Showcase“.

During the site visit the workshop participants were able to explore and try different components of the smart grid, e.g. electric cars and pedelecs (electric bicycles).

The ENERTRAG Hybrid Power Plant: Renewable Energy for Electric Power, Heating and Transport

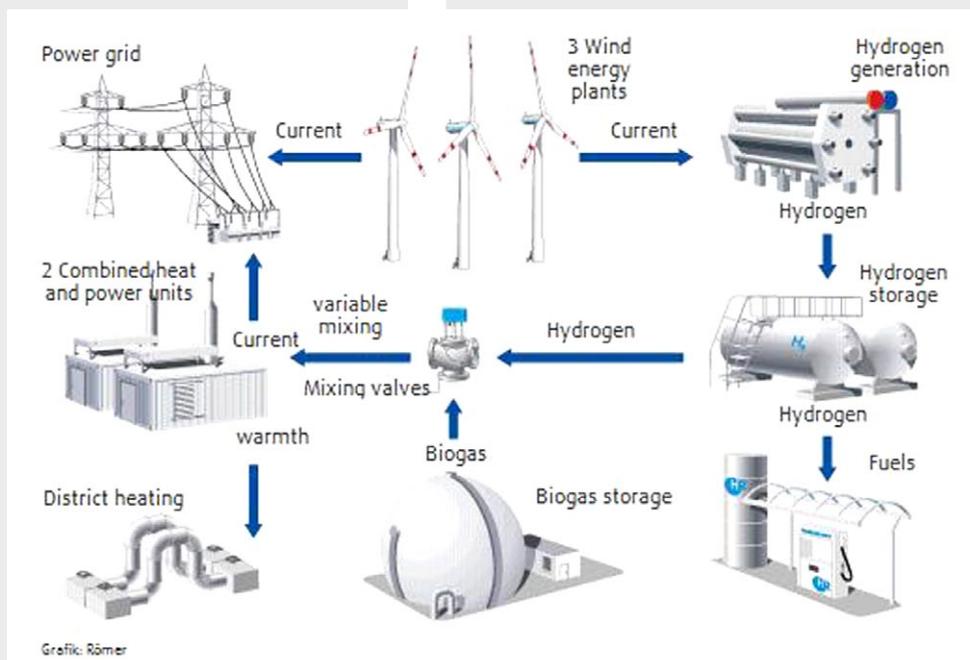
The ENERTRAG hybrid power plant in northern Brandenburg stores excess capacity wind-generated power in order to make it readily available for power re-conversion during periods of calm. By employing wind power and biomass as energy sources (and utilising electrolysis and hydrogen storage, as well as power re-conversion and heat generation) it is possible to reliably supply electrical power and heating from renewable energy sources regardless of how the wind is blowing. Presently, energy is being supplied by three 2-MW wind turbines as well as a biogas plant. The power plant serves the district heating grid of the city of Prenzlau; at the same time it produces hydrogen, which is utilised in TOTAL Deutschland’s hydrogen filling stations as well as in the natural gas grid (power-to-gas). The late phase of the project saw the acquisition of DB Energie, Vattenfall Innovation and TOTAL Deutschland as project partners.

The pilot plant demonstrates that fluctuating energy sources such as wind and solar, together with hydrogen as the storage medium, can fully replace the fossil fuel power plant. Capturing electric power peaks avoids the usual practise of feed-in reduction due to excess levels of wind energy and by supplying hydrogen for vehicles innovatively links system integration of renewable energy into the transport sector. At the same time, it takes advantage of local resources, thus generating new regional value creation chains and making Germany less dependent on energy imports.



Source: ENERTRAG

In just a few decades, the energy supply of the future will look much different that it does today. The concurrent increasing energy demand means that the global consumption of resources – despite advances in energy efficiency – will continue to increase. Due to the growing scarcity of fossil fuel resources only the potential offered by renewable energy will allow us to reasonably address these needs in the power, heating and mobility sector. The hybrid power plant is a technically viable option that is already available for application today. Follow-up projects are already being planned: With “performing energy”, the development in Germany of multi-megawatt industrial systems will make an important contribution to turning around Germany’s energy policy.

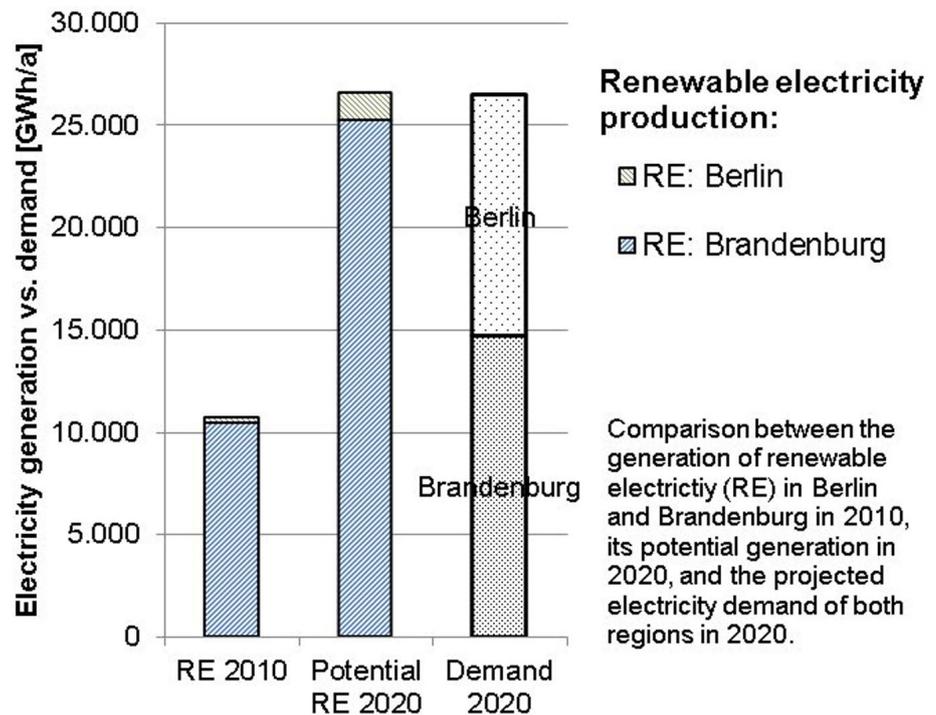


Source: ENERTRAG

Success of and Potential for Renewables in the German Metropolitan Region Berlin-Brandenburg

The German federal states of Berlin and Brandenburg have established ambitious climate and energy policy goals. To achieve these, concepts for a more climate-friendly approach to mobility will also need to be developed and implemented. The deployment of renewable energy sources in place of fossil fuels represents – along with strategies for traffic mitigation and a shift to non-motorised and public transport – an important component of such mobility concepts. In Brandenburg, there exists a strong potential for the production of renewable energy especially by wind and solar power at levels that in the mid- to long-term will exceed regional demand. At the same time there exists – in Berlin in particular – substantial demand density. The premises are thus good for the deployment of regionally produced renewable energy in the transport sectors of the two regions – the subject of an analysis carried out by two research institutes. In addition to this analysis, examples of good practice were assessed in order to identify the factors for success as well as barriers to such new concepts.

Electricity can be used in a wide range of technologies in the transport sector, e.g. trams, trains, e-cars, and e-bikes. At the moment, 39% of all vehicles in the Berlin-Brandenburg transport association are powered by electricity. Furthermore, electricity can be converted to hydrogen or methane, and thus be used in vehicles powered by compressed natural gas (CNG) or H2 (page 7). In Brandenburg, the production of renewable electricity exceeded 11 TWh in 2011, which is more than 70% of the state's electricity demand. By 2020, Brandenburg could already produce about 25 TWh of renewable electricity, which would be almost enough to cover the demand of the whole metropolitan region, including Berlin. This complements Berlin well, which will only be able to cover approx. 14% of its electricity demand using its own renewable energy sources by 2020 (see figure below).



Renewable electricity generation in Berlin and Brandenburg in 2010 and potential for 2020 compared to the projected demand in 2020 (Source: IÖW)

In contrast, biofuels from regional biomass have only a very limited potential of around 5% of the fuel demand, because the production of food should not be compromised. Furthermore, the energetic use of biomass must compete with other processes such as heat or electricity generation. Further imports of biomass are possible, but often not sustainable and suffer a lack of public acceptance.

The Vision of Regional Energy Partnerships

While the potential for renewable energy production is quite limited in most major cities such as Berlin, it is comparably huge in the surrounding rural areas, e.g. Brandenburg. Hence, the concept of regional energy partnerships might be a way to create a win-win situation and to foster the expansion of renewable energy in metropolitan regions. The regional production of energy could positively affect its acceptance among the population because the need for expansion of the power grid could be reduced while jobs are created and value added is generated at a regional level. People could even be involved in the planning of renewable power plants and participate directly in their profit through fairly partitioned leasehold models such as in Schlalach (Brandenburg), where a community wind farm ("Bürger-Windpark") was established in 2010.

However, fostering renewable electricity generation can cause problems concerning the security of energy supplies. The renewable energy sources of Brandenburg consist of more than 70% wind power and about 15% solar power. The generation of electricity from these intermittent sources fluctuates greatly. Hence, increased reliance on these power sources leads to the necessity of buffer or storage systems, which can store excess production in times of high power generation in order to cover the demand during times of low power production. Initial studies show that batteries in electric cars could contribute only little to solve this problem within the next 10 years. Smart grids, new storage systems, and new market mechanisms are required to ensure that the demand side can react to fluctuations on the production side which need to be compensated. A good example of such a new technology, linking in the transport sector, is the new hybrid power plant in Brandenburg, which generates hydrogen to store excess wind power (page 7).

Renewables in Transportation

There are enormous differences with respect to the deployment of renewable energy between the two main modes of transport: motorised individual transport (MIT) and public transport (PT). MIT is responsible for 85% and 90% of passenger-transport CO₂ emissions in Berlin and Brandenburg respectively. This is due to the mobility behaviour of the population (40% motorised private transport in Berlin, 53% in Brandenburg), but also to the dominance of conventional fuels in the MIT sector. Alternative propulsion systems such as CNG, e-cars, or hybrid cars represent less than 0.5% of the passenger vehicles in the region, but there are many projects to increase the number of such vehicles and ensure adequate filling stations. As each of the technologies bears its own specific opportunities and obstacles for the deployment of regional renewable energy it is currently not possible to identify any one technology as being either the only suitable direction for development or as fully unsuitable. It is therefore advisable to proceed with the existing plurality of conceptual approaches. The evaluation of technologies and their potential depends, among other things, on the time perspective: while the use of biogas in natural gas vehicles or renewable electricity in rail passenger public transport is already technically feasible, other propulsion systems will need to be further developed and infrastructure needs to be expanded before they are able to achieve market suitability.



Source: RainerSturm / pixelio.de

On the basis of the projects and examples reviewed, it was possible to identify certain **success factors**, mainly at the political level (policy regulation and continuity, support from state government and local precincts, as well as close cooperation with local authorities). The effective networking of the various stakeholders is essential for the successful implementation of mobility based on renewable energy. This is particularly true for the growing importance of the public utilities, as well as transparency, e.g. with respect to location and production conditions of deployed biomass.

Mobility based on renewable energy, particularly the use of alternative drive systems, faces a number of technological, infrastructural, political, and other **barriers**. The most important ones mentioned by the experts are:

- Technology and infrastructure barriers: many alternative drive systems are not yet technically mature and are expensive; vehicle availability is limited.
- Political barriers: limited financial resources of the federal states and local communities; differences in approach and degree of cooperation of regulatory agencies; lack of legal incentives for giving preference to alternative propulsion systems; lack of standardisation.
- Other barriers: unanswered questions concerning deployment (e.g. availability of charging infrastructure); competition between companies with respect to technology development.

This shows that there are still a number of barriers making broader political support necessary. The cooperation of the various stakeholders in government, academia and industry is likewise an important prerequisite for the successful expansion of renewable energy mobility in the region. With this in mind, **regional energy partnerships** might be one way to advance specific technologies and propulsion systems or selected concepts for the expanded deployment of renewable energy in passenger transport.

Interview

Senate Department for Urban Development and the Environment, Berlin

State Secretary Ephraim Gothe



Source: Oliver Feist / berlin.de

How important is climate protection for Berlin's transport policy?

The transport sector is one of the largest emitters of greenhouse gases. There is clearly a need for action here if German and European climate goals are to be achieved. For the major cities, in their role as transport hubs in particular, an environmentally sound approach to mobility development is extremely important.

Clean air means a better quality of life and is increasingly viewed as a location and relocation advantage in European and global competition. Berlin is proud of its extensive and well-developed public transport system and the comparatively low level of motorisation; we want to build on this.

What is the significance of renewable energy for passenger transport in Berlin?

Berlin wants to make personal transport altogether more climate friendly. Our intent is to make the capital's mobility more sustainable and to achieve a 40% reduction in transport-derived CO₂ emissions by the year 2020. The share of renewable energy therefore needs to be significantly increased.

The electric car plays an important role in this. Berlin, together with Brandenburg, has won a federally sponsored competition and is now an "Electro-Mobility Showcase". Our goal for the region is to have a total of approximately 15,000 electric automobiles on the road by the year 2015; by this time, more than 3,700 public and private charging stations are to be made available.

Nevertheless, we do not view the electric vehicle as merely a substitute for fossil fuel-based motor vehicles. Instead we want to develop integrated transport solutions in which passengers first of all make use of local public transit and, as the need arises, rent a

bicycle, electric bicycle, or electric car. Ownership of a personal motor vehicle will therefore no longer be a necessity. We know from young people, in particular, that they often no longer desire to own their own car; we can leverage this sentiment to increase the share of renewable energy in transport.

But where will the necessary “clean electricity” come from?

Primarily from Brandenburg. In this respect, the city and the region are a perfect match and together can establish a regional energy partnership.

Interview

Ministry for Infrastructure and Agriculture, Brandenburg

**State Secretary
Rainer Bretschneider**



Source: M.Schmieding, A.Obst

What role does public passenger transport play in the Berlin-Brandenburg region?

Berlin and Brandenburg enjoy a close relationship. A key element of this relationship is a well-functioning public passenger transport system – it is the glue that binds the metropolis and the surrounding region together.

Of particular importance to us is the availability of a capable public transport service. The quality of the regional public transport system has been significantly improved, which has led to on-going annual increases in passenger numbers. Every day approximately 3.5 million people in Berlin and Brandenburg make use of public transport.

What is Brandenburg doing to increase the share of renewable energy in passenger transport?

Today in Brandenburg much cleaner electrical power is already being produced by means of wind and solar power facilities and these are being further developed. A share of this electrical power is used in the transport

sector, including rail transport and electric vehicles. In the future, greater use will be made of the batteries in electric vehicles for storage in order to capture supply peaks from wind and solar facilities. Ultimately, this can even lead to a reduced need for the construction of new power transmission lines.

What about renewable energy with regard to the commuter railways (S-Bahn) and regional trains?

Today's rail commuter is already making a contribution to the environment. The urban and regional trains offer commuters in Berlin-Brandenburg an attractive and effective alternative to the use of an own car. Energy consumption per passenger in fully occupied trains and buses is significantly lower than in motorised private transport. In tender calls for the provision of transport services, plus points are currently already being awarded for low-emission drive systems and the utilization of renewable energy sources.

All trains operate with the electric power mix that DB Energie makes available, which currently includes a 20% renewable energy share. In light of the still very low number of electric cars on the road, we are making an effort to increase the share of renewable energy in public transit through innovative, regional solutions.

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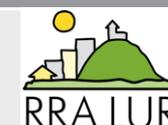
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