

# SMART CITIES



THE UNIVERSITIES OF NORTH RHINE-WESTPHALIA:  
YOUR PARTNERS FOR EUROPEAN RESEARCH PROJECTS

**SMART CITIES:**

COMPETENCIES OF NORTH RHINE-WESTPHALIA'S UNIVERSITIES



## THE UNIVERSITIES OF NORTH RHINE-WESTPHALIA: YOUR PARTNERS FOR EUROPEAN RESEARCH PROJECTS CREATING "SMART CITIES"

With a total of 69 universities, approximately 500,000 students, and more than 50 non-university research institutes, North Rhine-Westphalia can boast the most concentrated science and research landscape in Europe. Its universities and universities of applied sciences offer outstanding development potential and research expertise.

The NRW Innovation Alliance was founded in 2007 to draw attention to the extensive range of services and research skills available in NRW's universities, maintain and deepen the contact between universities and industry, and promote research and knowledge transfer. This organisation is a cooperative network of universities, universities of applied sciences, and university spin-off [transfer] organisations in North Rhine-Westphalia.

In 2010, the NRW Innovation Alliance initiated a series of presentations on "The Universities of North Rhine-Westphalia: Your Partners for European Research Projects". Catalogues describing excellent research projects have been produced. These were presented at symposia in Brussels at the Permanent Representation of North Rhine-Westphalia to the European Union. The first subjects were: "The Ageing Society" and "Water". Both catalogues and symposia were very successful. In this latest catalogue, we are presenting another challenging issue: "Smart Cities".

According to latest forecasts, two thirds of the world's population will live in megacities by 2050. In seven European countries, this proportion will be 90% or more by 2020. For many, the future of this highly urbanised world lies in "Smart Cities". Here, information, communication and technology will transform the way that cities are experienced. They will be governed and operated in completely new ways.

NRW has the highest population density among the German Landers. At its heart, the Rhine-Ruhr agglomeration is one of the world's 30 biggest metropolitan regions. Taking this particular situation into account, scientists at NRW's institutes and research facilities are addressing key questions relevant to the future of cities and their residents. The whole spectrum of urban life has been considered. Approaches have been devel-

oped that include not just technological issues, but also economic, ecological, and sociological topics. Some 40 research projects from 16 NRW universities are presented in this catalogue. These span energy supply, environmental protection, logistics, health care, infrastructure, refurbishment, modernisation of public administrations and education systems, three-generation living, and traffic. Additionally this catalogue contains a list of scientists in North Rhine-Westphalia's universities, their research activities and contact information. A short presentation about the NRW Innovation Alliance concludes this publication.

In May 2012, North Rhine-Westphalia's universities and universities of applied sciences will present their potential input, scientific excellence and multiple resources for developing and shaping current and future European research programmes. This symposium will provide access to a potentially large audience, including the European Commission, European Parliament, political parties, industrial representatives and associations. The close cooperation of universities and industry in North Rhine-Westphalia will be demonstrated with practical examples. To enable representatives from other scientific institutions and companies to make direct contact with appropriate potential partners a R&D partnering session will be introduced.

On behalf of the board of directors of the Innovation Alliance of the Universities of North Rhine-Westphalia

Prof. Dr. Gisela Schäfer-Richter  
Dr. Dirk G. Ebling



*Gisela Schäfer-Richter*



*Dirk G. Ebling*

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## YOUR PARTNERS FOR EUROPEAN RESEARCH PROJECTS CREATING "SMART CITIES"

### AIMS

With this catalogue, the Universities in North Rhine-Westphalia outline their excellent research in dealing with the many aspects of "Smart Cities", an issue that is of enormous importance to all members of the European Union. The presentations document the universities' scientific capacities, highlighting the issues and research that should be taken into consideration by the European Union in present or future funding programmes. The collection of high-quality references in this catalogue enables European companies and research institutions to easily contact relevant research partners in North Rhine-Westphalia's universities.

### THE FIRST STEP

In November 2011, the "EU-Lobbying" team from the NRW Innovation Alliance, comprising representatives from more than ten universities, conducted an inquiry at all universities in North Rhine-Westphalia asking for research projects dealing with various aspects of "Smart Cities".

### GUIDELINES

- Focus on excellent research projects, e.g. collaborative research centres and priority programmes funded by the German Research Foundation (DFG, Deutsche Forschungsgemeinschaft), the Federal Ministry of Education and Research (BMBF), the European Union, companies etc.
- Not just basic research, but also applied projects.
- Various points of contact for the issue "Smart Cities", e.g. energy supply, environmental protection, logistics, health care, infrastructure, refurbishment, modernisation of public administrations and education systems, three-generation living, and traffic.
- Cooperation with business partners.
- European dimension, Cooperation with partners from other European countries.
- Not more than four projects per university (one page per project).
- Easy-to-read representations.
- Contact information on project leaders and participants. 16 universities participated in this survey and submitted details for 41 research projects.

### PROJECT PRESENTATION

ALL ARTICLES ARE STRUCTURED AS FOLLOWS:

- Project title.
- Name of the university, contact.
- Abstract – description of work, objectives, main targets.
- List of participants, business partners, research institutions, networks etc. (from North Rhine-Westphalia and from other member states of the EU).
- Project start and duration, total costs and funding.
- Perspectives, approaches and ideas for further development at the European level.

## 1.1 ELECTRIC MOBILITY NEW PROSPECTS FOR INTEGRATED MOBILITY CONCEPTS

### ABSTRACT

The rising number of vehicles, increasing CO<sub>2</sub> and noise emissions, and the inevitable depletion of fossil fuels have together provided an enormous stimulus for research and development into electrically-powered mobility. The German government intends to put 1 million electric vehicles on its roads by the year 2020. However, despite a generally high confidence in electrically-powered cars, the social acceptance of such vehicles is not very high because they are relatively expensive to purchase, have a relatively reduced range, and a limited storage space for electrical energy.

The project ec2go (Electric Car To Go), with its eight project partners, addresses the development of an electric CarSharing concept for urban spaces. The goal is to encourage use of electric cars by the general public, removing any perceived disadvantages of electromobility for e-car users.

Within the ec2go project, Aachen University of Applied Sciences provides expertise for the development of a new business model as well as the required information and communication technology.

Interdisciplinary research activities have demonstrated that CarSharing is an ideal model for promoting electric mobility. Many disadvantages of electric cars can be compensated for by using the vehicles that are used predominantly for urban driving. Hence, the costs are distributed among all users and other cars in the vehicle pool are also available to the customer.

Within the scope of various research and development projects, Aachen University of Applied Sciences is investigating and developing a comprehensive eCarSharing mobility concept for the urban space. Analysis of target groups and their needs have proved that an electrification of conventional vehicles is either insufficient or oversized. Since the focus is on CarSharing, electric vehicles must become adjusted to a large user group, rather than individually-owned passenger cars. This mobility concept not only relies on a particularly customisable vehicle but also on modern information and communication systems that can make electric mobility easy to manage and usable by "everyone". Most people have never driven an electric car, so it will be necessary to provide drivers with an advanced assistance system to inform them about specific features of the electric car (e.g. no sound, consumption, costs and life cycle assessments).



Driving assistant

m2c lab FH Aachen

Individual customers can configure preference profiles for the vehicle (e.g. setting preferred seat positions, etc.). Interactive interfaces connect users, vehicles, infrastructure and the CarSharing operator. It will be possible to set an intelligent energy management system appropriate to the user's mobility requirement. eCars can be found and booked using a Smartphone application.

eCarSharing in the urban space combines current developments in mobility research, automotive development, production engineering and information technology. A smart eCarSharing system makes use of renewable energy sources and intelligent charging strategies. It serves as both a mediator and a link between motorised individuals and public transport. Therefore such a mobility concept not only helps to strengthen the acceptance of electric cars in society but also makes a positive contribution to environmental protection.

### LIST OF PARTICIPANTS

Aachen University of Applied Sciences, Aachen;  
[www.fh-aachen.de](http://www.fh-aachen.de)

AixControl GmbH, Aachen;  
[www.aixcontrol.de](http://www.aixcontrol.de)

cambio Aachen, Aachen;  
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[www.metagmbh.de](http://www.metagmbh.de)

Solar-Institut Jülich der FH Aachen, Jülich;  
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ZenTec automotive GmbH, Geilenkirchen;  
[www.zentec-automotive.de](http://www.zentec-automotive.de)

### PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: September 2010 - August 2012

Costs: 2.639 mio. Euro

Funding: 2.193 mio. Euro

### PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

In the future, individual mobility will change from buying physical goods (e.g. cars) to an optimised combination of various mobility services. Thus, an intelligent electric car can play an important role in future smart mobility concepts that address economic and ecological aspects of society. In technological terms, the intelligent car will become an important information hub for future information networks; analysis of this information will become a crucial input for managing and optimising mobility.

2.1 **DUAL DEMAND SIDE MANAGEMENT**  
NEW ENERGY CONCEPTS AND RELATED INFORMATION TECHNOLOGIES

**ABSTRACT**

The project aims to develop the knowledge necessary to manage an urban multi-grid system based on a study of Bottrop's Innovation City. We propose to elaborate a new concept we call Dual Demand Side Management (2DSM). This 2DSM is an evolution of the standard Demand Side Management (DSM). It is designed to simultaneously meet the needs of local systems and the grid infrastructure.

Innovative software solutions will integrate all available grids – electricity, gas, heating and cooling – and the consumers and decentralised producers into a single model in order to link the grids, optimise the overall grid structure, take advantage of synergy effects, and to develop the connecting grid interface.

**LIST OF PARTICIPANTS**

- RWTH Aachen University, E.ON Energy Research Center, Aachen
- Institute for Energy Efficient Buildings and Indoor Climate, (EBC)
  - Institute for Automation of Complex Power Systems, (ACS)

**PROJECT START AND DURATION, TOTAL COSTS AND FUNDING**

Project: June 2011 – May 2014  
Funding: 900,000 Euro by E.ON gGmbH

**PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL**

Further development of the approach to fulfil EU goals for energy positive neighbourhoods.



2DSM as connecting point between the building and the supply grids



Future supply structure

## 2.2 HARDWARE-IN-THE-LOOP (HiL) TECHNOLOGY A TEST BED FOR HOME ENERGY SYSTEMS

### ABSTRACT

Homes are melting pots for different forms of energy. As such, they are key elements for future smart grid technology. The developed test bed, based on Power-Hardware-in-the-Loop technology, allows for testing of renewable home energy systems, comprising thermal, hydraulic and electrical interfaces.

In the HiL platform, an energy control unit with a smart meter can be tested in conjunction with major consumers of primary household energy, for example, electrical heat pumps. Load profiles can be simulated for both the household appliances and photovoltaic components. The hardware components will be integrated into a simulated environment based on coupled building and systems engineering simulations in the programming language, Modelica. A climate chamber and the hydraulic test bed emulate the surrounding conditions for the hardware components. Real-time electrical loads within the house will be simulated at the same time as the corresponding grid dynamics are emulated by a grid emulator. With fast controllability and total measurability, the HiL approach can provide an ideal lab environment for verifying new control strategies and extracting the load profiles of a home energy system. This represents an innovative platform where electrical and mechanical engineering questions can be solved simultaneously.

### LIST OF PARTICIPANTS

RWTH Aachen University, E.ON Energy Research Center, Aachen

- Institute for Energy Efficient Buildings and Indoor Climate, (EBC)
- Institute for Automation of Complex Power Systems, (ACS)
- Institute for Power Generation and Storage Systems

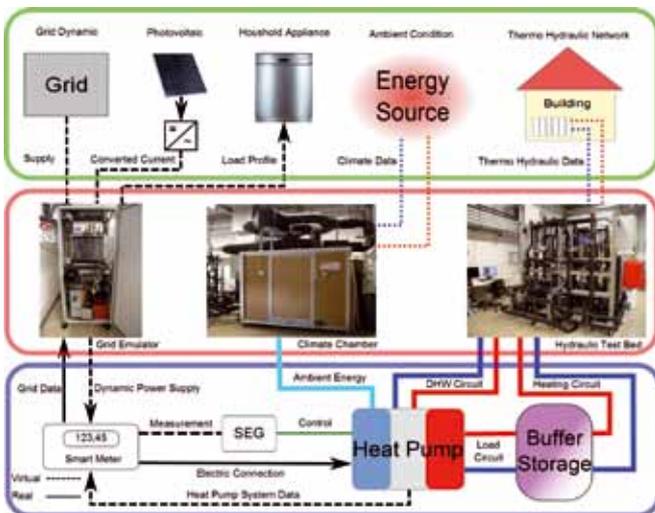
### PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: June 2010 – May 2012

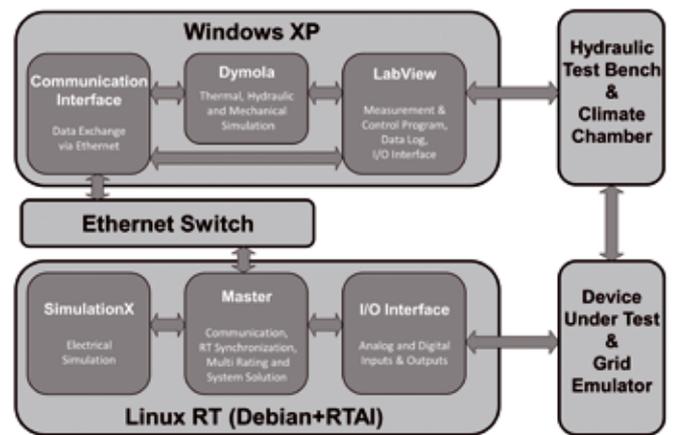
Funding: 900,000 Euro by E.ON gGmbH

### PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

The HiL set-up will be further coupled with an electrical grid including a micro combined heat and power generation unit, which allows a closed-loop emulation process with various heat sources and a total home energy management system. The test bed allows dynamic evaluation of home energy systems and can contribute to guidelines regarding home energy system performance.



Scheme of the HiL test bed with hardware (blue), test bed (red) and simulation (green) level



Simulation environment

2.3 ENERGY EFFICIENT CAMPUS  
DEVELOPMENT OF A DYNAMIC SIMULATION TOOL

ABSTRACT

With the goal of reducing the primary energy demands of existing buildings, this project analyses the energy supply for the RWTH Aachen University and Forschungszentrum Jülich. Both of these research centres are supplied by district heating grids. A detailed knowledge of these complex hydraulic systems is crucial in order to find holistic approaches for improving the energy supply chain.

This project aims at developing a simulation tool which dynamically maps the thermodynamic properties of the energy supply system. To do this, we have set up powerful simplified models representing both the buildings and the grid. The aim is to provide a planning tool that can help to improve similar systems which supply campus-structured areas with energy.

LIST OF PARTICIPANTS

RWTH Aachen University, E.ON Energy Research Center,  
Institute for Energy Efficient Buildings and Indoor Climate  
Forschungszentrum Jülich GmbH

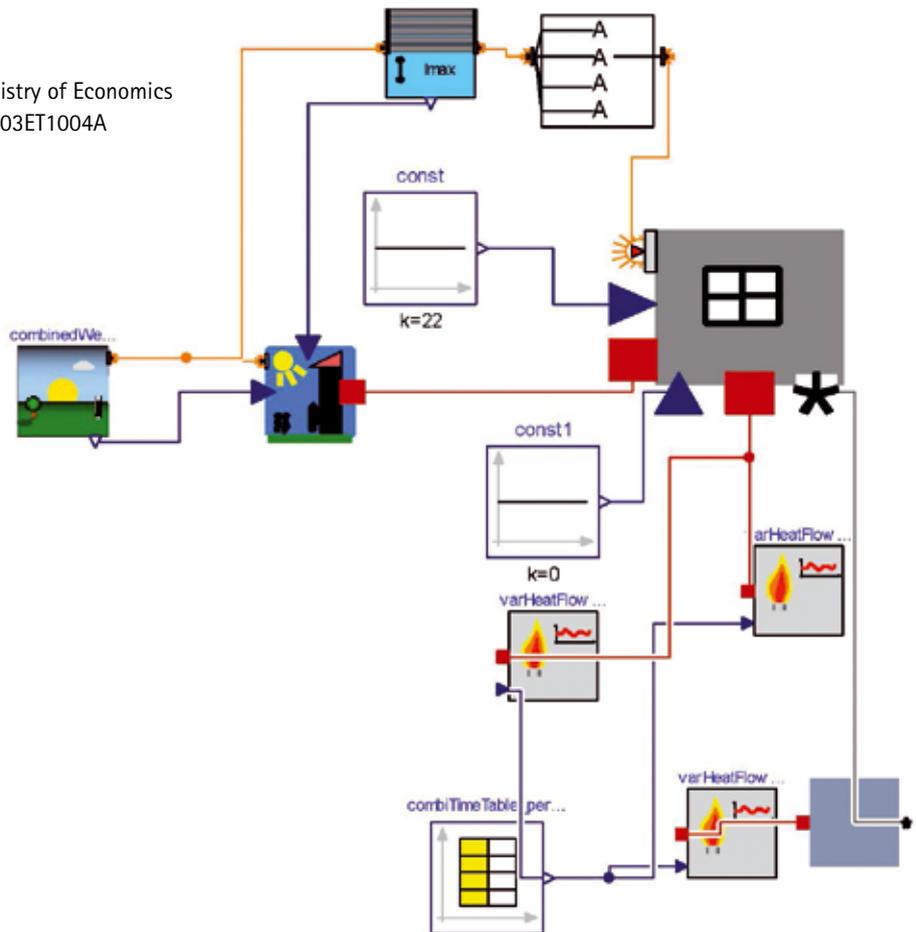
PROJECT START AND DURATION,  
TOTAL COSTS AND FUNDING

Project: January 2011 – December 2013

Funding: 1.083 mio. Euro by German Federal Ministry of Economics and Technology, promotional reference 03ET1004A

PERSPECTIVES, APPROACHES AND IDEAS FOR  
FURTHER DEVELOPMENT AT THE EU LEVEL

At the EU level, the simulation tool developed in this project can be applied to evaluate and improve energy supply chains for campus-structured areas that use district heating grids. Furthermore, the knowledge gained from this application in different technical and legal environments can be used to improve the simulation tool. Thus, the developed methods and tools can help to reduce primary energy demand on a European scale.



Building model in the graphical user interface of Dymola/Modelica



## 3.1 LIGHTING A HISTORICAL TOWN CENTRE ACCEPTANCE – EFFICIENCY – MONITORING



*Measuring illumination performance in the town of Rietberg*

*Anja Heidsiek (left, centre) and N. Reiners (right)*

### ABSTRACT

The city of Rietberg with its 30,000 inhabitants lies to the south of the district of Gütersloh on the upper reaches of the river Ems (North-West Germany). The town's historical centre is illuminated by 210 lighting points with seven different types of illumination. However, both the townspeople and local businesses complain about the poor quality of this illumination. Additional lighting, for example, at Christmas, is considered to be much better.

One objective of the project is to replace conventional lamps in the street lighting with light emitting diodes (LEDs), paying particular consideration to the illumination of designated historical buildings. A block will also be installed with a tactile surface illuminated by LEDs to aid visually handicapped people. The combination of a historical background with innovative LED technology represents a special challenge for this project.

Bielefeld University of Applied Sciences will carefully monitor the project to verify that the enhanced illumination conforms to existing standards. These research activities will include technical measurements (for example, light intensity) and face-to-face interviews with local citizens, representatives of the city council and business people. The results will compare conventional lamps to the new LEDs both for technical performance and aesthetic acceptance. Based on these measurement results, the energy efficiency of LEDs will be determined.

According to the conclusions of this study, application to other cities with historical centres might be envisaged. The aim is the establishment of innovative, energy efficient LED technology.

### LIST OF PARTICIPANTS

Bielefeld University of Applied Sciences, Dept. of Engineering sciences and Mathematics, Prof. Dr.-Ing. Eva Schwenzfeier-Hellkamp  
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RWE Rheinland Westfalen Netz AG  
Planning Group MWM Aachen  
Ostwestfalen-Lippe University of Applied Sciences

### PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

**Project:** April 2011 – March 2013  
**Funding:** 2 mio. Euro by Federal Ministry of Education and Research (BMBF) for the whole project

### PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

We would like to transfer our positive results to other European cities with historical centres.

Two interesting key aspects to be investigated on the European level are the thermal behaviour of LED technology under various climatic conditions and the acceptance of this technology by different populations.



## 3.2 OPTIMISED SMART DISTRIBUTION 2020

### ABSTRACT

The project has focused on the integration of decentralised energy technologies such as biomass, photovoltaic systems, wind power and e-mobility, into an existing 10kV/0.4 kV distribution system. The following questions have been investigated:

What happens if large numbers of photovoltaic systems are installed on many houses?

What is the influence of an unregulated usage of e-mobility?

To answer these questions mathematical models have been developed to simulate the real 10kV and 0.4kV systems, photovoltaic systems, and e-mobility usage.

Further questions have dealt with the 10kV system. The parameters needed for calculating and simulating the 10kV system were developed using the paper plan of the real system and investigated using the experts' empirical knowledge. Mathematical models of the biomass- and wind power systems also had to be developed and integrated into the simulated power system.

The results of the project permit the simulation of the 0.4kV and 10kV power distribution systems of a German town with varying degrees of decentralised energy, and different scenarios for e-mobility.

### LIST OF PARTICIPANTS

Bielefeld University of Applied Sciences, Dept. of Engineering Sciences and Mathematics, Prof. Dr.-Ing. Jens Haubrock (IEEE & VDE)

Industrial Partner: local distribution grid operator

### PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: January 2011 – May 2011

Costs: 10,300 Euro



Department of Engineering Sciences and Mathematics: Headquarters and Laboratories

Anja Heidsiek

### PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

A high penetration with photovoltaic energy and e-mobility could cause a bottleneck effect and voltage problems, especially in 0.4 kV systems. There is a huge demand for the development of effective and reliable power management systems. The knowledge gained during the project "Optimised Smart Distribution 2020" could be extended by conducting further investigations at the European level.

## 4.1 SATELLITE-BASED AEROSOL MAPPING OVER MEGACITIES METHODOLOGY AND APPLICATION IN HEALTH AND CLIMATE RELATED STUDIES

### ABSTRACT

Human health is highly affected by the fast growth of urban areas. Governability in such areas is often limited, resulting, for example, in a lack of formal public health care, unhealthy living and working conditions, and socioeconomic disparities. This research focuses on different dimensions of urban health in the megacity of Guangzhou (GZ), the capital of Guangdong Province, South China.

In cooperation with colleagues from the Sun Yat-sen University, GZ, China, the public health group of A. Krämer reviewed secondary data from published articles and governmental institutions. It also conducted an epidemiological field study among different subpopulations in GZ. This extensive urban health analysis increases knowledge about the living conditions in the megacity of GZ and will result in health maps emphasising urban air pollution at a district level. According to findings from the Global Burden of Disease Study, chronic obstructive pulmonary and cardiovascular diseases, caused by both indoor and outdoor air pollution, are important causes of mortality and disease burden in China. To obtain a deeper understanding of air pollution exposure in GZ and its effects on the health of its inhabitants, this project established a close cooperation between international experts on public health, epidemiology, aerosol remote sensing, and in-situ aerosol measurements.

One major aim is to improve technology for aerosol load estimation over large areas by using remote sensing satellite information. Megacities like GZ are important sources of anthropogenic aerosol particle pollution. Aerosol monitoring by satellite-borne remote sensing instruments (e.g. the MODerate resolution Imaging Spectroradiometer, MODIS) is a feasible methodology for continuous aerosol observations over large areas. However, aerosol optical depth (AOD) data retrieved by MODIS measurements are sensitive to surface reflectivity. In order to consider these methodological challenges, this project aims at analysing this sensitivity, taking into account the effects of different land use patterns and their reflectivity characteristics. Airborne and ground-based remote sensing instruments are used to correct MODIS AOD information.

The improved satellite-derived AOD fields will be compiled over a longer period and the result will be a series of AOD maps of different time intervals reflecting representative AOD fields over GZ and the surrounding Pearl River Delta region. These aerosol particle maps will then be linked with the above-mentioned health maps. Subsequently, both corrected AOD information and health information will be linked to data collected in the corresponding period by PM in-situ measurements.

Combining public health methods and multidimensional aerosol measurements represents a novel technique for estimating health threats due to air pollution over megacities that lack area-wide aerosol monitoring systems. This approach takes into account the local surrounding conditions and can allow transfer of results to other cities/regions with similar conditions in the future. Results will integrate local knowledge into global developments and will highlight the spill-over effects of mega-urbanisation, environmental pollution and health.

**CONTACT:** Dept. of Public Health Medicine, Prof. Dr. A. Krämer

### LIST OF PARTICIPANTS

#### 1. Principle investigators

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#### 2. German cooperating partners

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#### 3. International cooperating Partners

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National Tsing Hua University, Department of Biomedical Engineering and Environmental Sciences, Hsinchu, Taiwan, Dr. G. Engling

### PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

**Project:** March 2007 – February 2013

**Funding:** German Research Foundation (DFG),  
Priority Programme 1233

### PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

Improvement of aerosol and health map techniques to accurately estimate particle pollution and health consequences in areas where comprehensive air pollution networks do not exist.



Prof. Dr. Alexander Krämer

## 5.1 ENERGY EFFICIENT CITIES

### ACCOMPANYING RESEARCH FOR THE COMPETITION "ENERGIEEFFIZIENTE STADT"

#### ABSTRACT

Increasing efficiency is the focus of the competition "Energieeffiziente Stadt", a research initiative of the German Federal Ministry of Education and Research. All of the cities that won the Energieeffiziente Stadt (energy efficient city) competition (Delitzsch, Essen, Magdeburg, Stuttgart and Wolfhagen) developed concepts that would improve energy efficiency in their communities. These cities are now implementing the concepts within their winning projects. For further information look at [www.wettbewerb-energieeffiziente-stadt.de](http://www.wettbewerb-energieeffiziente-stadt.de)!

The main target of our accompanying research is to frame and support the different projects to achieve a greater multiplier effect and a higher transferability to other cities. Besides the analysis of mathematical models to describe the "city" system, holistic analyses are performed in the form of life cycle assessments of the different services to improve energy efficiency. To investigate the transferability of the five projects to other towns, theoretical models and cross-section analyses are performed. The development of planning models, practical tools, and generalized quality criteria and their evaluation by the participating cities will support the quality and sustainability of the whole process.

#### LIST OF PARTICIPANTS

Ruhr-Universität Bochum (RUB), Institute for Energy Technology, Chair of Energy Systems and Energy Economics (LEE), Prof. Dr.-Ing. Hermann-Josef Wagner, Prof. Dr.-Ing. Marco Koch  
 Karlsruhe Institute of Technology (KIT), Departments: Building Lifecycle Management and Institute for Industrial Production  
 Institute for Future Studies and Technology Assessment (IZT), Berlin  
 Beratungs- und Servicegesellschaft Umwelt mbH B.&S.U., Berlin



Prof. Dr.-Ing. Marco K. Koch

LEE

#### PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

**Project:** October 2011 – September 2016

**Costs:** 1.545 mio. Euro

**Funding:** Federal Ministry of Education and Research (BMBF)

#### PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

By analysing and evaluating the projects of the five participating cities, energy efficiency concepts can be transferred to other interested cities all over Europe. At the same time, new fields of action and new options for further research will be identified.



Prof. Dr.-Ing. Hermann-Josef Wagner

LEE



6.1 DESIGN QUALITY FOR PPP PROJECTS

**ABSTRACT**

Public Private Partnerships (PPP) enable the construction of public buildings of outstanding quality. However, such partnerships do not automatically lead to better quality. The central focus of this research project was to identify which instruments and measures ensure a consistently higher quality in public-sector buildings.

By cross-evaluation of the processes used to determine quality assurance and feedback from the public authority and users of PPP-sponsored projects, as well as the results of evaluation by the design experts, it was possible to obtain a cause-and-effect relationship between the procedures used and the quality levels achieved.

In conclusion, the project's results have led to policy recommendations for the quality management of procurement processes and the supervision of PPP projects. Moreover, we have come up with suggestions for new procedures for integrating design competitions into the PPP procurement process, underpinned and supported by legal advice.

**LIST OF PARTICIPANTS**

**Client:** Federal Ministry for Transportation, Building and Urban Development  
**Partner:** IfS, Institut für Stadtforschung und Strukturpolitik, Berlin

**PROJECT START, DURATION AND FUNDING**

**Project:** August 2011 - November 2011  
**Costs:** 140,000 Euro  
**Funding:** Federal Ministry for Transportation, Building and Urban Development

**PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL**

Development of a standardised system to evaluate the design quality of public buildings. Development of policy recommendations for the quality management of the procurement process and the supervision of PPP projects.



The Research Report

BMVBS

6.2 **COLOGNE SMART CITY 2022**  
**SUSTAINABLE BRANDSCAPE NRW**

**ABSTRACT**

By the year 2022, Germany will have finished its energy turnaround ("Energiewende"), i.e. its exit from nuclear power. Energy supply in Germany is consequently undergoing a rapid change from traditional top-down to decentralised, more "democratic" systems, in which the single elements of production, consumption, and energy storage are connected by a "smart grid". Our research team of architects, urban planners and material experts is investigating what effects these structural changes will have on the built-up environment in a mid-term range. Its focus is on North Rhine-Westphalia, with emphasis on the City of Cologne as a model for other metropolitan centres in Germany and Europe.

Based on a broad analysis of international best practice solutions, a spectrum of project ideas is being developed for the City of Cologne. These ideas will eventually be turned into a "toolbox", which can be applied to other cities and urban environments. Crucially, this approach will not look at just a single segment of an energy-related urban transformation process – such as e-mobility, new storage systems, etc. – but it will also seek to understand the complex relationships between all the elements.

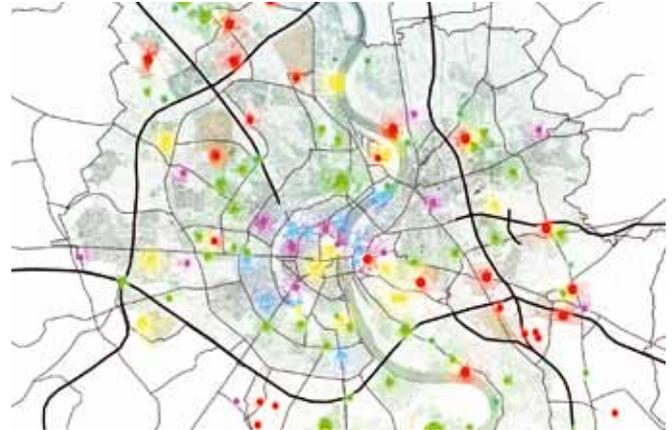
The research is aimed at finding smart, integral solutions to redefine parts of the urban fabric. In particular, city areas that are degraded, undergoing change or redevelopment might benefit from this approach.

**LIST OF PARTICIPANTS**

Cologne University of Applied Sciences,  
Faculty of Architecture, Prof. Jochen Siegemund,  
Andrea Dung, Dietmar Köring, Lena Hocke, Jan Schulz,  
Katrin Hanses, Sabina Priese, Nadja Reisen, Jochen Robert  
Bayer MaterialScience AG, CD-NB-Creative Centre,  
Dr. Lorenz Kramer, Leverkusen

**PROJECT START, DURATION AND FUNDING**

**Project:** July 2011 – March 2012  
**Costs:** 116,824 Euro  
**Funding:** 89,824 Euro NRW Ziel 2-Programm:  
"Transfer NRW: FH-EXTRA"  
15,000 Euro Bayer MaterialScience AG  
12,000 Euro Cologne University of Applied Sciences



*Potentials for energy-related transformation processes in the City of Cologne*

*Research Centre Corporate Architecture*

**PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL**

The "toolbox" represents a catalogue of planning methods and ideas, which can be applied to energy-related urban transformations in Europe and world wide. This approach also implies that customized solutions will be sought according to the respective local parameters and conditions.

Being able to transfer the results of this research to an international context is of special interest to the project partner, Bayer Material Science. As a global venture, Bayer is hoping to gain valuable insights for future decision making in the field of material science and product development. Therefore, the collaboration and knowledge exchange between Bayer and the Corporate Architecture Research Centre at the Cologne University of Applied Sciences will be extended beyond the current project phase. Furthermore, a collaborative network is being founded with other research initiatives in Germany and the EU working on similar tasks.

6.3 MAXIMISING RENEWABLE POWER SOURCES IN DISTRIBUTION GRIDS  
APPLICATION OF INNOVATIVE SMART GRID TECHNOLOGIES

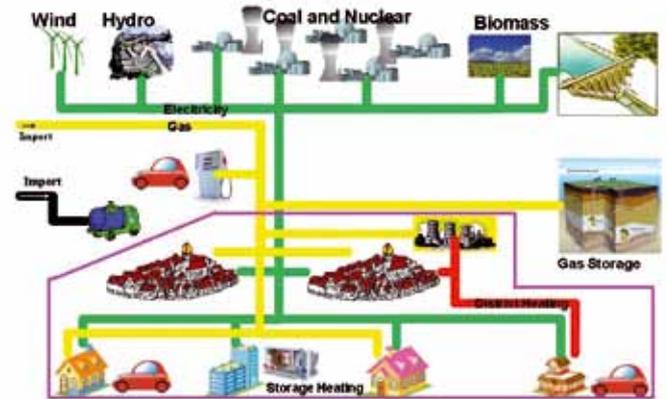
ABSTRACT

A combination of factors will have a substantial influence on the load profiles of distribution grids, especially the low-voltage grid, up to reverse load flows. These include shortages of fossil and nuclear resources, climate change associated with emissions from these energy sources, changes in the regulatory environment (with increased requirements for data management) together with rising energy prices, and society's desire to use more renewable energy.

The legal obligation to employ "Smart Metering" in the medium-term represents the basis for controlling an increasingly volatile and decentralised power generating structure. For example, matching load and power generation can be achieved by the application of "time-variable electricity pricing" that encourages customers to load their shifting activities.

Unlike photovoltaic systems, with increased feed into low voltage grids, the trend towards heat pump systems causes an increased grid load in the electricity distribution grid. By storing energy, the load profile of the distribution grid can be influenced. Thermal storage is being considered in connection with heat pumps, or combined heat and power systems, while batteries are associated with electric mobility.

The project will provide answers and strategies about the degree to which renewable energies can be integrated into distribution grids, as well as the maximisation of grid usage when taking into account the trends mentioned above. In addition, different distribution grid configurations are examined (primarily low voltage grid configurations) using existing and newly developed simulation tools. The consequences of these trends for the gas and district heating grids are also examined. The project will provide suggestions for the adjustment of a new incentive regulation, taking account of the increasing tasks that have to be fulfilled within distribution grids.



Prof. Dr. habil. Ingo Stadler

LIST OF PARTNERS

Cologne University of Applied Sciences, Institute of Electrical Power Engineering (IET), Prof. Dr. Ingo Stadler  
Rheinenergie AG, Cologne

PROJECT START, DURATION AND FUNDING

Project: May 2011 – April 2014  
Costs: 210,000 Euro  
Funding: Rheinenergie AG, Cologne

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

Investigation of distribution grids throughout Europe and the consequent development of smart grid applications.

6.4 **BALANCING FLUCTUATING RENEWABLE POWER THROUGH COMBINED HEAT AND POWER WITH THERMAL ENERGY STORAGE**

**ABSTRACT**

Germany has decided to cover its future energy supply from renewable sources. However, renewable energies are not constant in their supply, therefore their integration as a basic component of the electricity supply system requires an increase in operating reserves to help maintain a stable, balanced energy supply. Completely new load flow situations are going to appear in an electricity grid that was originally built for a centralised electricity supply.

This research project aims at integrating decentralised generating plants, like combined heat and power (CHP) plants, into our present power system, while allowing for a big proportion of fluctuating renewable energies. The periodic heat demand and variable in-feed of CHP-generated energy can be handled by setting up thermal energy storage that decouples the production of electricity and heat. Therefore, decentralised CHP plants could make a substantial contribution to the future functioning of the power supply.

At present, the power supply must follow the load. This means that the overall capacity of power plants must directly correspond to the peak load level, even though the operational demand is temporary. Storage systems that are charged during low-load periods and discharged in peak-load periods could be profitably used to decouple production and consumption. The project partners will design a solution to be tested in three pilot plants. These decentralised CHP plants can be integrated into the electricity market and into the energy management of a future power supply system. The project is divided into the following three parts.

- Design and development of a communication link for the CHP-storage combination together with management algorithms and optimisation software, such that plant and storage management can react flexibly to the needs of the electricity supply system and electricity market.
- Planning, implementation, and testing of three pilot plants, each with a CHP plant, thermal storage, and corresponding communication technology. All plants will be integrated into the portfolio of a power trader.
- Finally, examination of the potential of this concept for the German power supply system and its competitive performance compared to the conventional supply structure of operating reserve and balanced energy supply.

**LIST OF PARTICIPANTS**

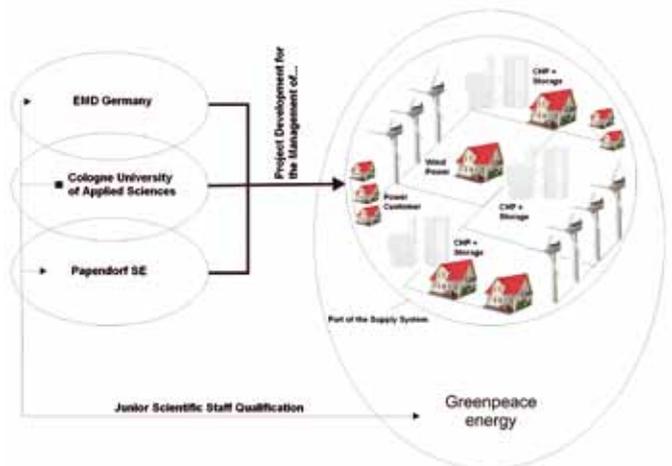
Cologne University of Applied Sciences, Institute of Electrical Power Engineering (IET), Prof. Dr. Ingo Stadler  
 EMD Germany GbR, Kassel  
 Greenpeace Energy eG, Hamburg  
 Papendorf Software Engineering GmbH, Calw  
 Fraunhofer Institute for Wind Energy and Energy System Technology (IWES), Kassel  
 University of Kassel

**PROJECT START AND DURATION, TOTAL COSTS AND FUNDING**

Project: July 2009 - June 2012  
 Costs: 253,081 Euro

**PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL**

Investigation of supply and optimised strategies for distributed generation in smart grid topologies on the national and EU levels.



Prof. Dr. habil. Ingo Stadler

## 7.1 MEGACITIES – MEGACHALLENGE

### INFORMAL DYNAMICS OF GLOBAL CHANGE

#### ABSTRACT

The project focuses on the informal aspects of megacities, mega-urbanisation, and their complex links to processes of global change. The principal objectives are:

- reconceptualising "informality", deepening the understanding of informal institutions and processes, and their relevance for mega-urban dynamics;
- further development of theoretical concepts, models and scenarios leading to a better understanding of interconnected processes and dynamics at the local, mega-urban and global levels.

These objectives are pursued in four thematic core topics:

- loss of planning control and governability and the influence of new forms of government,
- dominance and differentiation of urban economies,
- complexity and dynamics of material and resource flows,
- multilayered dynamics of settlement development.

The programme focuses on two mega-urban areas: Dhaka in Bangladesh and the Pearl River Delta in China (Guangzhou, Shenzhen, Hong Kong) and consists of ten individual projects, each of them closely cooperating with research partners in the respective regions. The topics cover areas such as: changing and hybrid (formal-informal) modes of urban and regional government; links in the urban water flow system, informal growth and steering mechanisms; links between internal and international migration, urban health and health management; satellite-based mapping of aerosols over megacities and the implications of aerosol pollution for urban health; production of new types of peri-urban landscapes and their dynamics; hybrid and changing institutional setups of value chains and innovative regional government; identifying interfaces in social regulation and statutory planning; mega-urban food supply and distribution systems; mega-urban economics and production, pollution and urban health; the resilience of the urban poor faced with climate-change induced flooding.

The project follows a dedicated transdisciplinary and multi-sectorial approach, with special focus on the interfaces and interactions between the diverse urban subsystems.

#### LIST OF PARTNERS

Overall programme and list of German partners:  
[www.megacities-megachallenge.org](http://www.megacities-megachallenge.org)

#### China:

Sun Yat-Sen University, Guangzhou: School of Geographical Sciences and Planning, Department of Anthropology, Department of Medical Statistics and Epidemiology  
 Beijing University  
 Chinese Academy of Sciences,  
 Institute of Remote Sensing Applications  
 Guangdong University of Technology, Faculty of Construction

**CONTACT:** Institute of Geography, Prof. Dr. Frauke Kraas

Hong Kong University, Centre of Urban Planning and Environmental Management

Polytechnical University of Hong Kong,  
 Department of Building and Real Estate

#### Bangladesh:

University of Dhaka, Department of Geography and Environment,  
 Department of Economics

Bangladesh University of Engineering and Technology,  
 Department of Urban and Regional Planning

Jahangirnagar University, Department of Geography and Environment

Rajshahi University, Department of Geography and Environmental Studies

Centre of Urban Studies, Dhaka

#### PROJECT START, DURATION AND FUNDING

**Project:** 2007 – 2013

**Costs:** 6.5 mio. Euro

**Funding:** German Research Foundation (DFG)

#### PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

##### Programme level:

■ Informal aspects of urban and regional development and management: recent statistics also show an increase in the so-called "informal economy" in OECD countries; it would be worth applying the insights and methodological knowledge gained from the advanced conceptualisations of "informality" in the SPP to analyse the characteristics, underlying drivers, and trends for informal processes in Europe.

■ Integrating global change research with urban and regional development: development processes on regional and urban level in Europe are as much connected to global change dynamics as they are in megacities in developing countries; understanding the complex, multilayered nature of these connections could be further improved in the future.

##### Project level:

■ A number of topics emerged during the programme's implementation e.g. improvements in sensor technology for assessing the level of atmospheric urban aerosol pollution (and the resulting disease burden), flexible hybrid modes of urban and regional planning combined with regional innovation; the complex (socio-political-technical) nature of the transition process in health-care systems; the dynamics of global production networks and shifts in decision-making power towards China and/or other regions; options and potentials for advanced participation in urban management and planning, including non-statutory mechanisms and regulation within overall planning frameworks.

## 7.2 GOVERNING EMERGING MEGACITIES

### TOWARDS A BETTER QUALITY OF LIFE IN THE PEARL RIVER DELTA AND PUNE

#### ABSTRACT

The Governing Emerging Megacities project focused on management issues in the emerging megacity Pune (India) and the densely urbanised Pearl River Delta Region (China) using a holistic, interdisciplinary approach. Within their national contexts, the two selected regions are hotspots of urbanisation. Comparing these regions using a tri-lateral approach was a challenging task since the political systems and their planning and management philosophies differ fundamentally. The project aimed at identifying research questions and study designs from the project's three core themes of water, health, and housing related to governance as an overarching topic.

Several small-scale studies were undertaken in the two research regions. The findings of these studies were discussed at several workshops during the funding phase. On this basis, the project consortium developed a future research agenda for the three main research topics. As funding was only available for the initial project phase, this research agenda has been taken up by several follow-up projects in both regions.

#### LIST OF PARTICIPANTS

University of Cologne, Institute of Geography, Prof. Dr. Frauke Kraas  
 Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ, former InWEnt) Servicestelle Kommunen in der einen Welt  
 TU Berlin University, Prof. Dr. Peter Herrle  
 University of Hannover, Prof. Dr. Monika Sester  
 Helmholtz-Centre for Environmental Research UFZ, Leipzig  
 Bharati Vidyapeet University, Pune Institute for Environment Education and Research  
 Sun Yat-Sen University, Guangzhou

#### PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: 2005 – 2008  
 Costs: 290,000 Euro  
 Funding: Federal Ministry for Education and Research (BMBF)

#### PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

The project was one of the first attempts to address management of mega-urban regions in a holistic way. It opened up new perspectives on specific mega-urban management issues, which were followed up in several projects: urban health issues (burden of health, mega-urban health systems), development of mega-urban fringes, ecosystem services in mega-urban regions, water supply for growing agglomerations, mega-urban food supply systems, management of complex systems, risk management in megacities).



Hong Kong (Pearl-River-Delta) Prof. Dr. Frauke Kraas



Prof. Dr. Frauke Kraas

**CONTACT:** Institute of Geography, Prof. Dr. Frauke Kraas

### 7.3 URBAN HEALTH IN PUNE (INDIA)



Water supply in Pune

Prof. Dr. Frauke Kraas

Based on these findings, several options for the improvement of the situation in Pune have been developed. Currently it is planned to assist local actors in implementing a health monitoring system for the Pune region.

#### LIST OF PARTICIPANTS

University of Cologne, Institute of Geography, Prof. Dr. Frauke Kraas  
 Bharati Vidyapeet University, Pune Institute for  
 Environment Education and Research

#### PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

The project started in 2007 and is partially funded by the German Research Foundation (DFG).

#### PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

Urban health as a research topic has been neglected in the developing countries over the last decades. This project showed that the focus on rural health issues hinders the implementation of sustainable health measures in the fast-growing agglomerations, which will be the main future habitats in these countries. Research is needed to generate a solid informed basis about the health status of urban populations in the developing world. Furthermore, access to health care is a major issue: both financial limitations and lack of knowledge are the principal barriers for access to the existing health infrastructure. Applied research needs to assist in the development of funding schemes to ensure equitable access.

#### ABSTRACT

The aim of the research project is to analyse how human health in mega-urban areas is affected by global change. It combines ecological disease and health system perspectives of urban health. The findings of these two approaches will be utilised to investigate health management processes and their implication for different population groups within a megacity. The project will have implications for a better understanding of mega-urban health.

In a series of household surveys in Pune, India, the project analysed the disease burden in different neighbourhoods of this fragmented megacity. This main method was supplemented by expert and in-depth interviews, mapping, and analysis of secondary data. This data was used for analysing differences in access to health care services and in the health status of different socioeconomic groups.



## 7.4 MEGACITY

### ZOOM FOR THE ENVIRONMENT (CITYZEN)

#### ABSTRACT

The main objectives of the project are to:

Quantify and understand the current distribution and development of air pollution in and around selected megacities/hot spot regions, including interactions at different scales.

Estimate the future impact of emission changes with a focus on the effect of rapid population growth in megacities/hot spots and the increasing background of pollutants (in particular, ozone (O<sub>3</sub>), particulate matter (PM), and their precursors).

Assess how megacities/hot spots influence climate change.

Estimate how megacities respond to climate forcing, which can influence transport patterns, chemical oxidation and biogenic emissions (especially biogenic volatile organic compounds (BVOC)).

Study mitigation options, e.g. by introducing biofuel, to keep the air pollution load in and around megacities/hot spots within sustainable limits in terms of human health effects and climate impact.

Develop tools to estimate interactions at different scales (megacities to global).

Bring to semi-operational use the scientific results and methods developed and applied during the course of the project, working on a more permanent basis with consortium partners.

Provide technical support for policy work, that is, ensure an excellent return on the project investment, during and subsequent to its operation.

#### LIST OF PARTICIPANTS

University of Cologne, Rhenish Institute for Environmental Research (RIU)

University of Bremen

Forschungszentrum Jülich GmbH, Jülich

The Norwegian Meteorological Institute, Norway

Centre National de la Recherche Scientifique (CNRS), France

Institut National de l'Environnement Industriel et des Risques (INERIS), France

University of Crete, Greece

Consiglio Nazionale Delle Ricerche (National Research Council), Italy

Norwegian Institute for Air Research, Norway

University of Oslo, Norway

Institute of Marine Sciences-Middle East Technical University, Turkey

University of Leicester, UK

International Institute for Applied Systems Analysis, Austria

National Observatory of Athens, Greece

#### PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: September 2008 – August 2011

Costs: 3,959,272 Euro

Funding: 200,000 Euro for RIU

#### PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

Participation in the EU FP7 project: FP7-ENERGY-SMARTCITIES-2012



## 8.1 IMPROVING QUALITY OF LIFE FOR OLDER PEOPLE IN SOCIAL SPACES



*World Café: elderly people discussing improvement strategies*

### ABSTRACT

This three-year long, practical research project, entitled "Self-determined ageing in the Ruhr area: Quality of life for older people in social spaces – ways to ensure individual participation, to strengthen responsibility, and to set up supportive infrastructures" focuses on an exploration of approaches for improving the quality of life of older people in the Ruhr Area. The basic hypothesis of the project is that the quality of life in old age depends on the extent and scope of individual participation and control over one's own living conditions. Due to the paradigm shift in social gerontology, the project believes that ageing is not just a detrimental process, but that it also provides new opportunities.

In order to check the validity of this hypothesis, measures to improve the quality of life will be developed by the elderly people themselves with the help of local city groups. An extensive survey of the quality of life in their residential areas (42% response rate) has already been accomplished. One outcome is that the senior citizens have already formed five working groups based on the topics: "security and cleanliness", "housing and residential environment", "mobility and road safety", "living together in our community" and "public relations". The reference area is a typical residential quarter of the Ruhr area (Schalke). This is to ensure that the results are at least transferable to other cities in the Ruhr area.

### LIST OF PARTICIPANTS

- City of Gelsenkirchen – Strategy Manager for Gelsenkirchen's Plan for Older People, Gelsenkirchen
- GE Network for Older People, Gelsenkirchen
- Vivawest Wohnen GmbH (housing association), Gelsenkirchen
- Older People's Advocacy Organisation in NRW, Münster
- Educational Gerontology research institute (FoGera e.V.), Witten
- University of Applied Sciences and Arts Dortmund, research sector "Design and Construction in Structural Change"

### PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

**Project:** May 2010 – April 2013

**Costs:** 260,000 Euro

**Funding:** Federal Ministry for Education and Research (BMBF), funding line „Social Innovation for Quality of Life in Old Age (SILQUA-FH)“

### PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

Europe is currently facing a demographic challenge that is characterised by demographic decline, low birth rates, and an ageing society. Upto 2030, the segment of the European population aged 60 years and older will grow by an average of 2 million every year. This development has a considerable impact on economic and social policies but is also an opportunity which can be utilised (politically). Under these conditions, the Ruhr area might be considered an exemplary European region. Its demographic development is already advanced. Hence the Ruhr area could serve as a model region for comparable urban agglomerations in Europe.



*LiW project conference  
"Schalke – a good place to live"*

*Andreas Weiss (2)*

## 8.2 THE UTILISATION OF ARTIFICIAL LIGHT IN PUBLIC SPACES

### AN INTEGRATED APPROACH TO CITY PLANNING



*The inner city of Dortmund at night*

#### ABSTRACT

The need for cities to develop in a sustainable way includes improvements to the lighting of public spaces during darkness. Socio-spatial demands, environmental conditions, economic efficiency, and design quality are playing increasing roles in artificial lighting. Purposeful integration of city lights into urban spaces can contribute to several dimensions of sustainability by balancing decreases in energy consumption and environmental pollution against the creation of atmospheric spaces and nocturnal qualities.

Many aspects need to be dealt with, e.g. reduction of running costs, light pollution, and CO<sub>2</sub>-emissions, while at the same time resolving so-called 'spots of anxiety' within the city. However city lights are planned and installed by different public and private stakeholders, each with its own intentions and purposes. Lack of control measures, guiding principles and tools within the local administration result, for example, in the installation of overlapping and competing lights.

Over the last two decades, municipalities have been using 'Lighting Master Plans' formulated by architects, urban planners and/or lighting designers in order to regulate city lighting. However it appears that this instrument has attained its position without critical analysis, or any further reflection or qualification. Frequently, it is only after the lighting strategies have been installed that on-site inspections discover the "weak spots". This is because of a lack of methodically proven knowledge about city utilisation, orientation or perception in urban spaces at night.

There are very few approaches for developing an applicable concept that describes the character of nocturnal cityscapes both in their social (or functional) dimensions and in their ecological conditions. There is a need to develop better "Lighting Master Plans" with a stronger theoretical basis in which lighting design follows a spatial urban planning scheme. The research unit "Light\_Space" was set up in 2006 at Dortmund University of Applied Sciences. Within its various projects, including municipal commissions, the

above-mentioned gaps in knowledge have been simultaneously addressed through basic research, planning practice, and on-site evaluation. To supply support for community bodies to act intentionally regarding city lighting, the multidisciplinary team of the "Light\_Space" research unit – interacting with a wide ranging network of NGO's, NPO's, companies and universities – takes into account all the relevant aspects of sustainable lighting.

#### LIST OF PARTICIPANTS

##### Project 1:

Dortmunder Energie- und Wasserversorgung GmbH (DEW 21)  
 City of Dortmund, Depts. of Civil Engineering and Urban Planning  
 Lichttechnische Gesellschaft des Ruhrgebiets (LTGR), Dortmund  
 Professional Lighting Designers' Association (PLDA), Gütersloh  
 Ruhr University Bochum, Workgroup for Environmental  
 Psychology & Cognition

Tokyo Institute of Technology,  
 Department of Built Environment, Japan

##### Project 2:

City of Castrop-Rauxel, Public Utility and  
 Dept. of City Development

##### Project 3:

City of Lüdenscheid, Dept. of Urban Planning

##### Project 4:

RWE AG – Energy Foundation  
 Regional Association Ruhr (RVR)

#### PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project 1: 2009-2011, 150,000 Euro (DEW21 & Ministry of  
 Innovation, Science, Research and Technology of NRW)

Project 2: 2010-2011, 100,000 Euro (City of Castrop-Rauxel)

Project 3: 2009-2010, 70,000 Euro (City of Lüdenscheid)

Project 4: 2009-2010, 33,000 Euro (Dortmund University of  
 Applied Sciences, RWE AG – Energy Foundation)

#### PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

The strategic use of artificial light in a nocturnal city contributes substantially to the sustainable development of our society. Integrated planning of artificial light in the urban context that takes account of the spatial structure of the city and its internalised social processes has immense potential for creating urban spaces that all inhabitants consider worthwhile living in. But a holistic strategy of integrated lighting plans still needs to be developed. Future perspectives include expansion of our international contacts to apply for European research projects, establishing educational programs, and publishing our experience internationally.

### 8.3 EMIGMA

#### EMPOWERMENT OF MIGRANTS FOR CLIMATE PROTECTION

##### ABSTRACT

Climate change brings about great socio-ecological problems for people to deal with. Thus, it is desirable to support the concept of sustainability in the population, to initiate changes in peoples' behaviour and to provide the necessary knowledge and skills.

Taking into account that almost a fifth (18.7%) of the German population has a migrant background, this potential needs to be promoted by our society more than ever. The topic of migration is a contemporary social issue, particularly since the Immigration Act of 2005. Integration policy is predominantly aimed at topics such as education, religion, problems of adaptation, assimilation or acculturation. The topic of environmental and climate protection has not yet been considered. However, a commitment to climate and environmental protection could represent a significant component in migrant integration.

There are few solid empirical findings on the attitude or behaviour of migrants relating to the environment, nor on their civic commitment to climate and environmental protection. But these studies do show that knowledge about the environment, environmental and climate protection is less pronounced among migrants than in the general German population. Assuming that this results from differences in their living situations, socio-cultural awareness, and the evaluation patterns of migrants, other forms of communication and intervention measures might be necessary. Such intervention measures will need to be specifically adapted to the target groups, whereby both the heterogeneity of the migrant sub-groups and the respective context of the environmental problems (mobility, nutrition, energy) should be taken into account. A close cooperation with communal stakeholders and migrant and environmental protection organisations is therefore essential.



*Project Team of University of Applied Sciences and Arts Dortmund and Ifeu-Institute together with representatives from migration and environmental organisations*

*Prof. Dr. Helmut Diederichs*

##### Project goals

Gather information on the environmental behaviour and attitudes of Turkish-speaking and Russian-speaking migrants with 800 standardised interviews each. These are related to the three environmental action fields: mobility, nutrition, and energy consumption, in four federal regions: North Rhine-Westphalia (Dortmund), Berlin, Bavaria (Munich/Augsburg) and Baden-Württemberg. Additionally a random

sample for comparison will be taken in North Rhine-Westphalia (Dortmund) where 400 citizens of German origin will be interviewed. Prepare individual behaviour-related carbon footprint sheets leading towards a language adaptation of the instrument (CO<sub>2</sub> calculator).

Develop target group-specific intervention measures which strengthen the commitment of Russian- and Turkish-speaking migrants towards climate protection. At the same time, in close cooperation with existing networks and migrant initiatives, social diffusion processes should be initiated and the work of the networks extended and professionalised.

Derive recommendations for measures relating to integration policy which are aimed at supporting theories for sustainability in integration policy and courses.

##### LIST OF PARTICIPANTS

###### Partners:

Dortmund University of Applied Sciences and Arts  
 Institute for Energy and Environmental Research (IFEU), Heidelberg

###### Network:

Turkish-German Environment Centre Berlin  
 Friends of the Earth (BUND) Berlin e.V., Yesil Çember  
 Association of Socio-Cultural Migrant Organisations Dortmund e.V. (VMDO)  
 Tangere - Society for Intercultural Cooperation e.V., Berlin  
 Migrants for Agenda 21 e.V.

##### PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

**Project:** September 2010 - August 2013

**Costs:** 687,072 Euro

**Funding:** Federal Ministry of Education and Research (BMBF)  
 FONa Social Ecological Research

##### PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

The research problem at hand is a contemporary issue not only for Germany, but for Europe in general. Research on migrant minorities, their different living situations and the socio-cultural awareness and evaluation patterns of migrants in relation to the mobility, nutrition and energy consumption in other European countries appears promising. For many European countries, these problems of environmental protection and the integration of migrants are of great importance. In our research, two major foreign speaking migrant minorities in Germany are investigated in relation to the environmental problematic. The information we gather, compare and evaluate could help to derive recommendations for measures relating to integration and environmental policy.

## 9.1 HISTORICAL PRESERVATION AND DESIGN STRATEGIES

### TOWNSCAPES BETWEEN CONSERVATION AND URBAN DEVELOPMENT

#### ABSTRACT

Some townscapes are considered worth preserving for their overall historical urban structure – a view that has been included in heritage preservation policy since at least the early 20<sup>th</sup> century, with prominent efforts such as the "Heimatschutz" movement.

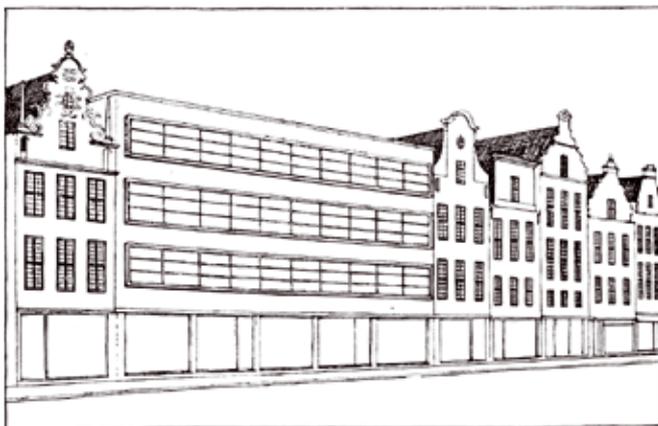
This approach eventually leads to a conflict between protecting the individual objects – whose pivotal value is often its substance with respect to the care of monuments and works of art – in a historical urban context, and the contemporary needs of urban development. Consequently, contemporary town planning practice is often characterised by the contradicting views of architects and urban planners who wish, on the one hand, to reshape and rebuild the city, and conservationists, on the other, who seek to safeguard specific aspects of the historical townscape. The structure of public authorities deepens this segregation, since institutions for the conservation of monuments and historical buildings are state-run, while building authorities, planning commissions, or citizens' initiatives, are at the municipal level. An intermediate step is often missing.

Within the Collaborative Research Project "Heritage- Values – Dialogue. Rethinking Conservation Theory and Practice" this project will strive to provide answers to questions posed by politicians, society and scientists, regarding the purpose and ideal values of heritage conservation at the level of urban planning strategies, thereby developing a critical reappraisal of conservation guidelines and their interrelationships. The project will not only communicate divergent professional positions and priorities, but also seek to interpret the priorities for monument conservation in society and reinterpret social demands for conservation practice.

#### LIST OF PARTICIPANTS

Working on the particular project as described above:

TU Dortmund University, Prof. Dr. Wolfgang Sonne,  
Dr.-Ing. Silke Haps



*Plan for a department store in the Langgasse, one of the most notable tourist attractions of Danzig (Poland)*

#### Cooperation partners of the particular project:

Swiss Federal Institute of Technology Zurich,  
Institute for the History and Theory of Architecture (gta),  
Prof. Dr. Vittorio Magnago Lampugnani,  
Dr. Konstanze Sylva Domhardt

University of Edinburgh, College of Art,  
Scottish Centre for Conservation Studies and  
Reader in Architecture, Dr. Miles Glendinning

#### Research Team of the Collaborative Research Project:

Bauhaus University Weimar, Prof. Dr. Hans-Rudolf Meier,  
Dominique Fliegler M.A., M.Sc., Johannes Warda M.A.

TU Dresden, Dr. Ingrid Scheurmann,  
Dr. sc. Stephanie Warnke, Anke Binnewerg M.Sc.

Archaeology and Conservation Authority of Saxony-Anhalt,  
Dr. Ulrike Wendland, Dipl.-Ing. (FH) Susanne Thiele M.Sc.

#### PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: April 2009 – June 2012

Costs: 251,635 Euro

Funding: Federal Ministry of Education and Research (BMBF)

#### PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

The project proposes the creation of an online-database, enabling users to investigate the meaning and genesis of terms and definitions related to the values of monument conservation. Further approaches at the EU level are in progress.



*New plan considering the historic buildings along the boulevard*

*From: Denkmalpflege und Heimatschutz 31, 1929, p. 38*

## 9.2 EIBURS PROGRAMME

### URBAN DEVELOPMENT FUNDS IN EUROPE

#### ABSTRACT

The research programme focuses on the JESSICA initiative of the European Commission and its implementation by the EU Member States. JESSICA means "Joint European Support for Sustainable Investments in City Areas" and supports the use of equity, loans and guarantees in addition to the common use of grants in EU funding of sustainable urban development (mostly ERDF funding).

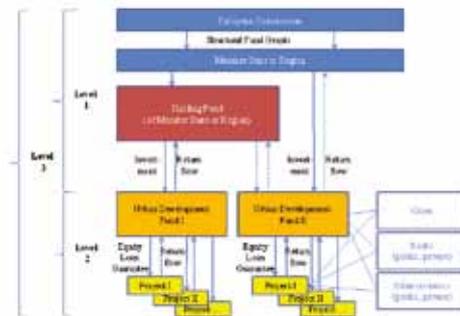
Our research approach is at both the macroeconomic and microeconomic levels. The macroeconomic approach ("Level 1") presents the perspective of the EU Member States, including the managing authorities, and the capital markets for urban finance. We intend to analyse different organisational models for holding funds, before applying Modern Portfolio Theory and Transaction Cost Theory and adapting it to the special tasks of a JESSICA-Holding Fund. The second focus is at the microeconomic level ("Level 2") and includes the perspective of the city and local authorities. From a financial viewpoint, the urban development fund is the main topic of research. Finally, Research Levels 1 and 2 merge into Level 3 to establish conclusions regarding the overall added value of JESSICA. Level 3 analysis therefore combines the macroeconomic efficiency at Level 1 with the sustainability analysis concerning integrated urban development at Level 2.

#### LIST OF PARTICIPANTS

TU Dortmund University, Chair of Real Estate Development (IMMO),  
Prof. Dr. Michael Nadler (Coordinator)

RWTH Aachen University, Chair of Corporate Finance,  
Prof. Dr. Wolfgang Breuer

European Investment Bank,  
Economic Adviser Gianni Carbonaro, Luxembourg



Level 1 = Macroeconomic Level

Level 2 = Microeconomic Level

Level 3 = Combining Level 1 and 2 to the "Added Value" of JESSICA and bridging the gap to political decision makers by networking

#### PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: October 2011 – September 2011

Costs: 300,000 Euro

Funding: European Investment Bank (EIB)

#### PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

Establishment of equity, loans and guarantees as funding instruments for sustainable development.

Efficient use of EU funding, revolving use of funding and thus higher leverage effects.

Better achievement of sustainability goals.

Monitoring of funded sustainable urban development projects.

### 9.3 GRID4EU

#### ADVANCED SMART GRID SOLUTIONS FOR EUROPE

##### ABSTRACT

Grid4EU (Large-Scale Demonstration of Advanced Smart Grid Solutions with wide Replication and Scalability Potential for Europe) is an innovative SmartGrid project proposed by a group of electricity Distribution System Operators (from the Czech Republic, France, Germany, Italy, Spain and Sweden), operating in close partnership with a set of electricity retailers, manufacturers and research organisations. Adopting a systemic approach organised around large-scale demonstration networks, located in six different countries, its structure is built to facilitate dynamic knowledge sharing, technical assistance and review.



Grid4EU aims to test, at full-scale, some innovative system concepts and technologies in order to highlight and help to remove some of the barriers to the deployment of smart grids and the achievement of the 2020 European goals. These barriers may be of a technical, economic, social, environmental or regulatory nature.

It focuses on how Distribution System Operators can dynamically manage electricity supply and demand, which is crucial for integration of large amounts of renewable energy, and empowers consumers to become active participants in their energy choices. Ultimately, these innovative concepts and technologies should cost-effectively increase the network's reliability, flexibility, and resilience.

The project is structured in 6 Demonstration Parts. TU Dortmund University is active in Demo1. It will demonstrate that European medium voltage networks can employ the concept of autonomous, self-organising nodes to serve the needs of both the Distribution System Operators and the served clients.

An increased integration of distributed renewable energy is expected, requiring the provision in the medium-term of advanced network surveillance and network control at the medium voltage level. In Demo 1, an alternative, cost-efficient approach should be pursued in the classical enhancement of the networks and a full-value SCADA-system. The approach of regional network automation in medium voltage grids can also be used to optimise an existing network control system. The necessary central decisions and tasks can be reduced significantly because the local agents can solve problems in the network on site: "Regional tasks need regional decisions". The demonstration to be held in Germany (North-Rhine-Westphalia region) requires upgrading a medium voltage network to make it significant enough to prepare scaling-up and replication by RWE and other European regions.

##### LIST OF PARTICIPANTS

Électricité Réseau Distribution France (ERDF), Paris, France (Coordinator) and 27 partners

##### PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: November 2011 – November 2015

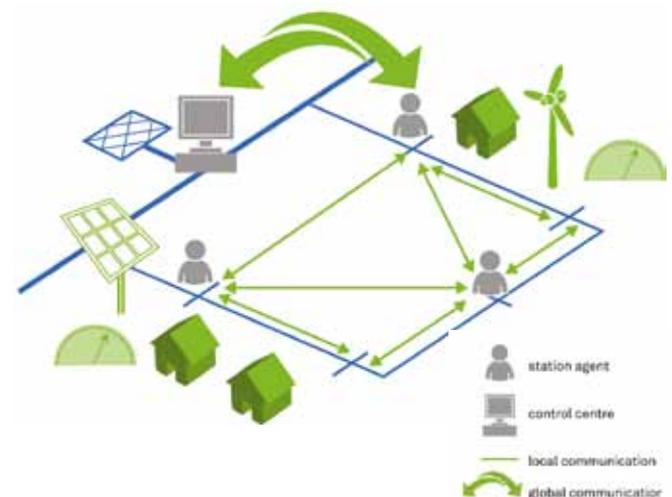
Costs: 53.751 mio. Euro

Funding: 25.558 mio. Euro by the European Union

##### PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

The targets for a mostly renewable electricity system can only be reached by strengthening the power grids throughout Europe. The grids are a key factor for balancing the fluctuations in renewable energies. In the future, the European power system will be extended to neighbouring countries like the Baltic States, Northern Africa, or even Russia. New network structures, like overlay grids, and new technologies for electricity transmission, like HVDC, must be integrated into an overall system concept. Beside the transmission grid, all grid levels down to the end customer in the cities have to be investigated. Distribution grids have to incorporate distributed renewable sources while balancing power demand management and storage mechanisms. All concepts require a European perspective for the large interconnected power system integrating all voltage levels, all kinds of energy generation, from offshore wind farms down to distributed renewable generators in households, and all types of demand side management and customer involvement.

Such overall system concepts and new grid structures for a future renewable energy system are the research focus of the ie3 – Institute of Energy Systems, Energy Efficiency and Energy Economics at the TU Dortmund University.



## 9.4 EFFICIENCY IN LOGISTICS FACILITIES



Case of application for the  
EcoSiteManager

Zoran Miodrag

### ABSTRACT

In recent years, logistics infrastructure has reached the limits of its capacity due to growth in shipment volumes. In many places there are bottlenecks in the supply of urban areas or superior supply-chains.

The aim of the project is to improve the output of logistics facilities within the network of supply-chain by developing a prototypical software called "EcoSiteManager - ESM". It will be developed for terminals, distribution centres, and production sites.

Based upon approaches of mathematical optimisation, material flow simulation, and forecasting, new methods will be integrated into a single management control panel for planning, controlling and steering. This will increase the amount of information available, including shipments and their properties in relation to resources and their current status.

The main target of the project is a major reduction in resource consumption by logistics facilities and thus a performance enhancement leading to supply security and emissions reduction.

### LIST OF PARTICIPANTS

DB Mobility Logistics AG

ESG Elektroniksystem- und Logistik GmbH

TU Dortmund University, Institute of Transport Logistics

Kühne + Nagel AG & Co. KG

Logwin Solutions Deutschland GmbH

AMETRAS nobab GmbH, Baienfurt

### PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: June 2010 – May 2013

Costs: 3.65 mio. Euro

Funding: 1.825 mio. Euro by the Federal Ministry  
of Research and Education (BMBF)

The project is part of the "EffizienzCluster LogistikRuhr".

### PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

The future focus will be on transfer of the results to predict and reduce freight traffic as well as emissions especially in urban areas (e.g., in smart city concepts).

## 10.1 IKERS – RENEWABLE MOBILITY

### SMART MOBILITY AND SMART GRIDS BETWEEN CITY AND RURAL AREAS

#### ABSTRACT

Regenerative energy generation, e-mobility, and management of electric flows in smart grids represent a rapid transition to a renewable energy technology and its use for new forms of mobility. Intelligent energy management networks control the power flow between power generators, storage, and consumers, while modern interactive communication systems link individual components. Initial pilot projects suggest a large potential benefit for this process chain.

This potential will be explored further in a pilot area, studying its economic, ecological and social effects, then it will be integrated into the urban environment. Small and medium-sized towns in rural areas have a much higher per-capita potential for renewable electricity, compared to large cities and dense urban areas. Mobility in urban areas is characterised by short distances within the city and heavy commuter traffic. These short distances represent an opportunity for use of electric scooters and pedelecs as alternatives to electric cars.

Taking the city of Dinslaken as an example - a small town between the Ruhr and its surrounding rural area - the individual components and their interconnection will be investigated. The basis of this analysis will be a web and map-based information and service platform. The data from static facilities (such as locations, electricity production sites, charging stations) and mobile devices (smartphones, ICT facilities to e-bikes, electric cars and buses) and the different functions (inform, reserve, pay) can be communicated over the platform. The platform is open to operators of rent services (e-bikes, e-cars), and the local transport authority (NIAG). Even traffic management will have access to this platform.

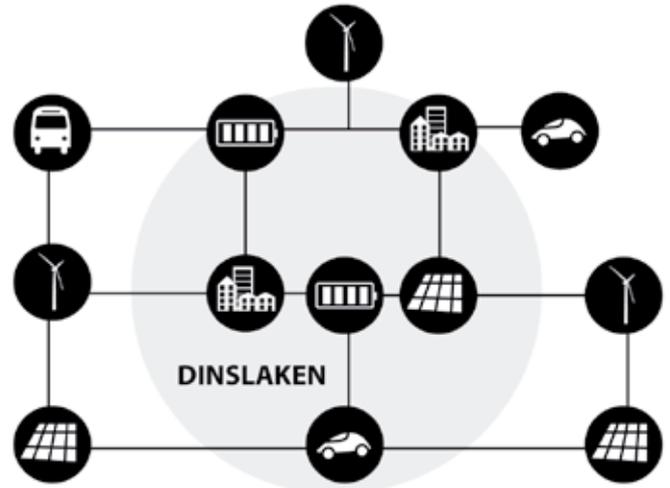
The focus is based on the IKT-platform and the charging, controlling and billing infrastructures for different vehicle types, as well as services and any emerging standards. Another key aspect deals with the city and its development with respect to the evolution of intelligent electricity systems.

#### LIST OF PARTICIPANTS

##### Scientific Partners:

University of Duisburg-Essen

- Centre for Logistics and Traffic
- Institute of City Planning and Urban Design
- European Centre for Ubiquitous Computing and Smart Cities



*Daniel Bläser*

#### Corporate / Business Partners:

Drive-CarSharing GmbH (Drive), Solingen

NEXCOM GmbH (NEXCOM), München

NIAG Niederrheinische Verkehrsbetriebe Aktiengesellschaft, Moers

Stadtwerke Dinslaken GmbH (SD), Dinslaken

TRC Transportation Research and Consulting GmbH (TRC), Essen

#### Associated Partners:

DINAMIT GmbH, Dinslaken

Elspass Autoland GmbH, Dinslaken

Zweirad-Vogel GmbH, Dinslaken

City of Dinslaken

DIN-Service, Dinslaken

#### PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

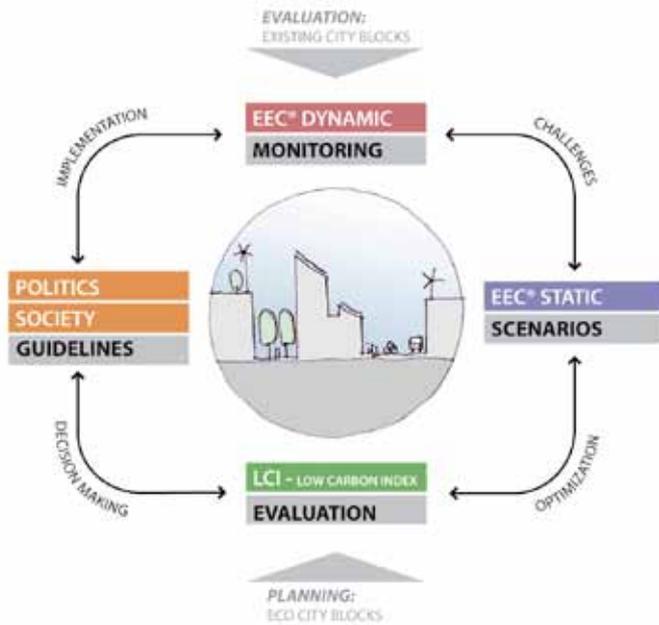
Costs: 2.8 mio. Euro

#### PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

The future focus will be on new charging, control and billing infrastructures, as well as on European standards for e-mobility. Behavioural aspects, such as new municipal and inter-communal traffic relations, may be explored.

10.2 URBAN FORM, MOBILITY, HOUSING, AND LIVING

TOWARDS A SUSTAINABLE AND ENERGY-EFFICIENT URBAN DEVELOPMENT



Circular structure of the LCI®/EEC® monitoring systems

Daniel Bläser

The Low Carbon Index (LCI®) was developed first; later it was tested and optimised using specific case studies. Adaptations to regional conditions and frameworks of metropolises in other countries are possible. The LCI® serves to evaluate the energy-efficiency of new projects in both qualitative and quantitative ways. This enables planners to realise SWOTs (Strengths, Weaknesses, Opportunities, and Threats analyses) in the planning process and to modify the concept. Additionally, the LCI® checklist helps to localise potential weak points, which can be overcome in the next planning phase. With the help of the LCI® as an evaluation tool, strategies for energy efficiency can be clarified and advanced.

To achieve greater effectiveness, especially with regard to sustainability and the control of planning processes, the Energy Efficiency Controller (EEC®) was developed. The operation of the dynamic EEC® relies on sensors and measuring instruments that check the energy consumption of buildings and convert the data into the respective CO<sub>2</sub> emissions.

The results are tracked locally by the Shenhong Company and can be presented online, so that it is possible to check and visualise the current energy consumption and information concerning CO<sub>2</sub> emissions of individual streets and buildings. A problem analysis can be carried out by the static EEC®.

ABSTRACT

Half of the world's population already lives in cities, while urbanisation of emerging countries is still accelerating. Cities have an extremely high energy consumption due to their specific structures and living conditions. But they also have a high potential to save energy. This is why the research project – funded by the German Federal Ministry of Education and Research – developed methods that enable us to support an energy-efficient and sustainable urban development, even under demanding conditions. The City is an urban system with many interrelated factors. The main topics of this project are urban structure and form, mobility, building and renewable energies. Other topics, such as water or waste, played marginal roles. The project was realised in the fast-growing megacity of Shanghai with two pilot areas:

- The newly developed Low Carbon Business Park in the District of Hongqiao.
- Xinkai, a low-cost housing area situated in the peripheral district of Songjiang.

The aim of the project was to develop methods for an early intervention in the planning process and for a simple and transparent means of evaluating the quality and efficiency of the planning, not only of single buildings, but also of the entire neighborhood. The methods developed in this project lead to sustainable and energy-efficient urban planning.

LIST OF PARTICIPANTS

- University of Duisburg-Essen,
- Institute of City Planning + Urban Design AVISO GmbH
- PTV AG
- TraffGoRoad GmbH
- SBA International GmbH
- TRC GmbH
- plus 16 partners in China

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

- Project: 2008 - 2011
- Funding: Federal Ministry of Education and Research (BMBF), programme "Future Megacities"

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

The findings of the project will be partially used and further worked on in other institute projects. The LCI® and EEC® tools are currently adapted and used in a new research project in Essen/Germany (Climate Initiative Essen – Acting in a new Climate Culture, duration 2011 – 2016), which is also funded by the German Federal Ministry of Education and Research.

### 10.3 CLIMATE INITIATIVE ESSEN

#### ACTING IN A NEW CLIMATE CULTURE

##### ABSTRACT

In addition to their built-up environments, economy, technology and political administrations, cities are characterised by social dynamics and cultural developments. All of these elements together influence residents' lives to a great extent. Climate Initiative Essen – acting in a new climate culture focuses on these human factors. It pursues a participatory action approach, in which technological measures, new municipal services and socio-cultural approaches play important roles in activating and supporting behavioural changes in the residents and institutions of the city.

The project's participatory approach aims, by 2020, at reducing Essen's CO<sub>2</sub> emissions to at least 40% of the 1990 level. This involves a milieu-specific targeting in the fields of urban development, mobility, building renovation and renewable energy. The step from know-how to action within previous strategies was often performed inadequately, or not adapted to reduce energy consumption. A differentiated approach is now required by all of the city's institutions and expanded municipal networks, together with the development of services and the monitoring of CO<sub>2</sub> emissions.

The Climate Initiative Essen is a project of the klima|werk|stadt|essen in cooperation with the City of Essen, the Centre for Logistics & Traffic and the Institute of City Planning and Urban Design at the University of Duisburg-Essen, Institute for Advanced Study in the Humanities (KWI) Essen, Stadtwerke Essen, Essen Transport Ltd., the Allbau AG and Transportation Research and Consulting Ltd. Supported by funds from the BMBF initiative competitive energy-efficient communities.



Daniel Bläser

##### LIST OF PARTICIPANTS

University of Duisburg-Essen  
 Institute of City Planning and Urban Design  
 Centre for Logistics & Traffic  
 City of Essen  
 Institute for Advanced Study in the Humanities (KWI), Essen  
 Stadtwerke Essen, Essen Transport Ltd.  
 Allbau AG, Essen  
 Transportation Research and Consulting Ltd.

##### PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: 2011 – 2016  
 Funding: Federal Ministry of Education and Research (BMBF)

##### PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

The Climate Initiative Essen is based on the involvement and participation of citizens to establish a new climate-culture in the City of Essen. Unlike conventional strategies, the Climate Initiative Essen focuses on a close cooperation among urban, economic and academic partners on the basis of socio-cultural activation and participation to achieve greater acceptance and commitment of citizens at the consumer level concerning issues of climate change.



Daniel Bläser

**11.1 SOLAR COOLING**  
**IN A HARDWARE-IN-THE-LOOP TEST**

**ABSTRACT**

The project deals with solar cooling, using an absorption chiller driven by a solar thermal system. Dynamic simulations with MATLAB/Simulink and the toolboxes, Stateflow and CARNOT, and parameter variations according to the work-efficient methodology of design of experiments (doe) are used to select useful system configurations, control strategies, and dimensioning of components.

During the following hardware-in-the-loop (hil) tests, the absorption chiller of Yazaki will be connected in a real system, driven by the real-time simulation of the remaining components, including the solar thermal system, cooling tower and cooling load. The benefits of hil-tests are the changeability of boundary conditions for building, control, independence from current climatic conditions and low maintenance.

**LIST OF PARTICIPANTS**

Düsseldorf University of Applied Sciences,  
 Department of Mechanical and Process Engineering,  
 Prof. Dr.-Ing. Mario Adam, Sandra Lohmann,  
 Johannes Goebel, Rada Radosavljevic

Vaillant GmbH

RWTH Aachen University, Institute of Technical Thermodynamics

**PROJECT START AND DURATION,  
 TOTAL COSTS AND FUNDING**

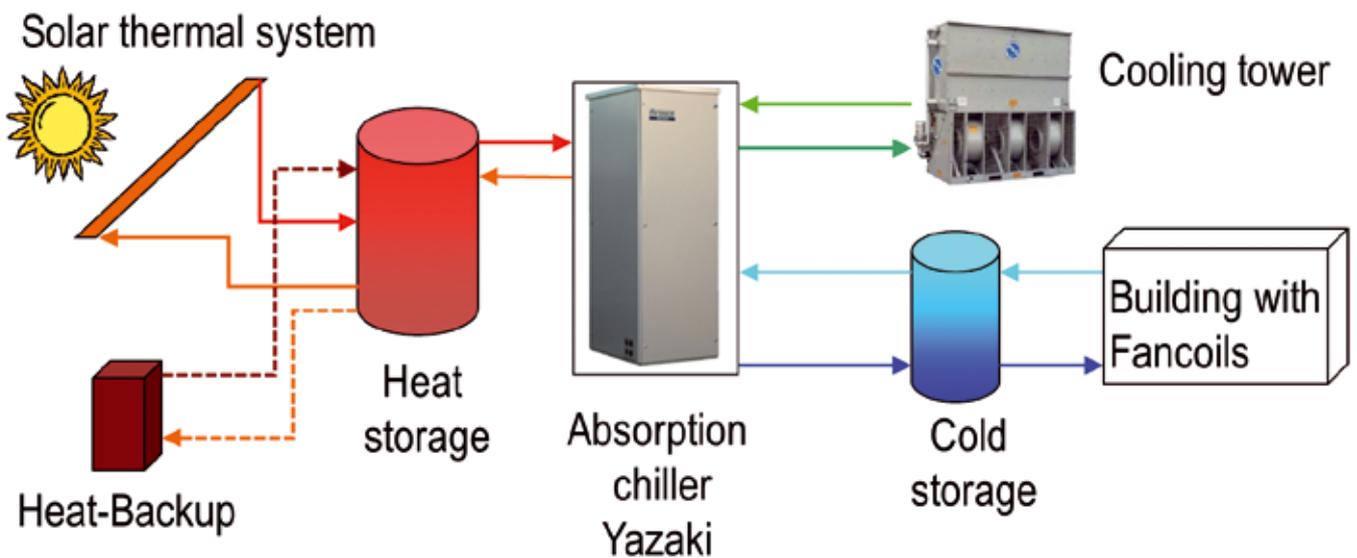
**Project:** July 2009 - June 2012

**Costs:** 270,000 Euro

**Funding:** Federal Ministry of Education and Research (BMBF)

**PERSPECTIVES, APPROACHES AND IDEAS FOR  
 FURTHER DEVELOPMENT AT THE EU LEVEL**

- Monitoring of solar cooling systems throughout the EU, especially interesting for the southern European countries.
- Further development of system control strategies in cooperation with manufacturers of sorption machines.



## 11.2 IMPROVING AIR TRAFFIC SAFETY

### AIRBORNE MEASUREMENT OF VOLCANIC PLUMES

#### ABSTRACT

Volcanic eruptions pose a serious threat to aviation. Only recently, volcanic ash clouds disrupted air travel across Europe. To monitor ash-bearing clouds and to determine local variations in ash concentration we performed a large number of research flights under various conditions, e.g. with and without volcanic ash plumes, during and after volcanic eruptions in Iceland (Eyjafjallajökull/Grimsvötn) and Italy (Ätna/Stromboli), and in the dispersed ash plume over Germany.

In the case of Eyjafjallajökull, large amounts of ash were emitted when water from the volcano's melting ice shield reached hot lava. Due to meteorological conditions (north-westerly winds) a strong plume of ash and volcanic gases drifted towards Central Europe, Great Britain and Scandinavia. This plume could be detected and tracked by satellite observations. The Volcanic Ash Advisory Centre (VAAC) of the Meteorological Office in London regularly released results from model calculations for the ash dispersion over Europe as maps of expected ash concentration. As high volcanic ash concentration is assumed to be hazardous to aircraft, the airspace over Europe was closed from 15 April to 21 April, 2010. This caused the cancellation of a huge number of flights and severe commercial problems. Later, the airspace was mostly re-opened, but due to localised high ash densities, it was partially closed again several times until mid-May.

In this situation, aircraft measurements were of special interest because they allowed temporal and spatial measurements of the ash plume. The University of Applied Sciences Düsseldorf used a light aircraft, optical particle counter and different spectrometers to investigate levels of gases and ash in volcanic plumes. The light aircraft was driven by a piston-motor, equipped with an air filter and a double ignition system, making it robust and safe enough to operate within the expected ash plume.

On the basis of data we collected during our investigative flights, airports on Iceland airports could have removed the flight ban earlier than expected, saving a large amount of money.

Most recent research is aimed at optimising in-situ measurement systems for volcanic plumes and flight tests of the advanced remote sensing ash detector, AVOID, which was developed by the Norwegian Institute of Air Research (NILU) and funded by Easyjet. Further flight tests are planned at active volcanoes overseas.



Research-Team

Prof. Dr. Konradin Weber

#### LIST OF PARTICIPANTS

- University of Iceland, Faculty of Civil and Environmental Sciences VRIL, Reykjavík, Iceland
- University of Fribourg, Dept. of Geosciences and FRIMAT, Fribourg, Switzerland
- Institute for the Research on Hazardous Substances IGF, Bochum
- Norwegian Institute for Air Research, Kjeller, Norway
- University of Cambridge, Department of Geography, Cambridge, UK
- AIRBUS, Toulouse, France
- easyJet Airline Company. London, UK

#### PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

- Project:** beginning May 2010
- Funding:** German Weather Service, DWD  
German Federal Ministry of Transport  
AIRBUS, France  
EASYJET, UK  
Norwegian Institute for Air Research, Norway

#### PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

Airborne measurements - mapping and identifying volcanic plumes with light aircraft - during and after volcanic eruptions, have proved to be a valuable tool for increasing civil aviation safety. Further developments of in-situ measurement systems, as well as remote sensing measurement systems, will be performed at the University of Applied Sciences Düsseldorf in cooperation with international partners. Field experiments are planned at active volcanoes in South America, Indonesia and Japan. Moreover, ash plume kinetics and ash plume dispersion will be studied in order to allow better modelling of the dispersion of volcanic plumes during future eruptions.

## 11.3 SORAQ: ELDERLY PEOPLE'S NEEDS IN CITY DISTRICTS CONSERVING AND ENHANCING RESOURCES

### ABSTRACT

There is an increasing need to take account of society's elderly members. The demographic change and differentiation within the elderly population requires adequate district-related concepts of analysis and management. On the one hand, the majority of elderly people want to live in their familiar residential environment. On the other, they have specific needs for essential goods and services, leisure time, and social contacts in the neighbourhood.

The research project 'Social Resources to meet Elderly People's Needs in City Districts' (Soziale Ressourcen für altersgerechte Quartiere - SORAQ) is part of the programme 'Social Innovations for Quality of Life in Old Age' (SILQUA FH) funded by the Federal Ministry of Education and Research (BMBF).

From a socio-spatial perspective, the project takes a closer look at existing and potential resources in six selected residential districts of Düsseldorf, and at the options for conserving, enlarging and enhancing them. Resources include active citizens, local stakeholders, civil associations and retail. Also spatial and structural resources will be examined. Social contacts, support systems and networking among elderly people are of particular interest to SORAQ, as well as the community-based preconditions for these factors.

The project's primary objectives are:

- Development of an analytic framework for examining the demographic ageing of inhabitants in residential districts.
- Modification of socio-spatial methods of social service work for elderly people.
- Identifying and stabilising social and infrastructural resources in the chosen residential districts, including intergenerational relationships.

To these ends, the research team uses several methods in an interdisciplinary approach:

- Quantative and qualitative survey of experts and inhabitants.
- Socio-spatial analysis of the investigated districts, especially of the age-based development linked with the urban development at large.
- Activating practical projects and workshops with elderly people and skilled employees of elderly care.
- Exchanges with other projects within the SILQUA programme that use a similar approach, for example, at conferences within the University of Applied Science Düsseldorf.
- Interdisciplinary tutorials in cooperation with the Department of Design and the Department of Architecture at the University of Applied Science Düsseldorf.



*Elderly people on a workshop about a residential quarter in the City of Düsseldorf*

*Prof. Dr. Reinhold Knopp*

SORAQ is both a research and practical project. It intends not only to generate new transferable scientific results and methods, but also to propose and realise - in cooperation with the urban administration - concrete changes in the chosen residential districts.

### LIST OF PARTICIPANTS

University of Applied Sciences Düsseldorf,  
Dept. of Social and Cultural Sciences, Prof. Dr. Reinhold Knopp  
City of Düsseldorf  
Evangelisches Erwachsenenwerk Nordrhein  
zentrum plus

### PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: August 2011 - July 2014  
Costs: 260,000 Euro  
Funding: Federal Ministry of Education and Research (BMBF)



### PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

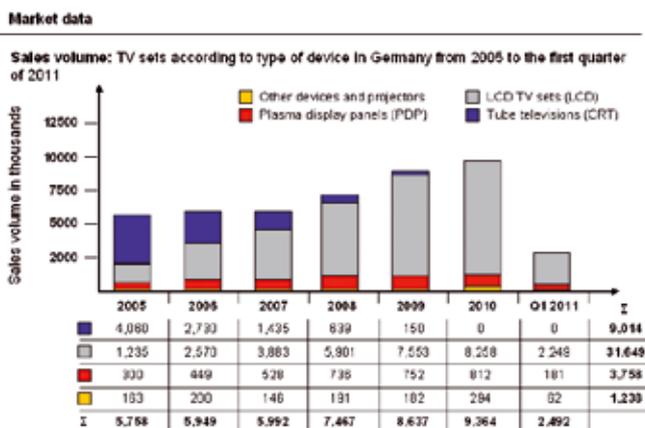
The expected scientific results and methods generated by this study could be applied in other EU countries to socio-spatial research on age-based living conditions in residential districts. A comparison of national differences in basic local parameters, regulatory frameworks and business conditions may be of use in preparing EU member states to manage the challenges resulting from demographic change and ageing societies.



## 12.1 LASER-AIDED DISASSEMBLY OF FLAT PANEL DISPLAYS

### ABSTRACT

Flat panel displays, in the form of LCD/LED or plasma screens, have replaced conventional cathode ray tubes in TV sets and computer monitors. In 2004, for the first time, more PCs with flat panel displays were sold than conventional monitors. According to BITKOM (Federal Association for Information Technology, Telecommunications and New Media), LCD and plasma TV sales have increased from 1.6 million in 2005 to 3 million per year (and will continue to do so), resulting in a total of more than 30 million flat-screen TVs in German households at present.



Market data

GfK, gfu, ZVEI

There is an urgent need for action with regard to the disposal of these devices (after an average service life of < 8 years) for various reasons:

In the medium term, there will be a need to dispose of dramatically increasing quantities of flat panel displays. The separation of components containing hazardous substances is required by the legislator. The films inside the screens, sometimes coated with rare metals, constitute a high resource potential.

The devices contain large quantities of environmentally hazardous metals, such as mercury found in the highly fragile neon tubes. When opened incorrectly, the mercury from the device can easily be released into the environment.

Because appropriate technologies are missing, the devices are currently dismantled by hand (< 10 devices per hour and disassembly technician).

In the medium term, there are insufficient disposal capacities available for the disposal of these devices.

A major aspect of the project is the use of laser-aided separating processes, enabling the screens to be mostly dismantled automatically while

- guaranteeing the high added value of the individual fractions
- minimising environmental/occupational health and safety risks
- guaranteeing economic efficiency in the long term.

The submitted project is divided into five work packages:

#### Work package 1:

Preparation of an overview of the screen types/designs on the market and the current state of the reprocessing technology

#### Work package 2:

Disassembly trials on a pilot plant scale to obtain design data for the laser application

#### Work packages 3 and 4:

Development of a reprocessing/disassembly concept and its large-scale trial/implementation

#### Work package 5:

Assessment of the reprocessing concept in due consideration of the following aspects

- technical feasibility
- value added; requirements of the recycling facilities
- occupational health and safety
- personnel costs/mechanical effort  
=> economic efficiency calculation

### LIST OF PARTICIPANTS

Münster University of Applied Sciences, Laser Centre,  
Professor Dr.-Ing. Klaus Dickmann

Remondis Elektrorecycling GmbH, Lünen

Metallrecycling Lohmann, Emsdetten

ZME Elektronikrecycling GmbH, Heuchelheim

### PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

**Project:** July 2011 - December 2012

**Costs:** 165,000 Euro

**Funding:** Ministry for Innovation, Science and Research  
of North Rhine-Westphalia

Competition "Transfer.NRW: FH-Extra"

European Regional Development Fund

### PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

The problem described here goes beyond Germany, because European legislation sets uniform standards for all European countries with regards to the disposal of waste electrical equipment, as laid down in the WEEE Directive and the RoHS Directive. These directives are currently being amended and are expected to specify higher recycling ratios. At the same time, the shortage of resources (including rare metals) and associated rising prices are of major importance, which means that there is a very real interest in the recovery of secondary raw materials.



## 12.2 ENERGY.ST

### STEINFURT – DISTRICT OF THE FUTURE – ENERGY SELF-SUFFICIENT 2050

#### ABSTRACT

The key objective of the project is to achieve a positive energy balance for the county of Steinfurt by 2050. For this we will devise a regional management system that incorporates a continuous improvement and development process.

The project takes into account several thematic priorities, such as increasing final energy efficiency, energy-efficient and solar construction, fuels and drives of the future, biomass, solar energy, geothermal energy and combined heat and power generation. The network project presents itself as an interdisciplinary topic designed from the perspective of tapping a new market. We focus on two aspects:

1. Improvement of energy use  
(energy efficiency and reduction of energy needs)
2. Increase of regional energy production (renewable energies)

#### ■ Essential working plan:

Determining the energy demand (heat, electricity, mobility) for specific consumption sectors (households, industry, trade, public buildings).

Demonstrate measures for the reduction of this energy demand.

Study the potential for renewable energy to cover this remaining demand.

Integration of the collected files in a geographic information system (GIS).

Development of a project network.

Integration of regional companies and institutions from different areas of expertise and their networking to identify significant fields of action and innovation potentials.

#### ■ Modules for reaching the aims include:

Development of a regional management system.

Construction of competence clusters along the value-added chain.

Networking of companies and decision-makers.

Knowledge and innovation transfer with practically oriented research close to enterprises.

Procurement of management skills.

Campaigns and marketing strategies.

Guidelines for transferability.

#### Establishing a project network:

The project work involves collaboration with regional enterprises and institutions, and their networking. The purpose of the regional actors' involvement is to highlight subject-relevant problems and key fields of action for the county of Steinfurt with the co-operation partners. The various actors will be involved in the development of the energy management system at an early stage, incorporating their specific expertise into the data acquisition and concept structure of the co-operating partners.

**CONTACT:** Faculty of Energy · Buildings · Environment, Prof. Dr. Christof Wetter, Prof. Dr. Bernhard Mundus



*Hand over of the grant notification  
through the ministries involved*

*County of Steinfurt*

By including actors in the process, the available capabilities within the region are utilised in organised work groups.

#### LIST OF PARTICIPANTS

##### Project partners:

County of Steinfurt,

Dipl.-Ing. Ulrich Ahlke, Dipl.-Biol. Birgit Rademacher

University of Münster, Dept. of Geography, Chair: Local, Regional and State Development / Spatial Planning,  
Prof. Dr. Ulrike Grabski-Kieron, Dipl.-Geogr. Ulrike Ludewig

Münster University of Applied Sciences, Faculty of Energy, Buildings, Environment, Prof. Dr. Bernhard Mundus, Prof. Dr. Christof Wetter, Dipl.-Ing. Elmar Brüggling M.Sc.,  
Dipl.-Ing. Nicole Aben M.Eng., Michael Rolfes B.Eng.

44 associate partners from industry and other institutions

#### PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

**Project:** November 2008 – May 2012

**Costs:** 714,250 Euro

**Funding:** Ministry for Economic Affairs, Energy, Building, Housing and Transport of North Rhine-Westphalia Programme "Rationelle Energieverwendung, regenerative Energien und Energiesparen progres.NRW"  
European Regional Development Fund

#### PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

Taking the county of Steinfurt as an example, it can be shown how quickly the subject of energy saving, energy efficiency and the use of renewable energies with a substantial increase in added value can be implemented in the region. In addition to the practical implementation of the project in this region, it is especially important to make the results transferable to other regions in Europe. To this end, guidelines will be drawn up.

## 13.1 E-HEALTH@HOME

### ABSTRACT

Based on innovative business models, the project E-Health@Home identifies, evaluates, designs, and implements telemedicine services for elderly people. The project contributes to solving problems resulting from an ageing society. The objective is the development of alternatives for those who have been living in residential nursing homes due to health impairment. The project has worked on four cases ("innovative business systems"):

- REMEO, a service provided by the Linde AG for the treatment of COPD-patients.
- meinZuhause, a service from the company of the same name in Bremen, for the supply of the elderly in their home.
- A service provided by the Liebenau Foundation for the supervision and care of elderly people living alone.
- Netzwerk Diabetischer Fuß (Network Diabetic Foot), a network of local physicians for the cooperative treatment of diabetes.

Beside these core activities, a subset of the E-Health@Home partners led a focus group for several other e-health projects, elaborating business models for products and services.

### LIST OF PARTICIPANTS

University of Duisburg-Essen, Rhein-Ruhr-Institute for Social Science Research and Political Consultancy (RISP) [www.risp-duisburg.de](http://www.risp-duisburg.de)

Fraunhofer Institute for Software and Engineering (ISST) [www.isst.fhg.de](http://www.isst.fhg.de)

T-Systems International GmbH [www.t-systems.com](http://www.t-systems.com)

Freie Universität Berlin, Competence Centre E-Commerce (CCEC) [www.ccec-online.de](http://www.ccec-online.de)

Ruhr-Universität Bochum, Institute for E-Business Security (ISEB) [www.iseb.ruhr-uni-bochum.de](http://www.iseb.ruhr-uni-bochum.de)

Gelsenkirchen University of Applied Sciences, Institute for Work and Technology (IAT) [www.iat.eu](http://www.iat.eu)

### PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: September 2008 – August 2011

Costs: 2,574,217 Euro

Funding: 2,020,977 Euro

by the Federal Ministry for Education and Science (BMBF)

### PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

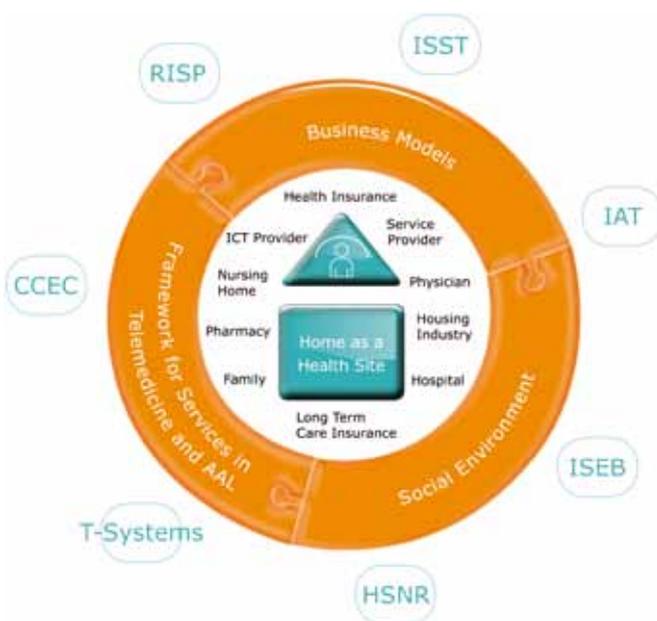
Based on the four cases, the project developed several theories:

- There are enough existing technologies to support them, but due to the lack of integration in marketable services, customers do not get the full benefit of these technologies.
- Appropriate business models have to be developed, recognising the properties of the different markets. Especially in Germany, with its complex first and second health market, the business models have to be extremely specialised.

The project has three recommendations for further e-health research at the EU-level:

- The research landscape in Germany and Europe needs better Integration of business models in projects.
- Complex e-health services need a well-composed interaction of different product and service providers, combined with user networks.
- The healthcare market needs input from EU and member state governments.

Due to the success of the E-Health@Home activities in Germany, the establishment of focus groups for e-health business models accompanying research projects is advisable.



E-Health consortium

RISP

13.2 REGTRANS

REGIONAL TRANSFER EFFECTS FROM HIGHER EDUCATION INSTITUTIONS

ABSTRACT

Higher education institutions influence their local economy due to expenditure effects; they also have knowledge-based impacts on the general development and innovation system in their regional environment. This has been shown by many studies that take into account either single institutions, or the ensemble of university institutions within a city, region, or the whole country.

Expenditure effects on local employment and production result from the university's own expenditure, but also from the staff's and students' consumption. These do not differ markedly from similar effects observed for any large expenditure-generating institution. Therefore knowledge-based impacts that can benefit the population and economy of the university region are more interesting, but also more difficult to assess and evaluate. These knowledge-based impacts are not only transferred from the university to the surrounding region, but also vice versa; hence, both the higher education institution and the surrounding region are actively involved in the transfer process. Academic literature uses the term "Knowledge and Technology Transfer" (KTT).

The significance of the transfer channels – both for expenditure-based and knowledge-based impacts – depends on the type of higher education institution, whether it is a university of applied sciences or a traditional university. The aim of the cooperative research project, RegTrans, is to define and outline the relevance of the different transfer channels and the positioning in the regional innovation systems for both types of higher education institution in Germany. Furthermore, the project seeks to identify and empirically examine the central determinants for an appropriate utilisation of the relevant transfer channels. On that basis, advisory and policy recommendations will be developed for interactions and cooperation between higher education institutions and their regional economy, and for the optimal utilisation of the resources of higher education in the best interests of the university region.

Project Outline:

- Setting up hypotheses
- Testing hypotheses based on empirical analyses
- Development, determination and analysis of nationwide available indicators
- Analysis of form and intensity of transfer channel effects applying various forms of empirical analysis that focus on case studies
- Analysis of optimal conditions for the best possible application of the transfer channels
- Strategy development, policy recommendations
- Publication and initiation of possible follow-up projects

LIST OF PARTICIPANTS

Niederrhein University of Applied Sciences, Moenchenglachbach/Krefeld, NIERS – Niederrhein Institute for Regional and Structural Research

Ruhr University Bochum, Dept. of Economics

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

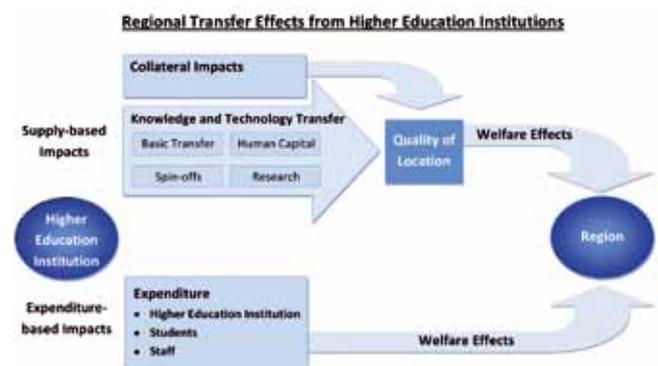
Project: March 2011 – February 2014

Costs: 670,326 Euro

Funding: Federal Ministry for Education and Sciences (BMBF)

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

The analysis can be expanded at an international level (i.e. as EURO RegTrans – Regional Transfer Effects of Universities in different EU Countries) to broaden the scientific basis for policy recommendations. Special attention should be paid to differences in third level education systems, to the conditions of the universities' legal frameworks, and to the capacities of regional innovation systems to absorb transfer impulses stemming from different types of higher education institution.



Systematisation of regional transfer effects from higher education institutions to the regional area

NIERS & Ruhr University Bochum

### 13.3 LUMINESCENT TEXTILES



Prototype of luminescent roller blind

Christine Steinem

#### ABSTRACT

A team of researchers has invented a method for producing electroluminescent textiles using conventional coating and printing techniques. The invention describes manufacture of an actively illuminating textile. The individual electrodes, active luminescent layer and other additional layers are applied to any textile in various process steps. The flexible fabric illuminates by applying an electrical current "from within" in different colours depending on the luminescent pigment. Through dyeing or printing of the textile base material, additional colours can be produced. The application for this invention was filed at the German Patent and Trademark Office (DE 10 2009 026 409.4) as well as the European Patent Office (EP 10720 619.5) and the US Patent and Trademark Office (US 13/ 320.555).

Unlike the best available technology for producing electroluminescent textiles, the present method requires no metallic fibers or other conductive elements in the textile. The first electrode layer, and all subsequent layers, can be applied via traditional application methods on any pre-treated fabric, depending on the material and its density. Both conductive layers and the isolating di-electric layer were changed into water-based polymers for the production of a prototype (a project of the German Federal Ministry for Economics and Technology with the Project Management Jülich).

The energy consumption of electroluminescent products is very small, while the luminescent effect is very high, depending on the material. Based on this invention and the production of a prototype, the current research project with two industrial partners was started to upscale results into an industrial product with the funding of the

Central Innovation Programme SMEs (ZIM). The planar luminescent layers are to be applied via coating or casting onto sunscreen materials. The required energy should be generated by photovoltaic cells and stored in appropriate accumulators. By this method a self-sufficient luminescent sunscreen should be produced. The project comprises the development of bi-functional textiles with active light production. It focuses on the production of electrical energy by the help of flexible photovoltaic cells as well as on the emission of light by electroluminescent particles. These two functions will be realised by means of conductive polymers placed on textile-based materials. Research involves formulating special polymers to meet the specific parameters of textile coating, analysing the base materials and the functions of the new textiles, developing new designs for light sources. Furthermore a project with several industrial partners in the textile chain has been funded to develop electrically conductive textiles for the automobile industry.

#### LIST OF PARTICIPANTS

Niederrhein University of Applied Sciences, Research Institute for Textile and Clothing

Industrial producers of sun screens and automotive textiles, but also partners manufacturing home textiles, banner and flag textiles.

Saxon Textile Research Institute (STFI), Chemnitz

Textile Research Institutions in Spain, Bulgaria and France

#### PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

ZIM Project: December 2010 – June 2012

Funding: 200,000 Euro by Federal Ministry for Economics and Technology (BMWi)

Planned project:

Project: July 2012 – June 2014

Costs: approx. 300,000 Euro

#### PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

The prototype has been developed primarily for decorative purposes in home textiles and commercial sectors; the technology is being further developed for other applications, such as automobile or safety textiles. These specialised textiles have been made possible due to the combination of a very innovative technology and traditional manufacturing processes. It is the aim of the research institute to cooperate with European researchers and industrial partners for further development of luminescent and generally conductive textiles at low energy consumption in connection with energy generating photovoltaic cells.

13.4 SMART PROTECTIVE CLOTHING FOR FIREMEN

UNDERWEAR WITH ECG MEASURING AND BROADBAND HF DATA TRANSMISSION

**ABSTRACT**

The project aims to develop personal protective equipment (PPE) for firemen, incorporating a measurement device that transmits vital data to a receiver, monitored by the officer in charge. Such a device could help to prevent injury in firemen by continuously monitoring their vital data during fire-fighting operations. For example, it will be possible to monitor and prevent impending circulatory collapse due to cardiovascular diseases or heat stress.

It is important to develop an affordable system for professional and voluntary firemen, that will be easy and safe to handle on a daily basis. Firemen's acceptance of any equipment is strongly correlated to the overall weight of the PPE. Therefore, the total weight should not exceed 4.5 kg. We intend to develop a highly reliable and suitable system which can be used under different conditions, such as common indoor operations.

**LIST OF PARTICIPANTS**

Alwit GmbH, Emmerich  
 Isis IC GmbH, Wesel  
 Niederrhein University of Applied Sciences, Krefeld

**PROJECT START AND DURATION, TOTAL COSTS AND FUNDING**

Project: July 2009 - March 2012  
 Costs: 174,242 Euro

**PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL**

Transfer of the developed sensory detection underwear for cardiac diagnostics.



*Sensoric shirt for firemen*

*Andrea Ehrmann*

14.1 LIGHTING A HISTORICAL TOWN CENTRE

ILLUMINATED GROUND SURFACE INDICATORS FOR VISION-IMPAIRED PEDESTRIANS

ABSTRACT

Techniques that help to lead vision-impaired and blind people safely through town streets could be a great aid. In the city of Rietberg, we have developed special paving blocks that can lead pedestrians by acoustic, tactile and visual means along certain walkways. The warning surfaces are marked by either light-on-dark or dark-on-light coloured line-elements on the ground. Unfortunately, these line marks may disturb the aesthetic impression of the architecture in historical ensembles, such as those found in the city of Rietberg.

Therefore, LED-lighting-elements will be integrated into concrete paving blocks with tactile surface "truncated bars". The necessary visual contrast will be realised between the dark-coloured paving block and the lighting-element. If the surrounding pavement construction is built using paving blocks of the same colour, the disturbance to the aesthetic impression will be marginal while still allowing the LED-lighted paving blocks to provide a linear guidance system. Furthermore, this LED-lighting-element can guide vision-impaired pedestrians both at twilight and during the night.

The integration of an LED-lighting-element into a concrete paving block is a technical challenge because it implies a reduction in its mechanical stability under traffic loads. Therefore, variations in the shape of the paving blocks and the composition of the concrete used will be tested in this project with the aim of reducing this disadvantage.

After testing, model blocks will be created and a demonstration surface in the historical centre of Rietberg will be covered using the new blocks to investigate their function under real conditions.

LIST OF PARTICIPANTS

Ostwestfalen-Lippe University of Applied Sciences,  
Dept. of Civil Engineering, Prof. Dr.-Ing. Martin Köhler  
Bielefeld University of Applied Sciences  
Council of the city of Rietberg  
Philips GmbH, Professional Lighting Solutions

PROJECT START AND DURATION,  
TOTAL COSTS AND FUNDING

Project: April 2011 – March 2013  
Costs: 112,000 Euro

PERSPECTIVES, APPROACHES AND IDEAS FOR  
FURTHER DEVELOPMENT AT THE EU LEVEL

Innovative tools and methods will be developed which can be transferred to other open coasts and similar estuarine areas to perform risk analyses making it possible to achieve comparable results as a way of implementing uniform risk-based design methods.



Illuminated ground surface indicator on the first test site

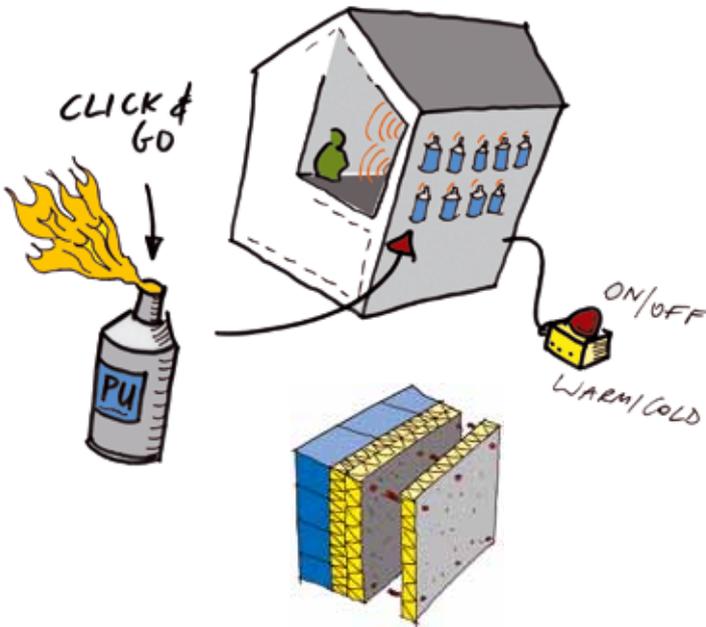


On-site-evaluation by a vision-impaired person

Prof. Dr.-Ing. Martin Köhler

14.2 CREED-PS

CLIMATE RELATED ENERGY EFFICIENT DESIGN – PRODUCT SOLUTIONS



Workshop sketch of new insulation application. HS OWL

ABSTRACT

To reduce the damaging effects of climate change, adequate building insulation and measures to increase energy efficiency need to be further developed. However, material and product solutions developed in Germany and Central Europe are often not applicable to parts of the world that have different climatic and economic conditions.

Therefore, at Ostwestfalen-Lippe University of Applied Sciences, we have focussed our teaching and research activities on the international dimension of innovation.

With respect to the city, the building envelope and the user, all products and construction elements must not only meet energy demands, but also remain essential design elements, strongly influencing the image of a city or the behaviour of a society. In addition, these products need advanced planning and pre-fabrication, ranging from its numerous interfaces to technical components. This will require special professional competence in participating companies.

To address these needs, a set of initiatives has been developed and conducted in cooperation with several companies and partner universities from the international community:

In 2009, a Summer Academy ([www.hs-owl.de/creed](http://www.hs-owl.de/creed)) with participants from Brazil and Mozambique focussed on urban and building aspects of climate-related, energy efficient development. A workshop on e-mobility initiated a discussion about the needs for electrical mobility in urban and rural areas, reflecting the different situations in Brazil, Germany, and Mozambique.

In 2010, students from the Masters programme, "International Facade Design and Construction", analysed the international market for insulation products to discover market needs.

In 2011, the project "Recycling-Design Germany-Brazil" was conducted. It concentrated on recycling-design as a resource saving tool

in the building market. The results of this project, funded by the International Bureau of the German Federal Ministry of Education and Research (IB-BMBF), are being used in our current projects.

In 2011, two national projects on e-mobility funded by the European Regional Development Fund (EFRE) in cooperation with public institutions and industry partners started development of a model region in East Westfalia-Lippe (Ostwestfalen-Lippe) that focussed on transportation for health, the economy, and tourism.

Our current project "CREED-PS" focuses on market-driven products and sample applications for the Indian market. In the context of "Smart Cities", bilateral/interdisciplinary workshops and a cooperation talk with industry partners will be held to discuss solutions and products for energy saving and energy efficiency. Furthermore, the results will be shown in seven Indian cities. Starting points and innovation potentials can be seen in the following areas:

- Development of material and building elements related to local construction and manufacturing processes.
- Energy balance in structural elements and buildings.
- Integration of product design and innovation management.
- Modifications due to characteristics of the local and regional building industry.

The project is strongly based upon interdisciplinary cooperation, both scientifically and economically, between the participating universities and institutions.

LIST OF PARTICIPANTS

- Ostwestfalen-Lippe University of Applied Sciences with its Research Platforms ConstructionLab and PerceptionLab
- BayerMaterial Science AG (BMS), Creative Centre, Leverkusen-Greater Noida
- Silence Solutions GmbH, Köln
- National Institute of Design (NID), Ahmedabad / Bangalore, India
- Deenbandhu Chhotu Ram University of Science and Technology (DCRUSTM), Murthal, India

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

- Project: October 2011 – October 2012
- Costs: 100,000 Euro
- Funding: partly by the International Bureau of the German Federal Ministry of Education and Research (IB-BMBF)

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

Based on the above-mentioned projects and experience, the Ostwestfalen-Lippe University of Applied Sciences aims to perform interdisciplinary research on product, material and process innovation in architecture and urban planning. This kind of activity is particularly attractive for cooperations with SMEs.

## 15.1 URBAN RETROFIT

### ABSTRACT

The project 'Urban retrofit' will identify and demonstrate ways to increase the retrofitting rate in the residential sector significantly to more than 5% up to 10% per year. This means new approaches that are not based on retrofitting individual buildings anymore, instead thinking of area-wide or at least district related approaches. Therefore the project will first find out lifestyle-related solutions for addressing citizens and building owners to activate and mobilize them at district level. Furthermore, market related and innovative full-service offers including financing arrangements based on energy costs savings will be developed as well as new prefabricated standard products to increase the economy of retrofits.



Modellstadt Bottrop

### LIST OF PARTICIPANTS

The consortium is led by the City of Bottrop/Germany and its partners: InnovationCity Management GmbH, the Hochschule Ruhr West – University of Applied Sciences and the Fraunhofer Society. Further partners of the consortium with focus on realisation projects are the Cities of Breda (NL) and Modena (I). Besides partners and targeted involvement from industry, financing, utilities, research institutes etc., this consortium will be assisted by the City of Nottingham which wants to improve a city wide planning tool for analysing the replication potential of the results to other European Cities. Additional support comes also from the City of Salzburg, the City of Annecy and the association forum European Energy Award®.



*Miner's House in progress*



*Miner's House*

*Innovation City GmbH (2)*

### PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

**Project:** 2013 – 2017  
 Proposal for the Call  
 FP7-2012-NMP-ENV-ENERGY-ICT-EeB  
 Topic EeB.ENERGY.2012.8.8.3:  
 Demonstration of nearly zero energy building  
 renovation for cities and districts

**Budget:** 12,462,971 Euro for 5 years

### PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

The characteristics of the cities involved in the Urban Retrofit project are representative for many small and medium-sized European towns. Bottrop, Modena, Breda and Nottingham have different prerequisites within the district area and they have different climatic conditions. For all cities and the countries they represent, the Urban Retrofit project will lead to significant advances that can be applied across Europe. The added value of creating the Urban Retrofit project as a European project (with participants from Germany, Italy, Netherlands, and the United Kingdom) is that these countries are a good representation of how district energy retrofit can be implemented in Europe. The different prerequisites and different climatic conditions make them well suited to contribute to the development of highly energy efficient and cost-effective large scale systems. The exchange of experience and creation of best practice examples is preferably made in a European project in order to attain the highest possible impact at the European level.

16.1 STROM

TOWARDS SUSTAINABLE DRIVETRAIN TECHNOLOGIES

ABSTRACT

The traffic sector contributes considerably to global environmental problems. One possibility for an evolution towards sustainable mobility is the development of alternative drivetrain technologies, i.e. hybrid, electric or hydrogen-powered cars. However, most of these technologies are still in the development stage, and thus essential technical and economic parameters have not yet been defined. Additionally, complex interactions and (partly) conflicting interests exist between the main actors of the automobile market – political decision makers, car manufacturers and consumers. Thus, further market development and the economic, environmental, and social impact of new drivetrain technologies remains uncertain.

The overall objective of the project "STROM" (Strategic options of the automobile industry for the migration towards sustainable drivetrain technologies in established and emerging markets) is the development of improved economic models to support decision-making by actors in the automobile sector – politicians, manufacturers and consumers. In a second step, these models will be combined into one holistic model with a special focus on interdependencies between actors. This permits an integrated assessment of drivetrain technologies taking economic, environmental and social criteria into account. The model is applied to Germany and China.

Project homepage: <http://www.strom-sustainability.de>

LIST OF PARTICIPANTS

University of Wuppertal

- Prof. Dr. Grit Walther, Chair of Production and Logistics, Researchers: Dipl.-Wirtsch.-Ing. Nina Leistner, Dipl.-Wirtsch.-Inf. Laura Hombach <http://prodlog.wiwi.uni-wuppertal.de>

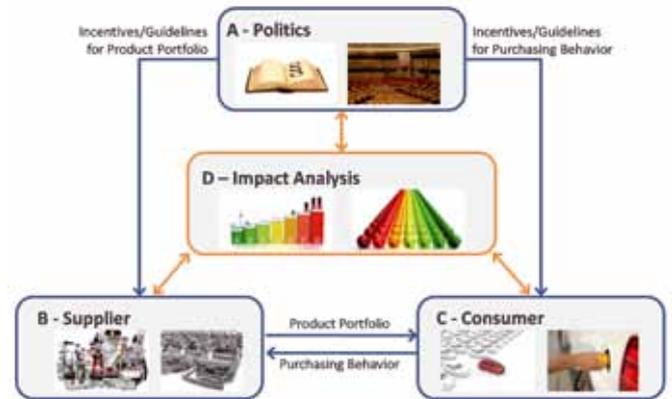
TU Braunschweig University

- Prof. Dr. Thomas Stefan Spengler, Institute of Automotive Management and Industrial Production, Researcher: Dipl.-Kffr. Katharina Wachter <https://www.tu-braunschweig.de/aip>
- Prof. Dr. Gernot Sieg, Economics Department, Researchers: Dipl.-Volkswirtin Antje-Mareike Dietrich, Dipl.-Volkswirt Uwe Kratzsch <https://www.tu-braunschweig.de/vwl>
- apl. Prof. Dr.-Ing. Christoph Herrmann, Institute of Machine Tools and Production Technology, Product and Life Cycle Management Research Group, Researcher: Dipl.-Wirtsch.-Ing. Mark Mennenga <http://www.iwf.tu-bs.de/>

Volkswagen AG

- Dr. Gilbert Heise, Group Market Research, Trend Research and Analysis, Wolfsburg, Researcher: Dr. Andreas Gessner, <http://www.volkswagen.de>

CONTACT: Chair of Production and Logistics, Prof. Dr. Grit Walther



Actors in the automobile market and their interaction

Prof. Dr. Grit Walther and Karsten Kieckhäfer

PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: June 2010 – May 2013

Costs: 700,000 Euro

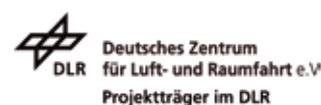
Funding: Federal Ministry of Education and Research (BMBF)

PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

Adaptation to other European Countries/ EU 15, EU 27

Adaptation to big cities with specific emission/car regulations (London)

University of Wuppertal



## 16.2 SMART ELECTRICITY DISTRIBUTION GRIDS

### ABSTRACT

In recent years, the Germany power supply system and associated industry has changed dramatically and fundamentally. The generation of electrical power is switching from centralised generation in nuclear or coal-fired power stations towards decentralised renewable energy with power grids that must transport electricity from these sources to the customers.

This calls for radical changes to the medium- and low-voltage grids close to the customers, and to the decentralised generation units. Enormous numbers of decentralised energy generation units have to be integrated into the existing grid, i.e. wind power stations, biomass power stations, photovoltaic units etc. These demands are accompanied by an increasing usage of electrical vehicles and electrical heat pumps, together with the installation and utilisation of electricity storage units.

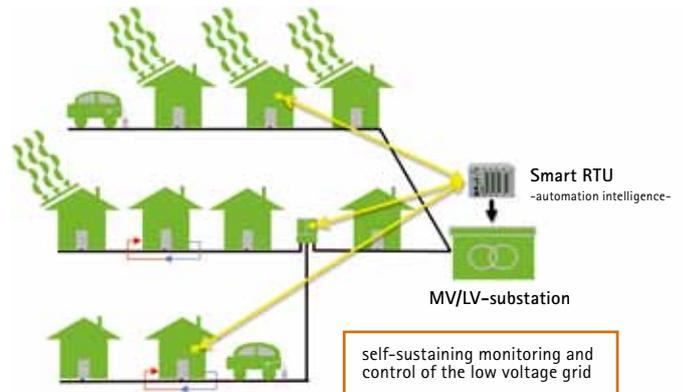
In particular, low-voltage grids that could meet these future requirements have never been planned, designed or constructed. In the past, the typical power flow was characterised by a centralised energy distribution, the maximum load in low-voltage grids always appearing near to the transformer substation. As a result of contemporary changes in energy generation, critical situations, such as a complete inversion of power flow, are appearing more often. In essence, the low-voltage grids face two basic problems:

- Deviations of the permitted voltage range ( $\pm 10\%$  according to DIN EN 50160).
- Local overloads of the grid equipment, especially of the power cables.

To overcome these problems, two solutions are proposed:

- Massive investment in additional low-voltage equipment, like cables, transformers etc. These investments will finally have to be paid for by the customers via a distinct rise in grid fees.
- Moderate investment in selective installations of local, stand-alone control intelligence. This solution is worked out in the project described.

A new method has been developed for control intelligence of low-voltage grids. This monitors the actual power flow situation and controls individual decentralised generators, like photovoltaic units, and consumer loads, such as electrical vehicles or heat pumps. This is performed by a new and cost-effective control unit (SmartRTU) installed near to the transformer substation. The control unit periodically communicates with a few measurement and control sensors placed in the branches of the grid at neuralgic points. A new power flow algorithm is used to observe the actual grid status and to send out adjustment commands. The solution is self-sustaining and does not have to be permanently connected to a superior authority.



electric powered vehicles, decentralised power generation systems, heat pumps, accumulators, cable distribution cabinets

Concept for a decentralised, automated grid framework

Institute of Power Systems Engineering

The advantage of this solution is the optimal utilisation of the existing low-voltage grid. Expensive grid enhancement such as the installation of new power cables and the repowering of installed transformers can be avoided. For the first time, the low-voltage grid will be equipped with modern automation technology. The intelligent control unit will be installed in the grid of Mainova, Frankfurt, in February 2012. This installation will be the first and only independent low-voltage grid control unit in the whole of Germany.

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### PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: September 2011 – March 2013

Funding: completely by the business partners

### PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

The described solution is the first existing smart grid approach in Germany. It is ready to enter the market and it has the capacity to revolutionise the existing electricity distribution system. The business partners have applied for a European patent for this solution to smart low-voltage grids.

### 16.3 SOLAR DECATHLON EUROPE 2010



*Solar house in Wuppertal*

*Peter Keil, Duesseldorf*

#### ABSTRACT

The project aimed to develop a completely solar-powered house for the competition, "Solar Decathlon Europe 2010". The competition included the conception, design and construction of an energy-efficient and innovative residential building with a maximum footprint of 75 qm and a height of 5.50 m. The concept should allow for the complete assembly and disassembly, including operation, of a functional house within a few days. University teams and their solar houses were selected from around the world to compete in a practical test under the same climatic conditions. In the competition phase, it was demonstrated over a period of 10 days that the building could cover its total energy consumption with the incident solar radiation and could feed surplus electricity into the grid. Although not energy-autonomous buildings, the target could perform intelligent interactions with the electricity grid to achieve an equalised energy balance. The requirements comply with those for "net zero energy buildings".

The project of the University of Wuppertal is characterised by a building that combines architectural and energy components into an integrated approach. Two solar-active wall panels are the dominant elements of this building, providing a striking symbol of the architectural and energy concept. They illustrate the spatial connection of inside and outside, expand the living room with two terraces and integrate photovoltaic and solar thermal systems as design elements.

Electricity is generated by a solar electricity plant on the roof and in the south wall. Energy management aims at covering the maximum possible proportion of the electricity consumption through the solar electricity generated from the building itself. In addition, the house has a battery pack which can store approximately the amount of electricity required for a single day's consumption. With this battery storage, the solar house acquires a high level of direct consumption coverage without buffering electricity in the public grid. The optimised use of solar energy, combined with low power consumption, gives rise to an energy plus house that can achieve a relatively high surplus depending on its location.

Since February 2011, the building has been occupied by two people. The aim is to test the living concept and functionality of all components in everyday use. The energy and indoor climate data will also be analyzed under real conditions.

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And 40 students from various disciplines.

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Business Partners:

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#### PROJECT START AND DURATION, TOTAL COSTS AND FUNDING

Project: September 2008 – January 2011

Costs: 1.7 mio. Euro

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Financial, material and planning support by numerous  
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#### PERSPECTIVES, APPROACHES AND IDEAS FOR FURTHER DEVELOPMENT AT THE EU LEVEL

The Solar Decathlon Europe is being established as an ongoing event, taking place every two years in major European locations.

Team Wuppertal's building was constructed in Wuppertal after the Madrid competition. The house is a living laboratory with continuous monitoring and energy analysis for research and education.



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The NRW Innovation Alliance, founded in January 2007, was initiated and is supported by its 29 member universities with a view to developing innovation transfer, as well as opening up more to cooperation and networking. A major objective is to give North Rhine-Westphalia's universities a clearly more important role within the framework of EU support programmes.

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