Environment and Energy in Bavaria

PROFILES
PORTRAITS
PERSPECTIVES

GLOBAL PARTNER

Transferring know-how and technology from Bavaria

Bavaria's contribution to globally sustainable water management

The International exchange of experience on the topic of water management in the Technology Transfer Water Project has now been active for almost 17 years and can look back on a track record of success. Located at the Bavarian Environment Agency's Hof site, the TTW project office was created in 1999 by the Bavarian State Ministry of the Environment and Consumer Protection to underpin international cooperation in water management issues following an increase in the demand for impartial consultancy support from partner countries and regions in central and eastern Europe.

Visiting the wastewater treatment plant Monheim as part of an expert seminar with participants from Slowakia ■

As a state-run non-commercial entity, TTW is used to channel the comprehensive experience of the Bavarian water resource management administration, as well as to provide support in building up functioning eco-management systems and setting appropriate environmental standards. TTW sees itself as a cornerstone of Germany's efforts to transfer technology in the water resources sector and to achieve implementation of the goals set out in the Agenda 21.

Conference on the topic storm water management at Gdansk – in cooperation with the Gdansk Water Foundation ■

The difficulties inherent in implementing environmental and infrastructural programmes are complex and tend to have their roots in the overall institutional field, with legal frameworks, administrative organisations, and management structures as the specific causes of most issues.

It is in this area that TTW measures are applied. In order to pass on the principles of integrated water resource management (IWRM) and good governance, TTW organises a broad range of activities to promote exchanges and educational measures to accompany projects being implemented. Within the framework of our IWRM seminars, for example, we try to offer insights into how different players in various parts of the water management sector work, removing mutual prejudices, showing the advantages of a modern services administration, and encouraging the growth of interdisciplinary networks abroad.

TTW is currently in contact with water management professionals in many countries in southern and eastern Europe, Asia, and Latin America. ■

Further information is available (in German) at:
http://www.lfu.bayern.de/wasser/ttw/index.htm

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Gersthofen Industrial Park a prime example of energy efficiency and environmental protection

Against the background of constantly rising energy and commodity prices pressure on manufacturing companies increases, to use resources more efficiently, to reduce the use of materials and associated costs and in particular: to save energy. In Gersthofen Industrial Park the operator company MVV Enamic IGS Gersthofen ensures firstly cheap energy prices due to their Refuse Derived Fuel (RDF) power plant and secondly offers a complete service in the areas of environmental protection and safety to the companies based on the site.

The focus of industrial activities in Gersthofen Industrial Park is on the production of chemicals. Energy costs are a significant factor in production for the five resident chemical companies, because the operation of process-technical plants requires a reliable (therefore seamless), ecologically sensible and economically advantageous supply with process steam.

As a result of commissioning of a highly efficient RDF power plant MVV Enamic IGS has in 2009 redesigned the steam supply of the Industrial Park and thus made it cheaper for their clients at the site. So-called replacement fuels are used as fuels. They contain the combustible ingredients from domestic and industrial waste such as paper, textiles, wood and plastics.

About half of that is of biological origin. These substances may no longer rot unused on German landfills since mid-2005. Because they contain more energy compared to normal household waste, they are excellent for the production of electricity and steam and to replace the valuable substances petroleum and natural gas. ■

Almost 100,000 tons of replacement fuels can be converted per year to process steam in the MVV Enamic IGS power plant ■

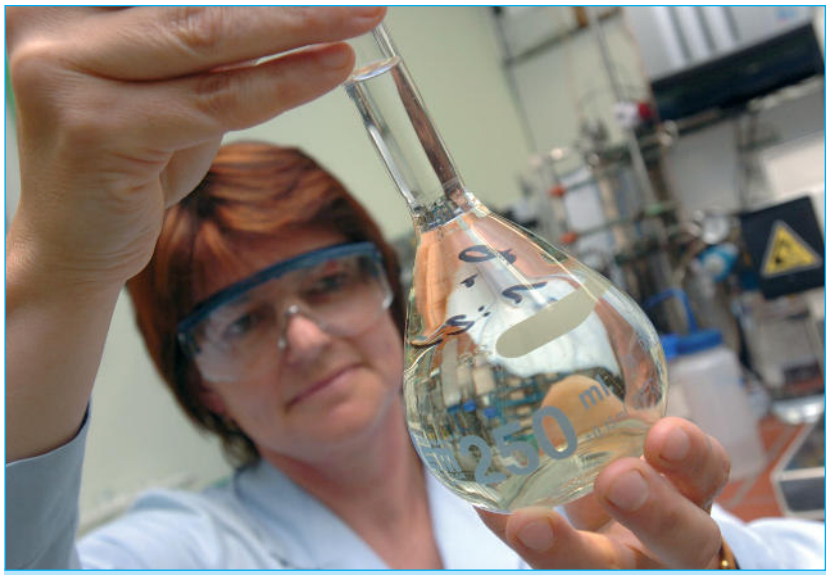
Less waste, less carbon dioxide emissions

Through the use of replacement fuels in a modern plant which is tailored to the needs of the site environmental and economic requirements can be brought in line with each other in an optimal way. Thus it is possible to recycle this waste with high efficiency. This in turn is in line with the political objectives of Bavarian waste management and saves about 20,000 tons of climated-amaging carbon dioxide per year (CO_2). ■

Competence for even more environmental protection

The protection of people and the environment from the dangers that arise from chemical production, is a major challenge for every operator. In Gersthofen Industrial Park MVV Enamic IGS operates a central waste water treatment plant with modern waste water analysis.

At this plant, special waste water taken here which does not comply with the municipal drainage statute for example, can be treated. The environmental labora-



The environmental laboratory in Gersthofen Industrial Park is equipped with the latest technology – to protect of our waters ■

tory is accredited according to EN 17025. The services in the field of wastewater analysis are varied and tailored precisely to the specific needs of the customers. ■

Information creates added value

MVV Enamic IGS not only looks after efficient energy production and requirement-compliant infrastructure, but offers its customers a wide spectrum of services, in particular in the areas of environmental protection, safety and health as well as authority management (=. ESHA). By the way, information about these subjects is made available conveniently and clearly on the new Internet platform „ESHA-Portal“ (www.esha-portal.de). In addition to approach to solutions, useful links and interesting downloads, the visitors to the website is given all important information.

The services of MVV Enamic IGS in the area of ESHA are comprehensive and based on many years of experience at a chemical site. Wherever a question arises, specialists are available, not only for the customers within the Industrial Park, but also increasingly in the region Bayerisch-Schwaben. ■

Info-box / IGS:

In Gersthofen Industrial Park the operator company MVV Enamic IGS Gersthofen GmbH provides the eleven resident companies with infrastructural as well as supply and disposal services from a single source. Among them are also energies and media that reach the production facilities of the resident producers of specialty chemicals over a wide pipe network. Other core competencies of the company are in the areas of environmental protection and safety. The services are certified according to ISO 9001:2008 and 14001:2004 and EMAS and OHSAS 18001:2007.

MVV Enamic IGS is a 100% subsidiary of one of Germany's largest energy providers, MVV Enamic GmbH, Mannheim. ■

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Shoulder responsibility!

Climate protection is not only the order of the day – it also pays off

Climate protection is a matter for all of us. This year in particular, many sights are set on what can be done to reduce CO_2 emissions in the coming decades. In the run-up to the international Climate Change Conference in Paris, Siemens has published its ambitious contribution to protecting the climate: Siemens aims to be the world's first major industrial company to achieve a net-zero carbon footprint by 2030. By as early as 2020, it plans to halve its carbon dioxide emissions, which are currently around 2.2 million tons a year.

Siemens plans to be climate neutral by 2030 ■

To achieve that, the company will invest 100 million euros in just the next three years in improving the energy footprint of its own production sites and buildings. To enable that, innovative technologies such as energy management systems, building and production process automation, and energy-efficient drive systems will be used in production. With the aid of these investments, Siemens plans to reduce its energy costs by 20 million euros a year. "Cutting our CO_2 emissions is not only an expression of our sense of responsibility, it is also good business," said Joe Kaeser, President and Chief Executive Officer of Siemens AG, when the program was published.

In addition, Siemens is using three other levers to reduce its CO_2 emissions in the long term: Greater use of decentralized energy systems in its own production sites and office buildings optimizes energy costs. Siemens is systematically committed to low-emission vehicles in its global fleet and e-mobility concepts. Moreover, the company aims to obtain its own electricity from low-carbon or CO_2-free sources, such as gas and wind, in the future and thereby achieve a clean energy mix.

Siemens will launch the program to reduce CO_2 emissions next fiscal year: Around 40 million euros will be invested at 15 different production sites worldwide in order to improve energy efficiency. Siemens is investing in the building of the future with its new headquarters.

Siemens is thus setting a good example and supporting not only its customers around the world in enhancing energy efficiency and ensuring more sparing use of resources with its leading-edge technologies, but is also using them at its own locations. That

Siemens' Environmental Portfolio helps customers to lower their CO_2-Footprint ■

pays off for Siemens and the environment! ■

The Siemens Environmental Portfolio

The Siemens Environmental Portfolio comprises 10 fields of technology throughout the electrification value chain. For each of the areas, we offer innovative products, solutions and services and help our customers increase their energy efficiency, cut costs and reduce their CO_2 footprint.

Products, solutions and services that have a significantly higher efficiency than a comparable solution qualify as energy-efficient. The condition for that is that energy efficiency must be improved by at least 20 percent or the greenhouse gas reduction for all annually installed products, solutions and services must be at least 100,000 tons of CO_2 in the usage phase.

The area of renewable energies comprises technologies such as wind turbines and hydropower solutions, as well as smart meters or intelligent controllers for energy distribution networks.

In fiscal 2014 alone, Siemens enabled customers of the Environmental Portfolio to reduce CO_2 emissions by around 428 million tons or approximately 50% of the annual figure for Germany. ■

Increasing energy efficiency

The installation equipment factory in Regensburg is steeped in tradition and produces circuit breakers and residual current circuit breakers. Back in 2012, it upgraded its heating technology, lighting and ventilation technology and made them more energy-efficient.

Since then, several measures have been tackled: Two combined heat and power units have been installed, the existing steam boiler system has been replaced with two hot water boilers and the heating network has been converted from hot to warm water. In conjunction with the new building control system, the result is far less heat loss. In addition, hot water air heaters have been replaced by more efficient ventilation equipment. There is also more efficient lighting technology enabling employees to use daylight better, which saves energy.

All in all, 2.2 million euros were invested in Regensburg. That sum will be recouped in four years: CO_2 emissions will be reduced by 1,500 tons each year and savings of 600,000 euros will be achieved per annum. The objective is for the ways in which Regensburg has already made good advances to be adopted worldwide. ■

The very highest sustainability standards

With its new headquarters in Munich, Siemens will create a modern, inspiring working environment for its employees over around 45,000 square meters of above-ground building space by 2016. Eco-friendliness and energy efficiency are key elements in the new building: It is to meet the world's highest standards for

Energy efficiency significantly increased - Siemens' installation equipment factory in Regensburg ■

Siemens' new headquarters in Munich will meet highest standards for sustainability ■

sustainability – and be certified in accordance with LEED and DGNB Platinum.

The building's fittings are totally geared toward efficiency – from intelligent facades that respond to sunlight and temperature conditions to highly efficient artificial lighting and air-conditioning. Photovoltaic systems and heat pumps generate energy for heating and cooling. Up to 95 tons of water are circulated in pipes in the floor slab each hour. As a result, the 29,000-ton concrete slab becomes an efficient means of storing energy. The crucial element for building efficiency is Siemens' control system Desigo. The building automation platform detects when people are present in rooms and then regulates the room temperature and lighting. Sensors check the temperature, room humidity and CO_2 level by means of a touchpad and at the same time control the amount of light. Siemens solutions are also used for the energy supply, distribution and energy management. ■

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Service with responsibility

BUCHEN UmweltService GmbH

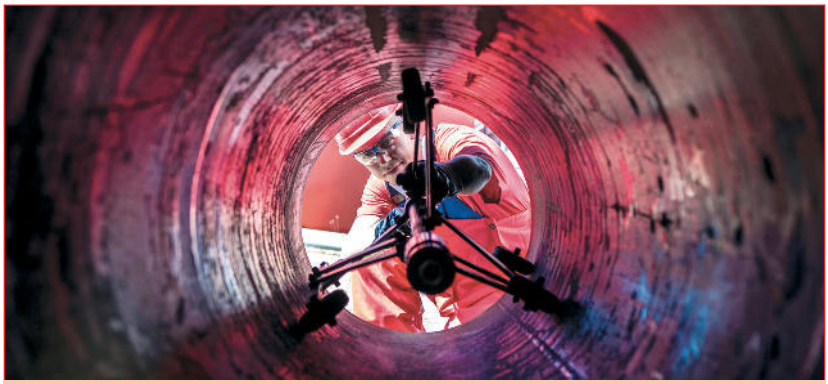
With around 2,700 employees, BUCHEN is one of the leading service providers in Europe and works mainly for refineries, chemical corporations and companies in the heavy industry. Due to its comprehensive range of services, innovative technology, automated processes and qualified professionals, BUCHEN makes an important contribution to maintaining the value and trouble-free operation of industrial plants.

The highest standards of safety as well as health and environmental protection are what set us apart. We set out our principles of occupational safety long ago. Today, they are an integral component of our process-oriented management system.

Throughout Europe, all BUCHEN divisions are certified to quality, safety and environmental standards. We also adhere to the statutes of the internationally recognised SCC standard. Our compliance with this standard is regularly checked by independent auditors, thus verifying the proper and safety-oriented execution of our services!

Moreover, we cultivate the risk and environmental awareness of our employees with regular training courses. Training and further education programmes keep our employees' expertise up to date and their technical and craftsmanship skills are continuously being further developed at our certified training centre.

We only ever deploy experienced and safety-conscious employees in critical environments and for tasks with extreme requirements. Our specialists can rely on their state-of-the-art equipment, such as breathing apparatus or HAZMAT suits, as they are maintained in our own company workshops.



Special industrial cleaning processes for various plant components – for example, containers, tanks, heat exchangers, piping systems and many more – are just one of the numerous professional specialty services offered by BUCHEN ■

Together with XERVON, BUCHEN and its subsidiaries and affiliates represent the specialised "Industrial Services" division within the REMONDIS Group, one of the largest privately-owned recycling, water and service companies.

As a result, BUCHEN's customers are not only able to use the services of the individual companies to their advantage, but can also benefit from the comprehensive concepts drawn up to cover a wide range of production and maintenance tasks.

BUCHEN services at a glance:

- Industrial cleaning
- Tank services
- Turnaround management
- Emergency management
- Power plant services
- Reactor services
- Sludge dewatering
- Foundry services
- Waste management
- Surface technology
- Cold cutting
- Nuclear services
- Remediation
- Sewer services
- Suction dredge services
- Safety services
- Silo cleaning
- Services for plate heat exchangers
- Dismantling of industrial plants

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Between reality and realization

Energy usage plans support Bavarian communities to efficiently use alternative sources of energy. To date they still have difficulties with the implementation of the stated package of measures.

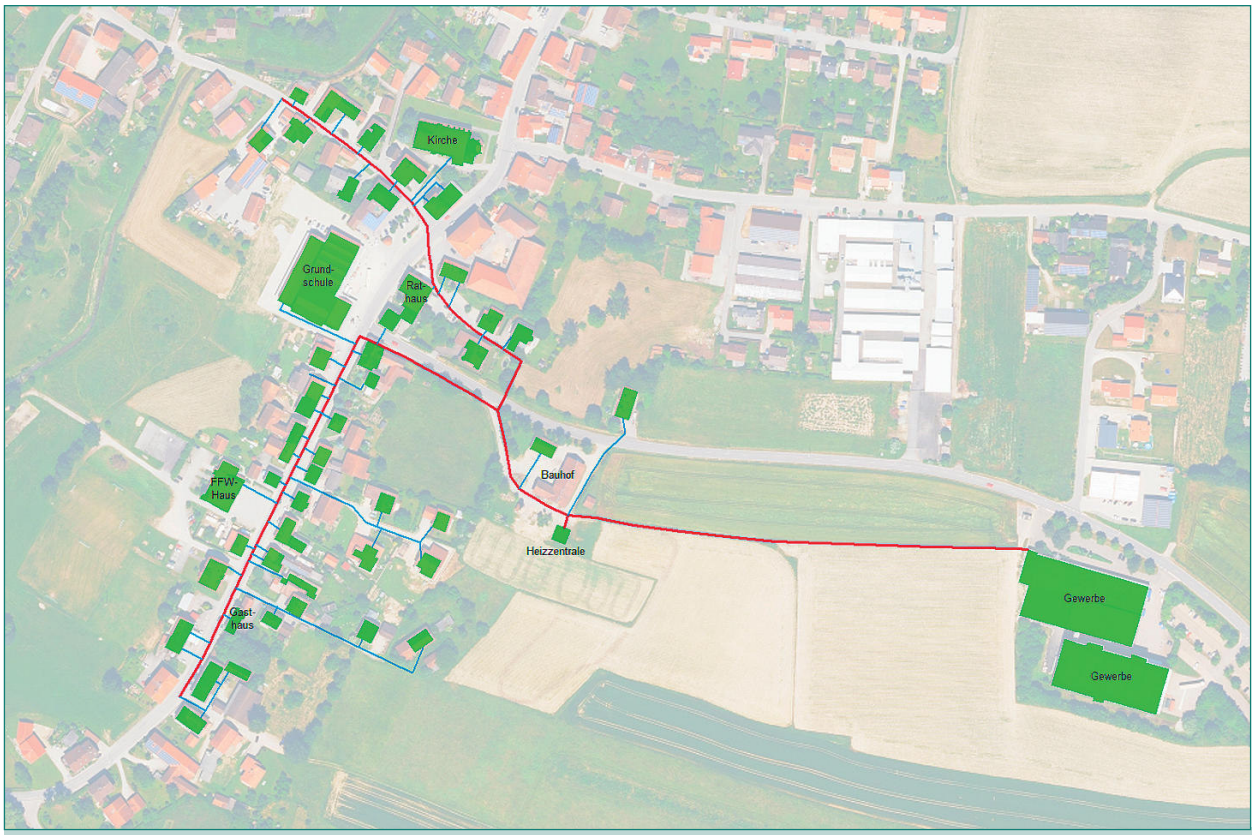
What structure plans mean for the urban and regional planning in Germany, this is what energy usage plans weigh for the energy administration of communities in the federal state of Bavaria. As a front-ranking and especially innovative planning tool these plans support communities and rural districts in handling the energy topics electricity and heat by providing realistic basics for the implementation of energy efficient measures. Depending on the horizon and the specific requirement of the community, it is profitable in a medium or long-term time span. ■

Connection of ecology and economy

Stated goal of an energy usage plan is the meaningful connection of ecology and economy: of energy friendly, alternative sources of energy and economic efficiency. Its preparation is pushed by largely provided grants of the Bavarian state. Divided into the three main stages inventory and potential analysis, concept development and implementation of the measures, the offer is so far eagerly accepted. The only exception is the third phase, exactly then when it comes to the realization of the concept. Here gaps a notable distance between reality and realization. ■

Financing

The reasons for the lacking implementation are versatile. One of the main reasons is very classic-money. Other than for the clear in price graded planning tools, here the communities have to execute vast investments for the implementation of the planned projects in a relatively short



Feasibility study for a heat grid as implementation of an urban energy concept ■

COPLAN AG

Presentation at the opening event for a county energy usage plan ■

timeframe. This is even harder as the success – in form of a transition to an ecologically oriented and permanent profitable energy production – can only be seen in the long-run. Another reason is, according to Andreas Huber, project manager at the engineering company COPLAN AG, the general situation of grants after the completion of the energy usage plan. "The criteria for the preparation of an energy usage plan are relatively manageable and can be realized with a modest effort. The incentives situation afterwards is rather confusing and requires, especially with reference to the administration, considerable persistence. "And in general, the administration: "The stress barriers of many communities are reached or definitely exceeded here", says Huber. ■

Prospects at the heat market

In order to push the topic energy further at regional level and as precise as possible, the engineering company offers an energy-coaching, so to say a light version of the energy usage plan. COPLAN AG attends already 16 communities in the administrative district upper Bavaria within the scope of energy coaching. "Primarily are currently energy topics related to heat" states Huber. "This is due to quite pragmatic reasons. Wind power is out of most community's league, and referring to water the state of Bavaria is ever since well-placed. The only potential is the reconstruction of big or the

Publicity event for an urban energy concept, Mayor Hermann Etzel (Municipality Egglham) and Andreas Huber, M.Sc. (COPLAN AG) ■

new building of small hydroelectric power stations." With reference to the construction of biogas and solar power systems there is, by Huber, currently only a little enthusiasm, since grants of country and state have been reduced lately. ■

Feasibility check as step to the implementation

Another step towards the implementation of energy usage plans are feasibility studies. From a project's point of view, they could make up a toehold between planning and implementation. Unfortunately the experience does not comply with the theoretic promises. "Experience shows that they only close the gap in very rare cases. These feasibility studies often provide no additional immersion or ascertainment to the existing energy usage plans, but show at this stage only planning alternatives. There is no measurable additional use for investors and operators." ■

Communication is the key

Along with thematically targeted, customer-oriented measures like energy coaching, COPLAN lately focuses on the factor communication. "Our experiences here have been completely positive", resumes Huber. "When it works to sensitize a community's or county's inhabitants for a special topic and hereby motivate them, it is easier for decision maker to have the green light for large investments. This is why we always search for measures, in large scale projects, that promote the participation of the public." ■

Second surge of energy usage plans

Hope for a more ecological economy generates, from the engineering service's point of view, the second surge of energy usage plans. Huber: "Especially the communities that deal with the topic of energy usage plans for a short time span, approach the topic with a less global and instead a more precise focus on special topics and projects. Since we do not only develop concepts, but want to realize them, this accommodates us." ■

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Energy-efficient and self-determined living through intelligent automation technology

The Federal Government of Germany aims at reducing the primary energy consumption by 50 % from 2008 to 2050. Taking into account that households – besides industry and transportation - represent the largest consumer group contributing approximately 27 % to the total energy consumption, it is obvious that in the field of energy efficiency of residences actions are required in order to achieve this goal. For this reason, the Bavarian State Ministry of Education, Science and the Arts has founded the E|Home-Center – Bavarian Technology Center for Domestic Living - in April 2012 as an interdisciplinary and institution-spanning research center at the University of Erlangen-Nuremberg (FAU) under the guidance of Prof. Dr.-Ing. Jörg Franke. Research is not only focussing on the aspect of energy efficiency in residential environments as it also considers other areas like comfort, security and infotainment *(see figure 1)*. This holistic approach also allows addressing problems resulting from the demographic change and user acceptance in order to create holistic solutions. This way, it becomes possible to master the area of conflict between economy, ecology and sociology in private residencies.

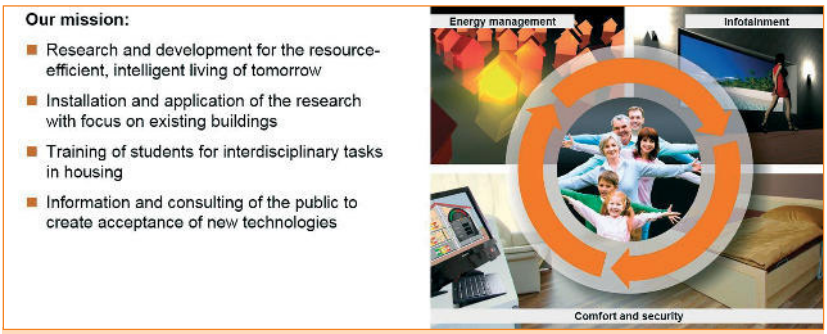

Fig. 1: *Mission of the E|Home-Center* ■

To perform this research task adequately, the E|Home-Center employs a research advisory board with representatives from science and industry in order to judge the proposed project ideas. This ensures that the addressed research topics have a high scientific standard and are at the same time application-oriented. This approach allows that the research results of the ongoing projects that are carried out in cooperation with partners from the industry can quickly be transfered into commercial solutions and take effect immediately in the application environment. The following paragraphs give an overview of the ongoing research activities at the E|Home-Center. ■

Aerodynamic and aero-acoustic optimization of small wind turbines

As part of the energy transition and the increased awareness of the need for ecological power generation, wind energy in Germany is gaining more and more importance.

In addition to conventional large wind turbines, small wind turbines are considered to be a way of using wind power in populated areas. These systems can be installed either detached near houses in rural areas or on roofs in an urban environment. So far, noise emission problems as well as production costs are reasons that hinder the broad use of small wind turbines.

Therefore research at the E|Home-Center is conducted under the management of the Institute for Process Machinery and Systems Engineering in cooperation with the Institute for Factory Automation and Production Systems (FAPS) - both FAU – not only on the aerodynamic and aero-acoustic optimization of small wind turbines, but also on concepts for low-cost manufacturing *(see figure 2)*. [3,4] ■

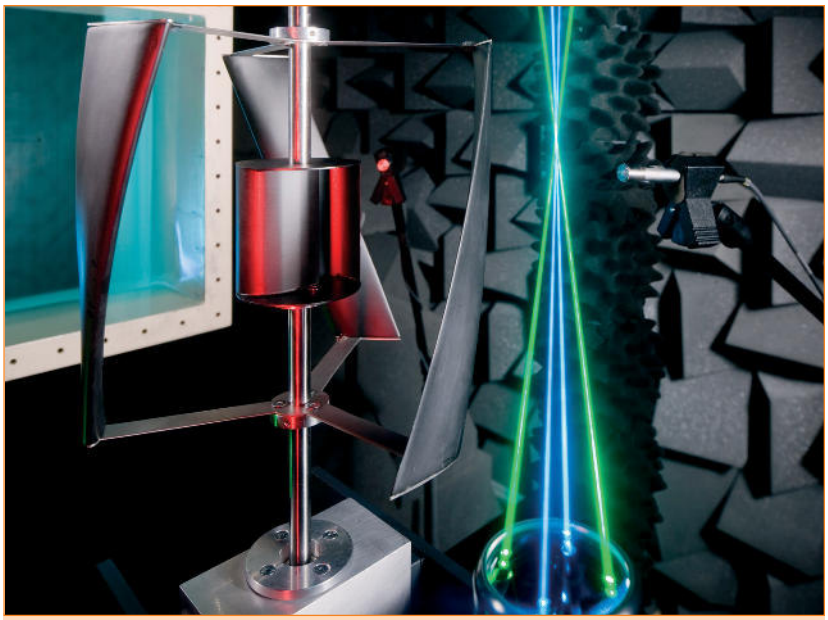

Fig 2: *Wind tunnel tests on a model of the small wind turbine for aeroacoustic review (Picture: Kurt Fuchs)* ■

Design of a new room ventilation system with heat recovery (REGVENT)

Due to stricter specifications concerning the insulation for new and renovated buildings the heat transmission demand of buildings was reduced, but on the other hand, the natural air exchange with the environment was largely suppressed.

Nevertheless, a regular air exchange is indispensable for the preservation of a pleasant room climate and to avoid moisture damage. For this reason, the usage of ventilation systems with heat recovery is a common standard in order to accomplish the required air exchange with little heat loss. Within the REGVENT project the E|HomeCenter under guidance of the institutes of Process Machinery and Systems Engineering and FAPS (both FAU) with support of the cooperation partners WBG Nürnberg GmbH, ebmpapst group, ANSYS Inc. and Meltem Wärmerückgewinnung GmbH & Co. KG develops a new concept for such a ventilation system, where the waste and fresh air transport as well as the heat transmission are bundled within a single functional element *(see figure 3)*. The concept is characterized not only by its extremely compact and low-cost structure but also by excellent acoustic properties.

This makes it ideal for the use as a decentralized ventilation system in the area of energy-efficient renovation of buildings. The experimental investigations of the concept are accompanied by flow and heat transfer simulations in order to allow a comprehensive study of various configurations. By using the gained knowledge an optimized ventilation system can be determined at the end of the project and tested in a field trial under real operating conditions. ■

CO_2-neutral extraction and reuse of heat and electricity in the household

The aim of this research project, which takes place under the guidance of the Institute of Separation Science & Technology (FAU), is an enhanced self-sufficiency and a reduced resource consumption of private households by linking the energy forms electricity and heat. To this end various thermodynamic analysis and simulations are carried out to identify potential savings and to evaluate these. Based on these results promising options are selected and their technical and economic feasibility will be examined in greater detail. An interesting starting point is the allocation of cold for fridges, freezers and air conditioning in the residential sector as about 17 % of the total demand of electrical energy of homes is consumed in this context. Within this project several innovative concepts are presented to enhance the energy efficiency of refrigerators and freezers as well as to reduce the energy requirements for the allocation of cold for cooling and freezing purposes. Amongst others, possibilities for using waste heat from refrigerators and freezers in order to support the household's hot water supply or for tapping into ambient cold by means of heat pipes and cold storages are studied. ■

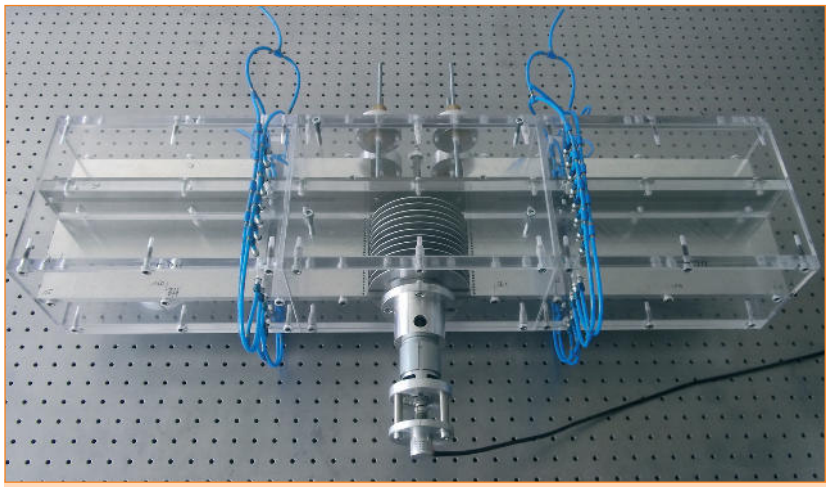

Fig. 3: *Experimental prototype of the ventilation system with integrated heat recovery* ■

Decentralized control of private homes with intelligent sensors and OPC UA based on the paradigms of Industry 4.0

The technical integration of automation components in the design of smart homes is a major challenge. Reasons are a number of established communication standards that are not interoperable with each other as well as substantial configuration efforts. Together with the partner Siemens AG, the FAPS institute and the Institute of Computer Architecture (both FAU) create the foundation for a self-organizing smart home environment *(see figure 4)*. As part of the research project, the decentralized control of smart homes using intelligent sensors and actuators communicating based on the OPC UA technology is pursued thus enhancing the picture of the future envisioned by Industry 4.0.

During the project it will be evaluated, to what extent building on this technology stack is able to remedy the previously described deficiencies. In a first step relevant application scenarios are identified in order to allow the creation of a semantic information model that describes individual system nodes and their interactions.

Afterwards it will be transferred automatically by a software framework onto abstract system components. In the following, a simulative analysis of the components and their behavioural interaction will be carried out before they are mapped onto suitable hardware and software components.

The resulting sensor respectively actuator nodes are then joined together into a demonstrator representing the selected application scenarios and evaluated in terms of their performance afterwards. [5] ■

Developing self-sufficient and intelligent miniature sensors for self-determined living (AIMS)

The integration of a variety of sensors and actuators will be one of the greatest challenges in the field of digital living in the coming years. In order to integrate an automatic and intelligent control for indoor climate optimization, heating cost reduction and vital data acquisition, not only global parameters such as room temperature and brightness need to be measured, moreover information about local properties (e.g. lighting conditions in every corner of the room, temperature and airflow at every window) are necessary. As part of the self-organizing autonomous infrastructure, actuators can be controlled in a defined and resource-saving way. However, it is not possible with current sensors to achieve a more comprehensive coverage of a residence. The reason for this can be found in the structure and design of such sensors, which consist primarily of standard electronic components on a printed circuit board. This leads to large dimensions and a high power consumption rendering stand-alone operation of these sensors impossible. One possible solution to this dilemma is the integration of all components within a highly integrated circuit. This allows the space and energy requirements to be significantly reduced. Other advantages such as the realization of redundant wireless sensors and the possibility of energetic self-sufficiency also foster a development in this direction. In order to achieve the long term

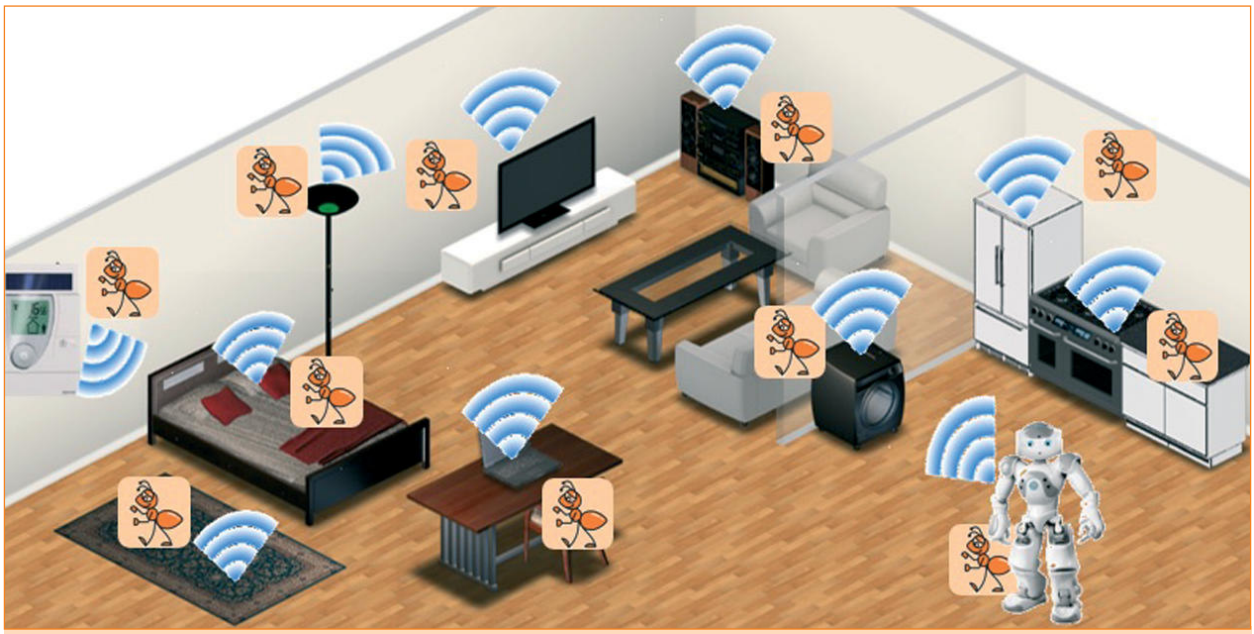

Fig. 4: *Self-organizing autonomous systems satisfy individual residents' needs with framework support* ■

goal of a „smart sensor to glue“ that can be placed almost arbitrarily across a residence, this project is carried out as a first step by the research partners Institute of Computer Architecture and Institute for Electronics Engineering (both FAU) in cooperation with LFoundry SrL and aims at developing an energy-efficient prototypical sensor based on a pressure sensor. Sensor, analogue/digital conversion and data processing are to be integrated into one chip using a specifically optimized low-power technology. Through defined interfaces and a generic architecture an integration of different sensors and various forms of data processing can easily be implemented. ■

Development of an intelligent system for training the cognitive and motor-driven abilities at home (MentalHealth@Home)

This project sets up a prototypical IT-system to train the cognitive and motor-driven abilities of elderly people. It is a joint project of the International Dialogue College and Research Institute of the University of Applied Science Wilhelm Loehe, FAPS and the SIMA Academy of Diakonie Neuendettelsau. This system is based on a proven dementia prevention and therapy concept and aims at training the cognitive and motor-driven skills of elderly people therefore preserving their capabilities for a self-determined living. By digitizing the dementia prevention program that normally takes place in small groups, a way of fostering the self-determined living for the elderly is provided even in sparsely populated regions. The combination of mind and movement exercises provides valuable support in the field of dementia prevention. The development of the system prototype is carried out based on user-centred design and its human-machine interface is displayed on the TV allowing for a seamless integration into the everyday life of the residents. He or she can train in virtual groups that also provide a means to contact a virtual coach by video chat if required who can assess the executed movements tracked by a Kinect camera *(see figure 5)*. [6,7] ■

Summary

The described research activities of the E|Home-Center have the objective to improve the energy efficiency of residential buildings in combination with the living comfort. Following this approach a substantial contribution to support the energy transition in Germany is provided from the field of domestic living. Additional information concerning the E|Home-Center as well as a comprehensive overview of its research projects is available under [8]. Further research projects of the E|Home-Center, namely those whose field test is carried out in the laboratory of the energy transition of SWW Wunsiedel GmbH, will be presented in the following article. ■

Literature

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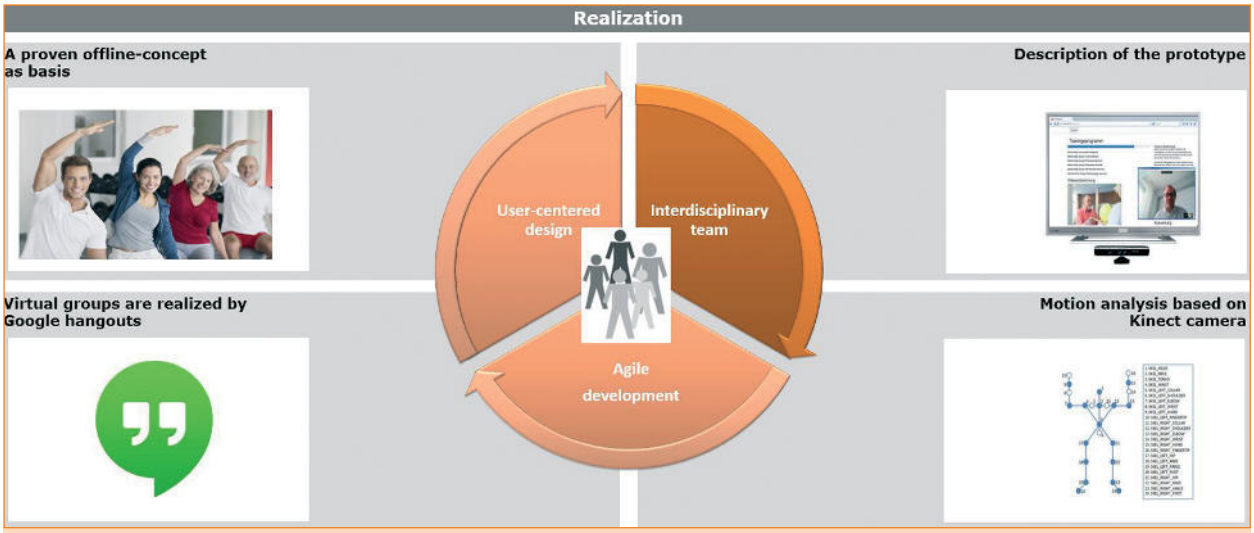

Fig. 5: *System concept of the digital dementia prevention program* ■

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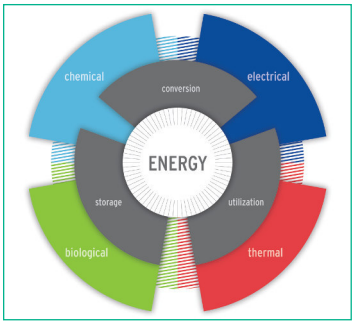

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