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ER-WIN INNOVATION CLUSTER
Greater Energy Efficiency in Saxony-Anhalt's Companies

DIGITAL SIMULATION OF OPERATIONS
Analysis of the Stork System

HEATING WITH PAINT AND PLASTIC WASTES
Cutting Disposal and Heating Costs

16TH IFF SCIENCE DAYS

JUNE 18 – 20, 2013

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» We are well on our way to making the idea of resource efficient production reality. «

Prof. Michael Schenk,
Director of the Fraunhofer Institute for Factory Operation and Automation IFF. Photo: Dirk Mahler

Editorial

Dear Readers,

Europe is rethinking its strategy and planning its reindustrialization. A robust industry will be the foundation for safeguarding prosperity long term. Statistics have been recording noticeable deindustrialization on the continent since 2000 at the latest. Official figures reveal that industry has dropped from making up twenty-two percent of the European economy at that time to fifteen percent today. The reason is that many European states have neglected development of the industrial sector in recent years. This has affected their sustainable value added and employment adversely. Consequently, the European Union is intent on raising the manufacturing industry's average share in the European gross domestic product to 20 percent again by 2020.

At the same time, this entails a commitment to modernize production systems. Research and business are already developing new solutions for this "third industrial revolution" under such catchphrases as "integrated industry", "cloud manufacturing" or "factory of the future". One idea unites them all: Industrial production in Europe needs to be smarter, more efficient and simultaneously greener. On the one hand, the focus is on developing technological know-how, high quality and efficiency and flexibility in order to keep European businesses competitive against their competition all over the world. On the other hand, this ambitious undertaking should not torpedo the European Union's climate targets, which are intended to reduce greenhouse gas emissions significantly by 2020 and beyond. In certain respects, Germany should be able to serve as a model for this.

The EU has defined various headline targets in its Europe 2020 strategy, which are closely aligned with this undertaking. In addition to supporting training and education and expanding the European market, they also include increasing expenditures for research and development. New technologies and qualified employees are supposed to help businesses prepare for future challenges. One of these challenges is dealing with the increasing scarcity and expense of of energy and raw materials, which, however, are needed now more than ever.

Attention is inevitably being focused on renewable energies and a green circular economy. We at the Fraunhofer IFF are also already working on solutions today, which will soon enable industry to manufacture largely with volatile, renewable energies alone while they simultaneously boost their energy productivity. We are also developing technologies that empower factories to manufacture even more greenly. We are interfacing companies, equipment and information systems and thus assuring more reliability and efficiency. We are also integrating new robots in production environments so that they relieve skilled labor of work.

Thus, we are well on our way to making the idea of resource efficient production reality. This latest issue of our IFFocus reports on some instances in which we have already done exactly this.

Your,

Prof. Michael Schenk

ER-WIN Innovation Cluster

Greater Energy Efficiency in Saxony-Anhalt's Companies

Energy and resource consumption is increasingly becoming an important competitive factor for industry. Energy prices in particular can be expected to continue rising in the long-term, not only in the course of the energy transitions. This will especially affect manufacturing companies in Saxony-Anhalt. The newly established ER-WIN Innovation Cluster is intended to help companies manufacture more energy and resource efficiently in the future with new technologies and solutions.

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Digital Simulation of Operations: The Analysis of Stork's System

Digital simulations helped engineers from the Fraunhofer IFF untangle and expedite truck traffic on the premises of the environmental service provider Stork.

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Heating with Waste from Coatings and Plastics

Metal coaters can cut disposal and heating costs with a combustor for powdery residues.

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Interview

Prof. Reimund Neugebauer, President of the Fraunhofer-Gesellschaft, on energy and resource efficiency and its importance for industry

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Sharp Minds

Who earned a doctorate? Who is new at the Fraunhofer IFF? What honors were bestowed on its researchers? Find out here.

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Producing More Value

New Fraunhofer Innovation Cluster ER-WIN Launched

Prof. Michael Schenk and then-minister Prof. Birgitta Wolff announce the launch of the ER-WIN innovation cluster. Photos: Viktoria Kühne

Rising energy and raw material prices are becoming the important competitive factor for Saxony-Anhalt's economy. The new innovation cluster ER-WIN under the lead management of the Fraunhofer IFF will therefore be developing innovative solutions in order to improve energy and resource efficiency in the manufacturing industry. A press conference at the Fraunhofer IFF in Magdeburg on April 15, 2013 officially kicked off the project.

Together with Otto von Guericke University Magdeburg and numerous other development and business partners from Saxony-Anhalt, the ER-WIN cluster will pool regional know-how to ensure that regional industry remains competitive in the long term. The state is also backing this intensively Then-Saxony-Anhalt Minister of Economics and Research Prof. Birgitta Wolff stressed that, "Rising energy prices are having a particularly great impact on industry. The state is therefore supporting the improvement of energy efficiency in regional companies and backing solutions that will make them more independent from the volatile energy market. Innovative projects that strengthen the region's economic structure and simultaneously build upon the state's distinctive features such as its higher than average share of renewable energies in the energy mix, which are produced here, deserve particular attention."

Prof. Schenk, Director of the Fraunhofer IFF, see two challenges in particular. "The primary goal is to cut production costs in order to keep regional businesses competitive. We want the ER-WIN innovation cluster to help companies manufacture more energy efficiently and more resource efficiently in the coming years," says Schenk. "This will require generating value adding synergies directly in companies as well as between different companies. We intend to achieve this by employing technical, organizational and technological innovations. One element of this will be to make renewable power produced in the region available for production." ■

www.fraunhofer.iff.de

Kerstin Stork, owner of Stork Umweltdienste GmbH, has been collaborating with the Farunhofer IFF for nearly four years. Her advice for other companies:

» Simply venture the step and approach the Fraunhofer IFF, Exceptional collaboration is bound to result. «

Dr. Jürgen Reinemuth, CEO of Taletec GmbH.

» Our production requires tremendous amounts of electricity and gas. Our goal is to save energy everywhere. For us, that means safeguarding jobs in the long term. «

One Standard for All: Standardized Tests for System Components Will Advance Electric Vehicle Network Integration

Differing standards for system components for vehicle-to-grid communication (V2G CI) is one of the things still slowing the commercialization of electric vehicles. They are supposed to enable electric vehicles, supply systems and electrical grids to communicate with each other in order to exchange information on charge levels, types of charges, ranges, energy prices and grid statuses with smart grids in the future.

Since complex compatibility tests and modifications have been needed to assure the requisite interoperability of manufacturers' products, the new binding standard for system components ISO/IEC 15118 was adopted to reduce the labor required to modify products and to expedite their market launch.

BMW, Continental, Daimler, Fraunhofer, RWE, Siemens, the Technical University of Dortmund and VW, all of which are German proponents of international standardization for V2G CI, have joined forces in the project "eNterop" to create an open test platform and a reference implementation for this interface between electric vehicles and charging infrastructures. They intend to develop the "eNterop" test system by 2014. It will enable any manufacture to quickly test its products' compliance with the ISO/IEC standards adopted for electric vehicles.

Government, industry and research representatives had the opportunity to exchange views on the current state of developments at the exhibition at the first eNterop event. Photo: Siemens AG

The Fraunhofer IFF is a partner in "eNterop" and primarily in charge of analyzing the test platform's requirements and drafting its specifications as well as developing and implementing the requisite test procedures. It is additionally seeing to it that automotive and charging infrastructure manufacturers and suppliers are involved in the project work. The two-year, international flagship project has a total budget of € 4.6 million. Half of this is being contributed by the Federal Ministry of Economics and Technology. ■

www.enterop.net

Common Cause with the Université du Havre

The Fraunhofer IFF and the Institut Supérieur d'Etudes Logistiques ISEL of the Université du Havre sealed their future research plans when they signed a memorandum of understanding. They expect their partnership to bring promising collaboration in the field of logistics and an expansion of international relations and partnerships.

The sister cities partnership entered into by Magdeburg and Le Havre in May of 2011 quickly revealed ties in logistics and provided both institutions the best prerequisites for successful collaboration. Reciprocal visits strengthened their intention until the memorandum of understanding was eventually signed in December of 2012 at a ceremony marking the opening of the first streetcar line in Le Havre. ■

Prof. Michael Schenk with Brigitte Dufour, Deputy Mayor of Le Havre, on his return visit to France. Photo: Nicolas Barubé

Sergej Boev, Director General of RTI (center left), and Prof. Michael Schenk, Director of the Fraunhofer Institute for Factory Operation and Automation IFF (center right), at the signing of the cooperation agreement at the Hannover Messe. Photo: Bildschön GmbH, A. Genz

RTI Technologies Joins the »Morgenstadt« Research Initiative

The Fraunhofer-Gesellschaft and the Russian company RTI Technologies signed a cooperation agreement on April 9, 2013, which officially made the latter a member of the "Morgenstadt: City Insights" research initiative. RTI will be collaborating closely with the Fraunhofer Institutes involved in this innovation network.

The level of urbanization will reach 60 percent, corresponding to an urban population of five billion, by 2030. The world will thus have to absorb and provide for 1.8 billion new city dwellers in the coming years. Cities, however, need energy and raw material, produce garbage and pollution and have overburdened transportation systems. All of this is already now confronting cities with major challenges related to urban planning, construction, transportation, security, energy and climate protection. Fraunhofer researchers have joined together in the "Morgenstadt" innovation network to develop sustainable urban technologies and systems. The goal of the "Morgenstadt" is to develop and design livable, sustainable and viable cities of tomorrow.

Different institutes in the Fraunhofer-Gesellschaft are collaborating to make this vision reality. The initiative's core themes are energy, buildings, production and logistics, transportation and traffic, information and communication, urban processes and organization, and security and protection. "RTI has extensive experience putting ready-made solutions for effective and reliable urban development into practice in Russia. Many of them, already implemented in modern metropolises, meet international standards. Together with foreign partners, we will be able to effectively modify our developments to create and spread 'secure and smart cities' while allowing for current trends and tendencies," explains Sergej Boev, Director General of RTI.

The object of the agreement between RTI and the Fraunhofer-Gesellschaft is the completion of research by the Fraunhofer Institute for Factory Operation and Automation IFF in Magdeburg and other Fraunhofer Institutes. This will center on compiling an overview of and analyzing globally innovative methods for sustainable new urban development and on combining urban technology systems, economic models and management systems in one comprehensive approach to research. ■

www.morgenstadt.de

Aviation Builder of the Year

That is the name of the award conferred by the Russian Union of Aviation Industrialists in the fall of 2012. The Fraunhofer IFF placed second in the category "Best Foreign Partner of Russian Aviation Builders" and received its award at a ceremony in Moscow on December 5, 2012. The Magdeburg research institute's years of collaboration with the Russian State Research Institute of Aviation Systems FGUP GosNIIAS was the decisive factor in the selection of the Fraunhofer IFF.

Their collaboration grew out of a strategic partnership in education, research and innovation initiated in April of 2005 by then-German Chancellor Gerhard Schröder and President Vladimir Putin. One focus of cooperation was the integration of RFID systems in aviation. ■

Hannover Messe

Fraunhofer IFF Presents Smart Technologies for **Sustainable Manufacturing**

Researchers from the Fraunhofer IFF presented new solutions from their research in digital engineering, automation, logistics and process and plant engineering at the world's largest technology trade fair on April 8 to 12, 2013. In keeping with this year's fair's theme of "Integrated Industries", they focused on key technologies and services in industrial manufacturing and technological innovations for productivity and efficiency. Visitors learned about our latest developments in the fields of smart residue recycling for resource efficient production, safe human-robot interaction, electric vehicle networks and smart logistics. The Fraunhofer IFF exhibited at seven different booths.

At the Fraunhofer-Gesellschaft's main booth, process and plant engineering experts from the Fraunhofer IFF showed a way to recycle residues smartly to manufacture more resource efficiently. They presented a combustor for powdery residues to explain how companies will be able to cut both disposal costs and heating costs in the future.

The Fraunhofer-Gesellschaft's Production Group was also represented with a booth of its own at which the Fraunhofer IFF's experts in robotics presented a tactile sensor system that enables robots to "feel" contact like an artificial skin. This makes it a key technology essential to safe human-machine interaction.

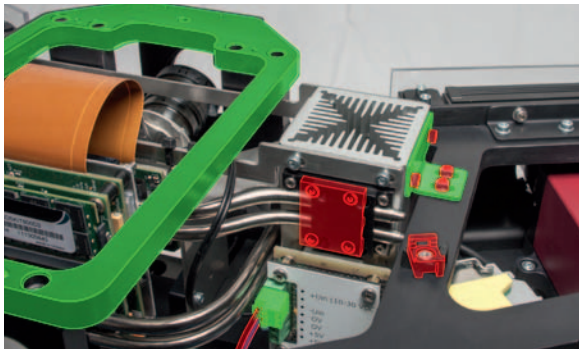
At the Fraunhofer Energy Alliance's booth, researchers from Magdeburg presented a new system for easy compatibility checks. Electric vehicles and charging stations are not always compatible. Differing manufacturers' systems are often to blame. Consequently, vehicles are not recognized and charged. A test box developed at the Fraunhofer IFF will enable manufactures to check the compatibility of their electric vehicle components with other manufactures' systems quickly in the future. ■

In the future, drivers of any make of electric vehicle will be able to charge their batteries anywhere without any problems. The test box developed at the Fraunhofer IFF will make it significantly easier for companies to test their system's compatibility extensively. Photo: Dirk Mahler

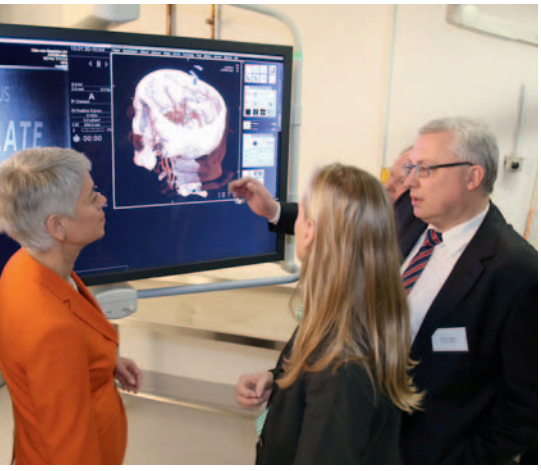
Control Trade Fair: In-line **Digital Assembly and Quality Inspection**

Not even the minutest deviations go undetected: Researchers at the Fraunhofer IFF have created the "Wheelinspector", an in-line compatible system that inspects 100 percent of vehicle wheels without contact. Visitors to Control 2013 were able to see a live demonstration of the technology. The Fraunhofer IFF's experts presented a wheel inspection system complete with the "Wheelinspector".

They also presented another development: Their digital assembly inspection system automatically inspects quality even when products are manufactured in small quantities. As in many sectors, the aircraft industry manufactures its products in small quantities. Production lines are not geared toward mass production because every airline desires its own interior. Since manual assembly procedures are common and assembly jobs change continually, automatic quality inspection has not been worthwhile. Novel software developed at the Fraunhofer IFF is changing this: It uses cameras to compare particular CAD data with a finished assembled product digitally and factors in modifications with a click of a mouse. Our experts presented these and other solutions at Control 2013 in Stuttgart from May 14 to 17. ■



In model-based assembly, software compares assembled components' digital target data with the real outcome. Errors are detected immediately.



Researchers in Magdeburg are Developing **Medical Technology** for the 21st Century

Prof. Martin Skalej (r.), Director of the Neuroradiology Department of University Hospital in Magdeburg, explaining the potentials of image-guided minimally invasive methods of medical treatment to State Secretary Cornelia Quennet-Thielen (l.) from the Federal Ministry of Education and Research and Saxony-Anhalt Minister of Research, Prof. Birgitta Wolff (m.).
Photo: Viktoria Kühne/OVGU

The STIMULATE (Solution Centre for Image Guided Local Therapies) research campus for innovative medical technology at Otto von Guericke University Magdeburg was ceremoniously opened in January of 2013 in the presence of State Secretary Cornelia Quennet-Thielen from the Federal Ministry of Education and Research,then Saxony-Anhalt Minister of Research Prof. Birgitta Wolff, representatives of the city of Magdeburg and Siemens AG Healthcare.

Under the collective umbrella of the research campus, researchers and developers from schools of engineering and medicine at Otto von Guericke University Magdeburg and non-academic research organizations, including the Fraunhofer IFF, will be developing medical technologies for image-guided, minimally invasive methods together with Siemens AG Healthcare and regional businesses, which are intended both to improve methods of medical treatment and to contain exploding healthcare costs. They will be focusing on important widespread oncological, neurological and vascular diseases.

"With the STIMULATE research campus, we intend to make Otto von Guericke University Magdeburg one of the world's leading centers for image-guided systems," said President Jens Strackeljan in his welcoming remarks. In her keynote address, State Secretary Cornelia Quennet-Thielen stressed the collaboration between businesses and the university. "The research campus is intended to facilitate new options for long-term collaboration between research and business. Magdeburg is a good example of this because strong partners have gotten together to develop a shining example of medical imaging."

The German government will make € 1.6 million available in the first year and, when the preliminary phase is successful, up to two million euros in each of the following years. The business and industry partners involved with also be contributing funds. The Federal Ministry of Education and Research could continue funding the project for up to fifteen years. It is funding a total of nine such innovative collaborative ventures. ■

www.stimulate.ovgu.de

Strengthening European **Robotics**

The European Commission and representatives of industry and academia, including the Fraunhofer-Gesellschaft, have reached an agreement to establish a public-private partnership in the field of robotics in order to help companies based in Europe expand their share of the €15.5 billion global robotics market. Representatives of European robot manufacturers and research organizations and the Vice-President of the European Commission, Neelie Kroes, signed a corresponding agreement in September of 2012 as the first step toward the establishment of a public-private partnership in 2013. Experts in robotics from the Fraunhofer IFF are also involved and attended the signing in Brussels. The commission is convinced that the future partnership will strengthen the robotics sector in the EU.

Robotics is a key technology for growth and competitiveness in Europe. The one million industrial robots in use are helping create or safeguard three million jobs worldwide. European robotics is extremely successful. It produces approximately one quarter of the world's industrial robots and maintains a fifty percent share of the market for commercial service robots. The market for household and commercial service robots, chiefly rescue, security and commercial cleaning applications, is expected to grow forty percent in the coming years. Service robotics will reach an annual market volume of €100 billion or more by 2020. ■

www.eu-robotics.net

Australian Plant Researchers Want to Cultivate **Higher Yield Crops**

Dr. Andreas Backhaus starting with an aircraft to record hyperspectral images of vineyards near Adelaide. The camera is in a housing mounted on the underside of the wing (to the left). Photo: Udo Seiffert

Australian soil is dry and salty in many places. Farmers cultivate their fields under some challenging conditions. Growers are working to create hybrid crops such as corn and wheat with valuable properties, which deliver higher yields. This would enable farmers not only to harvest corn with plumper kernels but also to cease having to fertilize or irrigate as often as before.

Well known among experts, the plant researchers at the Plant Accelerator unit of the Australian Plant Phenomics Facility of the University of Adelaide are researching topics in this field. In what is probably the world's largest automated greenhouse, they control temperature and irrigation to grow plants and collect fundamental phentotypes. They need to be able to analyze phytoconstituents, though.

Researchers from the Fraunhofer IFF in Magdeburg have made exactly this possible and opened a view into plants' insides. Prof. Udo Seiffert, project manager and manager of the Biosystems Engineering Expert Group at the Fraunhofer IFF in Magdeburg, and his team shipped their hyperspectral equipment to Australia for a joint research project and used its hi-performance camera to take measurements at the Plant Accelerator. The data is being interpreted and analyzed at present.

Researchers at the nearby Australian Wine Research Institute are also involved in the project. The researchers from the Fraunhofer IFF even took to the air to analyze their grapevines. The hyperspectral camera was mounted on an airplane and aerial photographs were taken of the vineyards. Conclusions about certain constituents and the grapevines' water content can be drawn from these special images.

The Australian partners were so impressed by the first results of the analysis that they are now preparing to collaborate on a larger project. The researchers from Magdeburg will be setting up a hyperspectral labor in Adelaide. "Anybody can buy a camera. Our expertise lies in developing the proper system for a client and rendering the data relevant for a client usable with special software," explains Prof. Udo Seiffert. ■

16th IFF Science Days in Magdeburg: More Efficiency in Production and Logistics

How will we be manufacturing in the future and what are we able to do now? What technologies will enable robots to become part of everyday life and what will make logistics even more reliable and sustainable? The Fraunhofer IFF in Magdeburg has once again extended an invitation to the IFF Science Days, its major annual research conference, in the city on the Elbe on June 18-20, 2013. It is expecting over 500 experts from business, industry, research and academia.

This year's IFF Science Days will again offer decision-makers and experts from business and research an attractive and diverse program of three parallel conferences on digital engineering, logistics and human-robot cooperation as well as a workshop on optical measurement and testing systems and a meeting of the Cooperation in Plant Engineering Industry Working Group. The main focus will be the application of new solutions and developments. Over one hundred presentations and seminars will provide insight into current research work and projects being completed jointly by researchers and industry partners. These events will focus just as much on innovative projects for the future as on examples of current best practice. ■

New technologies for safe human robot interaction enable humans and robots to work together directly without protective barriers.

www.wissenschaftstage.iff.fraunhofer.de

Logistics Day: 36,000 Visitors at 381 Events

Dr. Jennifer Schwarz was the speaker at the 16th Logistics Guest Lecture Series at the Fraunhofer IFF on Logistics Day. Foto: Viktoria Kühne

Around 36,000 people, more than ever before, attended 381 Logistics Day events throughout Germany and neighboring foreign countries on April 18, 2013. 640 companies, organizations and educational institutions opened their doors as part of the German Logistics Association's initiative.

The promotional day focussed on programs for university and school students. Visitors came to take a look behind the scenes of the business sector, to learn about logistical operations, jobs and careers, to find out about educational and academic programs and to talk with the hosts.

The Fraunhofer IFF in Magdeburg also took part in this promotional day. Interested attendees heard a lecture on "The Role of Humanitarian Logistics in Emergency and Development Aid for Sub-Saharan Africa".

In her presentation, Dr. Jennifer Schwarz explained the importance of knowledge transfer for the development of logistical capabilities in Africa and their significance for humanitarian aid. Her presentation was part of the 16th Logistics Guest Lecture Series to which the Fraunhofer IFF regularly invites practitioners and experts to speak before the general public. Thomas Webel, Saxony-Anhalt Minister of State Development and Transportation, had assumed the patronage of the Guest Lecture Series and opened the event on Logistics Day by delivering welcoming remarks. ■

www.tag-der-logistik.de

8th Long Night of Science Thrills Magdeburg Residents

Magdeburg was all about research on the 8th Long Night of Science on June 1, 2013. Over thirty research organizations opened the doors to their laboratories and auditoriums to astound young and old discovers.

The Long Night of Science was opened by the traditional hemisphere experiment in which sixteen horses vainly attempt to pull two hemispheres void of air apart and thus to overcome the power of a vacuum. Visitors spent the rest of the night immersed in the fascinating world of Magdeburg's research and academic scene. Not only informative experiments but also enthralling presentations, interesting tours and impressive demonstrations awaited visitors. Researchers provided insights into various fields of research and current research topics, which are not so easily accessible to the public the rest of the year.

Visitors to the Fraunhofer IFF and its Virtual Development and Training Centre (VDTC) in the port of science discovered the world of logistics and other things and learned the latest about resource efficiency and electric vehicles in an entertaining manner. As in years past, the Elbe Dom was the big draw. In its 360 degree laser projection laboratory, researchers took visitors away to digital corporate environments. The singing and walking robot "Rotto" won young visitors hearts, though. ■

The VDTC is a big draw: Many people were waiting at the Elbe Dom's doors hours before the smartest night of the year began. They patiently anticipate waits of up to ninety minute. Photo: Viktoria Kühne

www.wissenschaft.magdeburg.de

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Dr. Elmar Degenhart
Vorsitzender des Vorstands,
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Fraunhofer IFF Director Prof. Michael Schenk with Madeleine Wehle from MDR Television, the emcee for the evening

Elga and Dr. Karl-Heinz Daehre, former Transportation Minister, Editor-in-Chief of the Volksstimme Alois Köster and State Secretary Dr. Klaus Klang

"Queenz of Piano" Jennifer Rüth and Anne Folger

Impressions

of the festivities celebrating »20 Years of Curiosity« on June 27, 2012: A trip through 20 years of research and development at the Fraunhofer IFF in Magdeburg

Dr. Sonja Schmicker, CEO Metop, and Dr. Harald Schmicker, CEO H&B Omega Europa

Prof. Peer Witten, Ehrenvorsitzender der BVL, and Giesela Horn-Moll, Prof. Albert Jugel von Venture Management Partners and Ehefrau Marina, Dr. Max Schachinger, CEO of Schachinger Logistik

Prof. Helmut Baumgarten from TU Berlin next to Honorary BVL Chairman Dr. Hanspeter Stabenau and Dr. Max Schachinger

State Minister Dr. Reiner Robra

Dr. Norbert Elkmann, Manager of the Robotic Systems Business Unit at the Fraunhofer IFF

Prof. Siegfried Wirth from TU Chemnitz, next to Fraunhofer IFF founder Prof. Eberhard Gottschalk and former Fraunhofer-Gesellschaft President Prof. Hans-Jürgen Warnecke

Fraunhofer Executive Board Member Prof. Ulrich Buller

Melanie and Prof. Raimund Klinkner, BVL Chairman, Madeleine Wehle and Prof. Michael Schenk

Lara Caroline Tykoski from Hegel High School in Magdeburg opened the on-stage program with a speech to Fraunhofer researchers

Prof. Klaus Richter, Manager of the Material Handling Engineering and Systems expert Group at the Fraunhofer IFF, with Sergey Ipp, Abdul Mahir and Alexey Kurapor from RTI Technologies

Frauke and Prof. Burkhard Scheel, Chairman of the Fraunhofer IFF Advisory Board

Brigitte and Richard Smyth, former Airbus Vice President

Prof. Gerhard Müller, Deputy Director of the Fraunhofer IFF, next to Manfred Maas and former University President Klaus-Erich Pollmann with his wife Dr. Kornelia Pollmann

All people are named from l. to r. | Photos: Viktoria Kühne and Bernd Liebl

Producing Resource Efficiently

Interview with Prof. Reimund Neugebauer,

President of the Fraunhofer-Gesellschaft and a Leading Expert in the Field of Resource Efficient Production

by Anna Mahler

Until now, we have been treating valuable resources very wastefully. We won't be able to do that in the future. As raw material and energy prices steadily rise, only companies that use material and energy efficiently will remain competitive.

Industry's prominence is one of Germany's crucial strengths as a center of business. Germany is poor in natural resources, though, and has to import important resources. What is more, raw material prices have been rising in recent years. What impact will that have on the manufacturing industry?

Production in particular is directly linked to resources and extremely dependent on their availability and cost. Material and energy prices influence the price of the end product significantly in many industries. If we were to reduce raw material use by just seven percent, we could save € 48 billion every year. these are reasons why minimizing energy and raw material consumption will become the crucial competitive factor in the coming years.

How can companies escape this cost spiral?

Resource efficiency is the only feasible path for the manufacturing Industry. We must become independent from unreliable sources of raw materials and use needed materials optimally because that is the only way we will be able to remain competitive in the long run and consolidate Germany's role as a technology leader. Sustainable competitiveness on the international market is increasingly being defined by innovations that boost efficiency. One way to defuse the resource situation is to develop new sources. Another way is to exploit available resources optimally. Resource efficiency means utilizing every raw material and all energy needed in a manufacturing process optimally. That reduces dependence on resources. At the same time, it frees up raw materials that can be used for new products or for increases in production.

Aren't renewable energies really the solution?

Renewable energies can only reduce our use of coal, crude oil, natural gas and nuclear power in the electricity and heat market gradually and take their place in the long run. A significant increase of energy efficiency is a fundamental prerequisite for the energy transition. Initial findings have revealed that sizeable potentials for savings can be developed in energy consumption as well as in raw material use – the biggest are in the building sector, industrial manufacturing and transportation.

What do you think the factory of the future will look like?

It will be based on the three pillars of efficiency, carbon neutrality and the integration of individuals. Technical innovations and long-range investments in highly efficient manufacturing facilities will be essential.

How can we manufacture products resource efficiently, though? What new methods of manufacturing will be needed to save material and power? Fraunhofer Institutes are researching these questions in numerous research and development projects.

How can efficient use of energy and raw materials be achieved?

One way is to reduce raw material consumption per unit of output. The other lever is to extend the service life of products. Ultimately, it is a matter of optimizing manufacturing processes and product design to assure resource conservation, energy efficiency and recyclability. That is why a product's entire life cycle must always be considered – from raw material production through recycling. Use frequently accounts for most of the total energy consumption.

» The most important factors are avoiding rejects and reducing reworking as well as optimizing processes and shortening process chains. «

Surely something from the energy flows in a factory itself can be used?

Right – the second stage will be about analyzing these and utilizing them optimally in cycles. Many production processes produce heat, which is released to the environment although it is needed elsewhere. Such sources of loss must be identified and made usable for other applications. Similarly, peak loads must be analyzed and controlled optimally. Comprehensive energy management also includes new concepts of energy storage and conversion. That is why all energy interactions have to be analyzed, both in production systems and processes and between production and the environment.

In the third stage, the factory will assume a new role as an energy producer and storage system. Many companies are already employing smart energy management to save energy and money today.

How can the efficiency of production be optimized?

The most important factors are avoiding rejects and reducing reworking as well as optimizing processes and shortening process chains. Virtual product design geared toward efficiency lays the groundwork for comprehensive resource management. In this digital age of product development, we can develop and test other features of new products in virtual reality. This already saves energy and raw materials for building real prototypes. Equipping virtual reality simulation tools with optimization criteria for resource efficiency is crucial. Future product development must therefore be augmented by preventive resource planning for the product, the production system and the manufacturing process. This will make it possible to make the best decisions on raw material efficiency already when drafting a design.

BRIEF CV

1975	Diplom degree in mechanical engineering, Technical University Dresden, majoring in machine tool engineering
1984	Doctorate in engineering
1985	Work in engineering and development in industry
1989	Doctorate in technology
1990	Executive director of the Department of Machine Tools, Technical University Dresden
1991	Habilitation degree in engineering; tasked by the Fraunhofer Executive Board with establishing the Fraunhofer Institution for Machine Tools and Forming Technology, later the Fraunhofer IWU
1994	Executive director of the Fraunhofer IWU
1995	C4 professorship for machine tools at Technical University Chemnitz and Director of the Fraunhofer IWU
2005	German Merit Cross 1st Class
2010 – 2011	President of the German Academic Society for Production Engineering (WGP)
2012	President of the Fraunhofer-Gesellschaft

ER-WIN

Innovation Cluster

Prof. Michael Schenk

Greater Energy Efficiency in Saxony-Anhalt's Companies

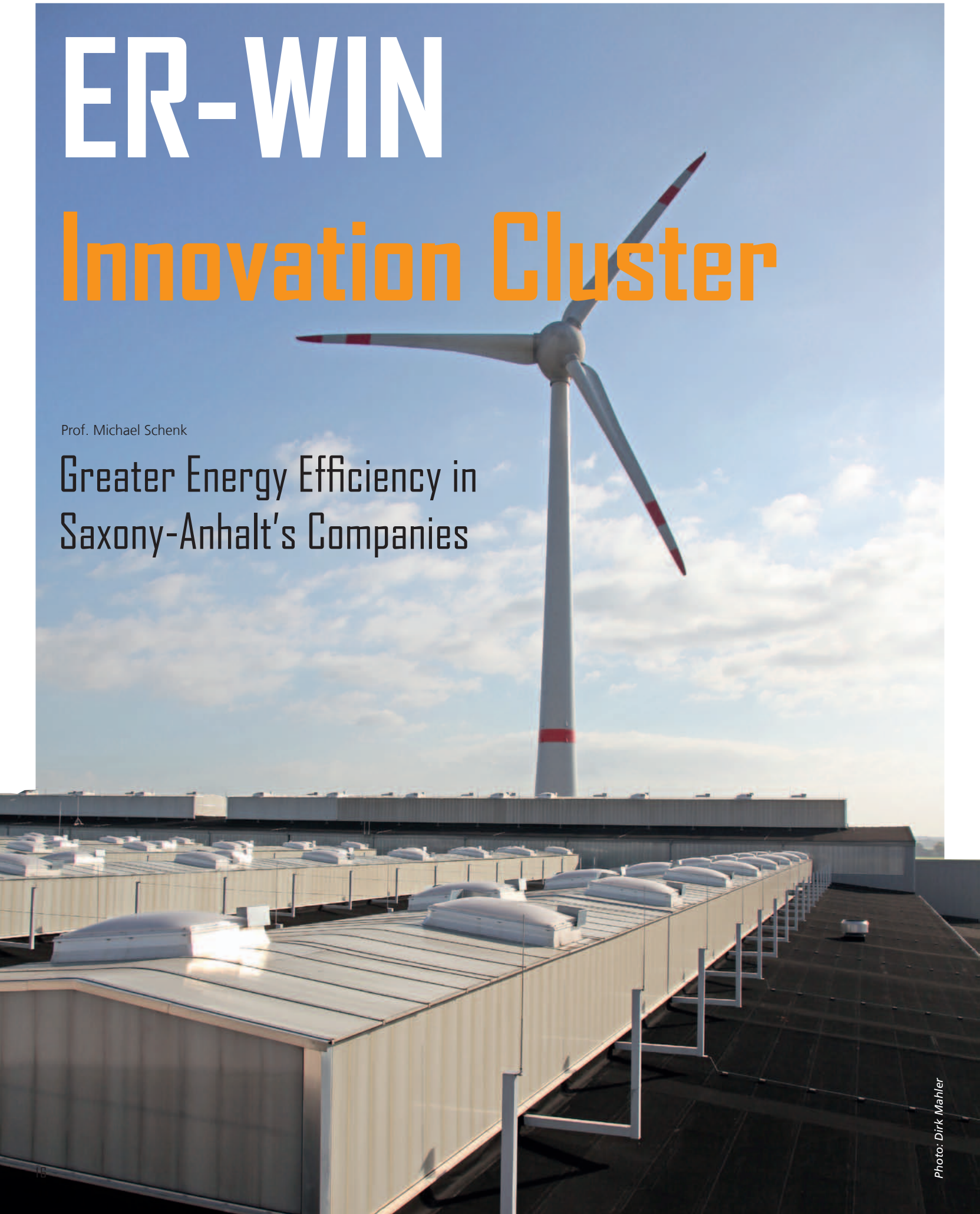


Photo: Dirk Mahler

» The introduction of production planning and control geared toward energy availability will enable companies in Saxony-Anhalt to minimize their energy and resource consumption in the production process. «

Energy and raw materials are some of the major cost drivers in industry. These costs, which will presumably continue rising in the long-term, are evolving into a significant competitive factor for German business. Manufacturers in Saxony-Anhalt are especially being affected by this. The newly established ER-WIN innovation cluster is intended to help companies manufacture more energy and resource efficiently in the future with new technologies and solutions.

The energy policy targets are clear: The European Union has resolved to cut CO_2 emissions by sixty to eighty percent by 2050. A large part of the CO_2 emissions is caused by the conversion and supply of energy. Achieving this target will necessitate rethinking energy production and moving away from fossil fuels to renewable CO_2-neutral sources. The challenge of reducing energy consumption in general is also becoming increasingly important.

Low Energy Productivity in Saxony-Anhalt's Companies

The reduction of CO_2 emissions is unquestionably necessary. Although energy is being consumed more efficiently, energy and raw materials continue to be major cost drivers in industry. Germany's decision to pursue an energy transition will presumably entail a further increase in energy prices. This, as well as higher utility costs, will especially affect Saxony-Anhalt. This is a major challenge for businesses in our state and especially for the manufacturing industry based here because it primarily consists of smaller enterprises. Since regional companies hardly benefit from the special regulations for grid fees and the green power surcharge for major customers, energy prices are an important competitive factor for them.

This is compounded by the energy productivity of Saxony-Anhalt's manufacturers, which is too far below the national average, i.e. the value added per unit of energy is lower here than elsewhere. The adverse effect this has on profits will only be exacerbated by rising energy prices. Cost pressure will continue growing and this will seriously jeopardize the competitiveness of many companies in Saxony-Anhalt.

ER-WIN Will Be Supporting Regional Companies

That is why the ER-WIN (Smart, Energy Efficient Regional Value Chains in Industry) innovation cluster was established at the initiative of Magdeburg's Fraunhofer Institute for Factory Operation and Automation IFF. It will be helping companies in Saxony-Anhalt meet these challenges effectively with new technologies and solutions. Together with Otto von Guericke University Magdeburg and numerous other development and business partners, it will be pooling regional know-how in particular. The state of Saxony-Anhalt is also supporting the cluster intensively. The common goal is to develop new, operational solutions for energy and resource-driven manufacturing in order to strengthen the competitiveness of companies here long-term.

To do this, the ER-WIN innovation cluster will be pursuing two interrelated approaches. A first phase will aim at immediately improving companies' energy efficiency. Dubbed the innovation sphere, this phase will primarily focus on individual corporate processes. Where are potentials for savings? What operations can be reorganized? This should go beyond merely achieving short-term savings since mundane energy savings alone will probably no longer enable companies to achieve their cost-cutting targets. Sustainable effectiveness, i.e. the future viability of potential solutions, will be the fundamental issue instead.

Using Renewable Energies for Production

This entails identifying alternative energy sources companies will be able to tap in the future and the conditions under which they can be made usable. A large share of the energy in Saxony-Anhalt is already being produced from renewable sources such as wind, sun or biowaste. They account for around thirty-five percent of the power mix, approximately twice as much as the national average. Renewable sources cover sixty-six percent of the energy requirement in the Harz region. At times, more power is produced in the state than can be used. This outstanding starting position and the prospect that this will help meet EU climate targets are reasons for taking advantage of this potential intensively. The arguably greatest advantage, however, is the growing independence from the national energy market and its price trends. Ultimately, producing more energy where it is also consumed, i.e. distributed and flexible production, is more expedient in terms of cost effectiveness and energy.

Renewable energies' volatility, which causes energy prices to fluctuate greatly, is a problem. Both utilities and the federal government are expected to step up the creation of incentive systems in the future in order to in-

volve companies in stabilizing the electrical grid. Companies will have to adapt to an extent to manufacture smartly. Manufacturers, for instance, will be able to achieve considerable cost advantages in the future by shifting high-energy stages of production when energy prices are lower. This will require integrating energy availability in corporate planning and control systems.

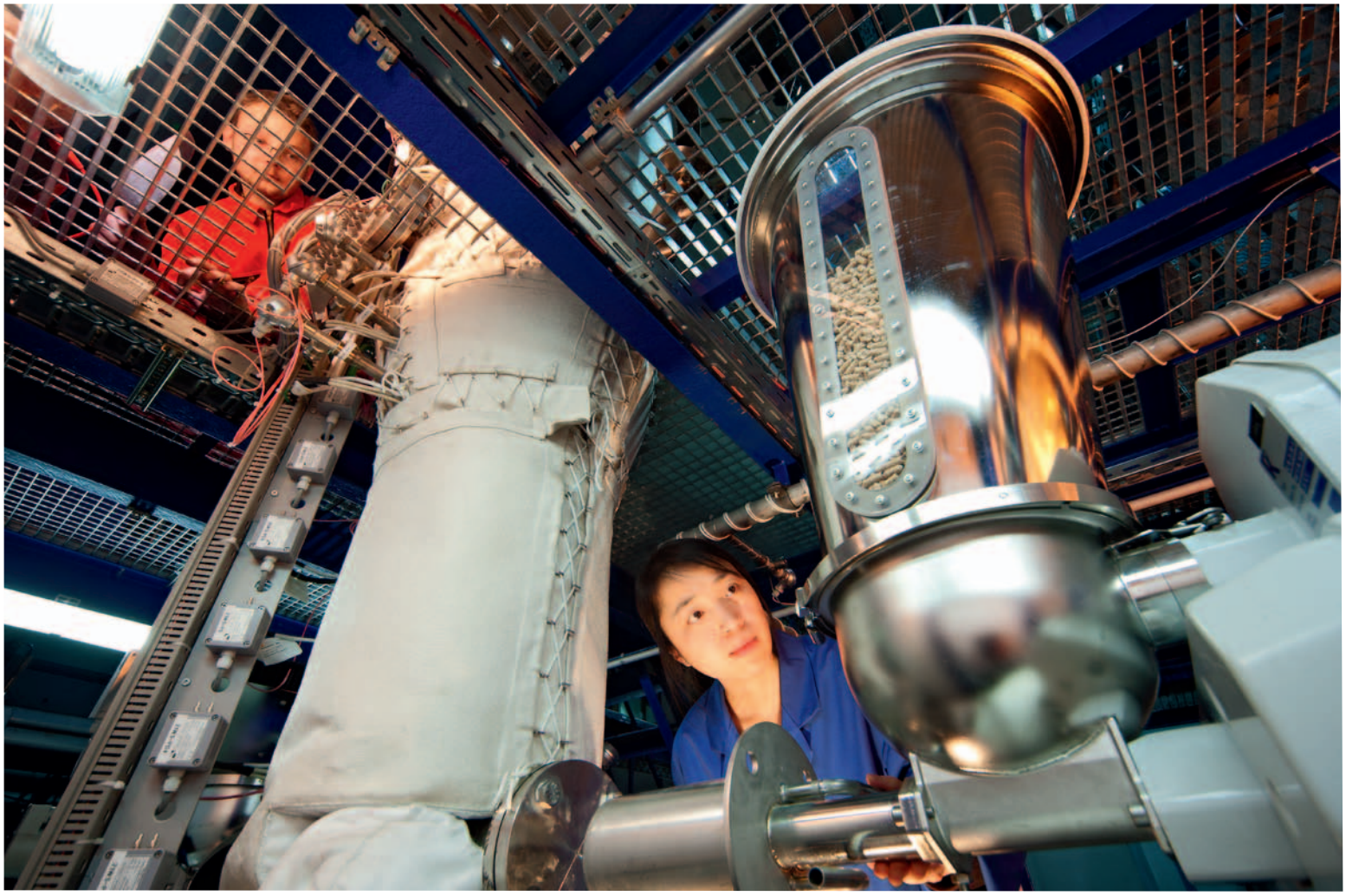
Gearing Production Facilities Toward Energy Efficiency

Such synchronization of companies' power demand with the variable supply of renewable energies will be one of the challenges in the ER-WIN cluster. This will necessitate more than just forecasting energy availability – if we want to use renewable energy as a control parameter for production, planning or material planning on short notice. It will also necessitate further developing smart grids and storage technologies. Another central focus of the innovation cluster's work will be the creation and use of new measuring systems and methods to gear the control of production facilities even more toward energy efficiency. This will also entail concrete measures such as the construction of small, distributed power plants, e.g. wind turbines or cogeneration plants with which companies will be able to use production residues to produce their own power and heat, or the use of new technologies that store and recover energy. All of these are realistic and proven solutions proposed by experts and ready for use.

Energy Networking among Companies

While ER-WIN will be devoted to individual companies in Innovation Sphere One, the level above companies will be analyzed in Innovation Sphere Two. The issue of energy networking and the generation of resultant synergies is highly interesting for small and medium-sized enterprises in particular. Above all, companies located in industrial parks – a typical situation in Saxony-Anhalt – have excellent conditions for this. They are frequently able to combine their energy requirements in order to generate a cost advantage, collaboratively invest in distributed energy conversion plants or collect production residues and collectively recover energy from them. The Fraunhofer IFF has already

A fluidized bed combustion test unit. The Fraunhofer IFF is developing new technologies that efficiently recover energy from production residues. Photo: Thomas Ernsting



Energy networking of companies holds many benefits. For instance, cogeneration plants can be used collectively to recover energy from production residues.
Photo: Dirk Mahler

demonstrated that companies can be outfitted with such technologies very effectively.

Saxony-Anhalt as a Model Region

Price trends in the energy and resource sector will be impossible to ignore. In Germany, preparing for them means also taking greater advantage of the country's edge in the production of renewable energies to safeguard the future of the nation's processing industry. The ER-WIN innovation cluster is pursuing the development and application of the systems, technologies and methods needed for model-based design and control of production systems in order to manufacture smartly. The introduction of production planning and control geared toward energy availability will enable companies in Saxony-Anhalt to minimize their energy and resource consumption in the production process and to manufacture more energy efficiently and largely carbon neutrally. The creation of an energy management system for industrial and commercial parks is intended to network companies with one another so that their energy consumption and production is complementary and thus reduces their energy requirements collectively.

Solving this problem will be one of the central tasks of many companies in Saxony-Anhalt in the coming years. If they are successful, Saxony-Anhalt can become a model region for efficient resource and renewable energy use in manufacturing for Germany.

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Optimization of internal processes is one of the bases of corporate success. That is why the Fraunhofer IFF's logisticians and visualization experts and the environmental service provider Stork closely scrutinized the operations on Stork's premises. The outcome is a virtual simulation of operations with which the impact of reorganization on logistical operations can be analyzed in advance.

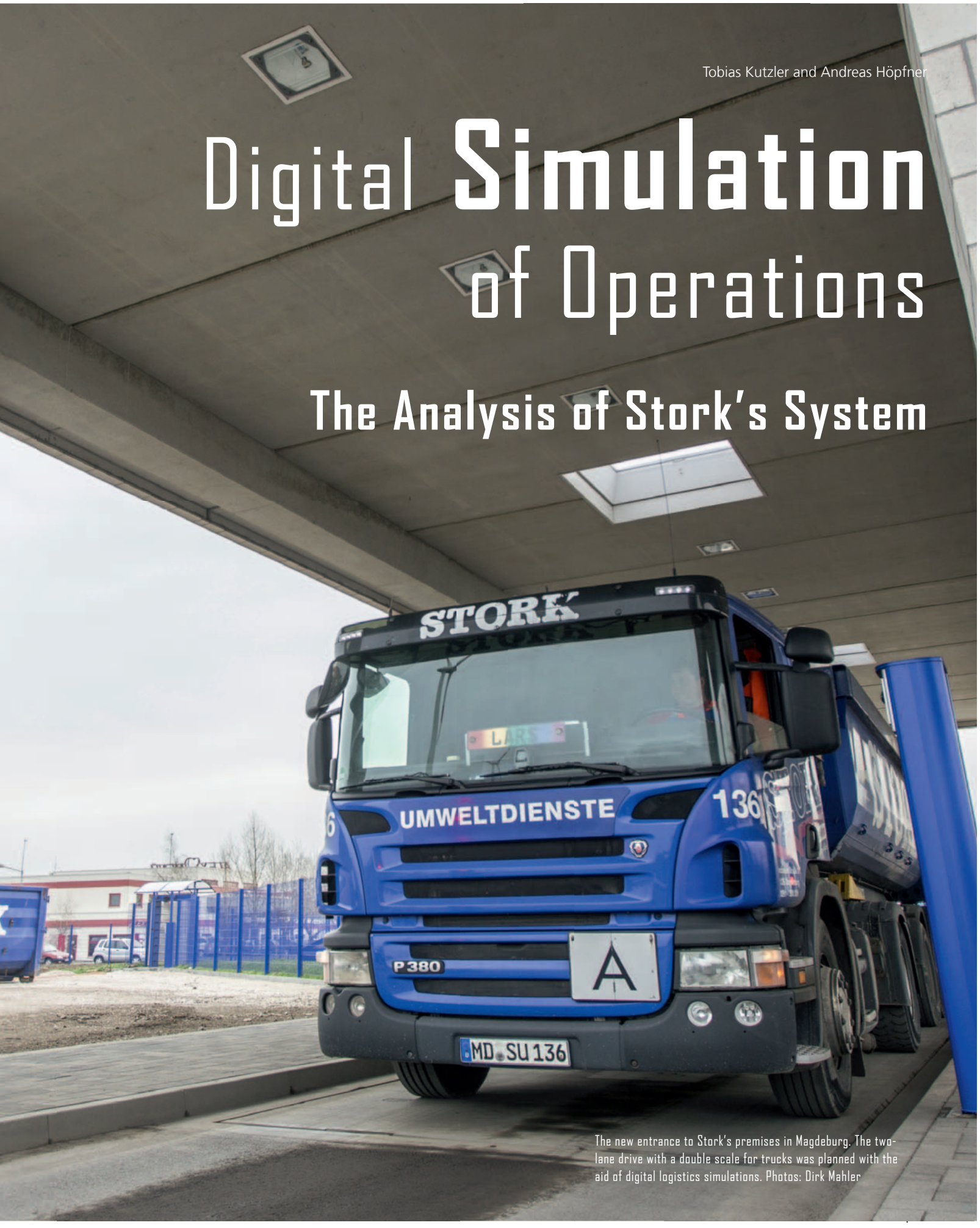
A blue truck turns from a street onto a company's premises and heads straight for a parking lot. It is surrounded by trees and lawns, next to which colorful cars are lined in rows. A second and a third truck follow; loaders are making their rounds further in the distance. After waiting a brief moment, the trucks start moving again. One after another, they drive over a two-lane drive with a cleverly devised system that weighs the vehicles. Then, they disappear between giant factory and warehouse buildings on the premises.

None of this is really happening. Trucks, trees and the scale house are elements in a virtual interactive 3D model of Stork Umweltdienste GmbH's premises in Magdeburg. The company disposes of and recycles waste and residues on a large scale at several locations in Saxony-Anhalt and Saxony. Every day, hundreds of trucks arrive on the premises, bring waste material and depart empty or reloaded with processed recyclables. A simulation of these daily processes is running on the computer at the moment. Key data are additionally appearing on the edge of the monitor. They are sorted in tables and lists. The operations on the company's premises are faithfully reproduced in the digital model. Vehicles, transportation routes, traffic volumes, buildings and storage facilities – everything can be varied as desired. And everything is connected with everything. Thus, any change in the simulation also has consequences for other, subsequent operations in this virtual environment.

Tobias Kutzler and Andreas Höpfner

Digital Simulation of Operations

The Analysis of Stork's System



The new entrance to Stork's premises in Magdeburg. The two-lane drive with a double scale for trucks was planned with the aid of digital logistics simulations. Photos: Dirk Mahler

More Efficiency on Every Level

This is useful because it enables the company to test what happens when, for instance, it relocates the entrances to its storage facilities. Or how many vehicles are allowed on the premises without causing congestion. This facilitates and significantly simplifies strategic decisions on replanning infrastructure and logistics processes, thus preventing planning errors and drastically reducing potential costs.

Stork expects greater effectiveness and efficiency on all levels from this software tool. The medium-sized, owner-operated company benefits from its passion for innovation, which is keeping it growing fast. In 2012, the company was even a finalist in the auditing and consulting firm Ernst & Young's 2012 Entrepreneur of the Year competition – an indication of the prevailing spirit at Stork.

Specialized in processing, recycling and disposal, the company has been growing quantitatively and qualitatively by leaps and bounds since it was founded in 1994. According to its own information, it has been able to more than double its volume of business in the past five years. The number of employees has grown to over 200. As the number of contracts rapidly grew, the infrastructure on the premises was becoming overburdened. A solution for this stressful situation was needed urgently.

Combining Process Simulation and 3D Visualization

That is why the company contacted the Fraunhofer IFF. Top priority was obtaining help to improve the organization of truck traffic operations on company premises. An analysis and simulation of the logistical processes was intended to help identify solutions. At the same time, Stork and the institute additionally held talks in which they also began to contemplate modeling the company premises in 3D. The company wanted a marketing tool that supported the presentation of its range of services, e.g. at trade fairs or before potential clients.

It quickly became clear that such a 3D model can be used for even more: The Fraunhofer IFF proposed interconnecting the model and the simulation of logistical operations, which essentially consisted only of mere numbers and algorithms. It could thus also be used to prepare the simulation intuitively and also to visualize the simulation results. This would make the simulation and its results far more accessible to users at Stork.

These synergy effects ultimately won Stork over. Stork and the Fraunhofer IFF realistically simulated the approximately thirty hectare

Every day, countless logistical and infrastructural processes take place on the company premises. In order to boost efficiency, it is essential to identify bottlenecks.

premises on the outskirts of Magdeburg on a computer: a varied development environment with buildings, streets, conveyers, trees and vehicles. They also created another 3D model of the company's nearby outdoor facility in Magdeburg's port.

A Realistic, Intuitive Planning Environment

Seeking to improve its performance, the environmental service provider regularly identified potentials for optimization at its facilities. Some of these potentials can also be leveraged thanks to the 3D visualization software developed at the Fraunhofer IFF. It was used to implement the interactive 3D models of Stork's premises, thus delivering a customized, virtual interactive solution that supports planning and reorganization actions. The three-dimensional representation is oriented toward the original almost one hundred percent. Mousing over the model environment reminds one of a helicopter flight. Moving vehicles on the premises make the representation even more realistic. Such realistic planning environments convey plans quickly and comprehensibly and provide a simple, intuitive interaction environment. Urban planners and planners of overhead power lines also use the institute's software for their projects, which is also used to interactively visualize machinery, plants and factories.

Stork thus received a system that is largely self-explanatory and intuitive to use. Clicking, dragging, deleting – users quite naturally enter the computer environment where they move and work quite confidently. The operations simulation was not developed for gaming or merely as an attractive presentation, though. It is all about smart logistics.

Identifying Bottlenecks

Every day, countless logistical and infrastructural processes take place on the company premises. The company has many value chains. The organization of material and information flows greatly influences the efficiency and sustainability of the company's operation. It is essential to identify bottlenecks but a number of questions have to be answered before this can be done. For instance, how many trucks drive onto the premises every day at what intervals? How many of them come from subcontractors? What is loaded on them? How long are the wait times at dispatching? What would happen if suddenly twice as many trucks were there? How must operations on the premises be controlled in order to ensure they are dispatched smoothly? Or would a new building make sense at all on a certain spot? Since no company can grow infinitely and unreg-

Smooth dispatching. A digital display panel informs up to 300 truck drivers a day when they may drive onto the premises.

> Those involved used the digital model to simulate the construction of a double scale and the impact of this investment on operations. As a result, operations were staggered and expedited.

ulated, it is imperative to identify snags and glitches and the system's limits when optimizing processes.

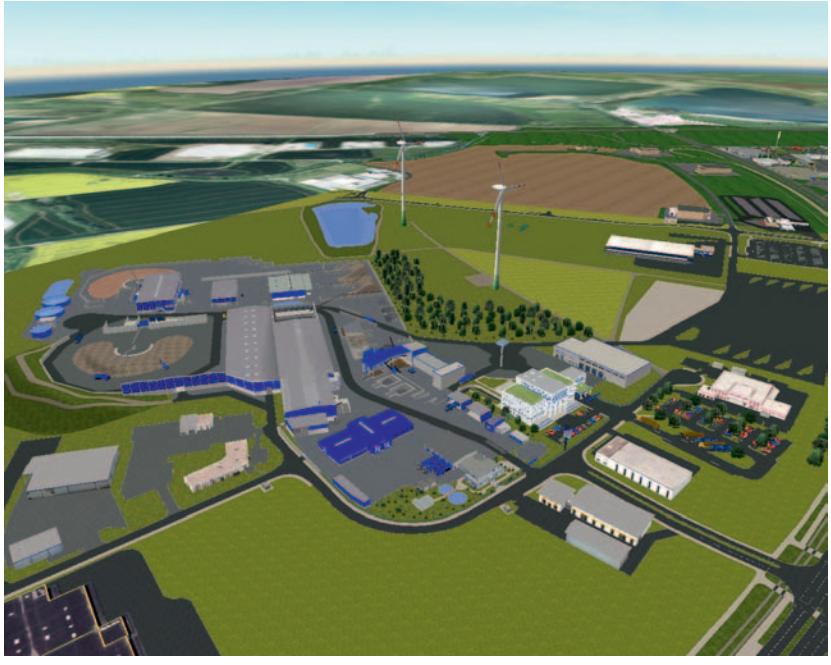
The VR scenario is a valuable aid when seeking the answers to such questions. The system is reliable because the key data come from actual analyses. Fraunhofer staffers were and are on site regularly to collect data, problems, ideas and opinions. Thus, the information used for the simulations is not generated randomly and the trucks and loaders do not drive through the scene at whim, either. Stork makes meticulous use of the Fraunhofer IFF's spatial and logistical planning. Together, the two partners are drawing out the company's innovative spirit. The expertise in logistics and visualization at the Fraunhofer IFF was pooled to do just this.

Already Implemented Findings

Martin Müller at Stork is acting as the interface to the Fraunhofer IFF. He cites two concrete examples of things implemented with the aid of the model: the new double scale including the new drive and the parking lot across from it. "For many years, the trucks just drove on and off the premises over a scale," says Müller. Dispatching arrivals and departures became a stress factor and the entrance regularly became a chokepoint. "Up to 300 trucks were driving to and from here every day. We had to act." Those involved used the digital model of the company to simulate the construction of a double scale and the impact of this investment on internal traffic and subsequent operations. As a result, operations were staggered and expedited. Today, arriving and departing trucks drive on and off the premises over two separate scales.

Parallel to this project, a holding area for the heavy duty trucks was created across the street. "Earlier, everything got congested at the entrance until our dispatching unit had all the papers finished," says Müller looking back. On some days, the line extended around several curves to the main street. The simulation model solved this problem, too. Calculations revealed that exactly eight parking spaces for trucks are enough for smooth dispatching. Today, drivers check in with the dispatcher and then wait in their vehicles. A digital display panel informs them when they may drive onto the premises. "Every large agency coordinates its customer flows this

A faithful, interactive 3D visualization of Stork's approximately thirty hectare premises.
Graphic: Fraunhofer IFF



way," says Martin Müller. "Now, we coordinate our trucks this way."

The Future Will Be Exciting

Now, the intention is to continue based on the example of the scale and parking lot and the system is supposed to be used successively in other areas, too. "We are scrutinizing our material management," says Kerstin Stork. And the data model will again have to find answers to many questions. "The future will be exciting," says the businesswoman. The Fraunhofer IFF is looking forward, too. The application is already being refined in the developers minds and on the computer. They are thinking about how to build upon this project and use it as a versatile application, for instance, for entire industrial and commercial parks.

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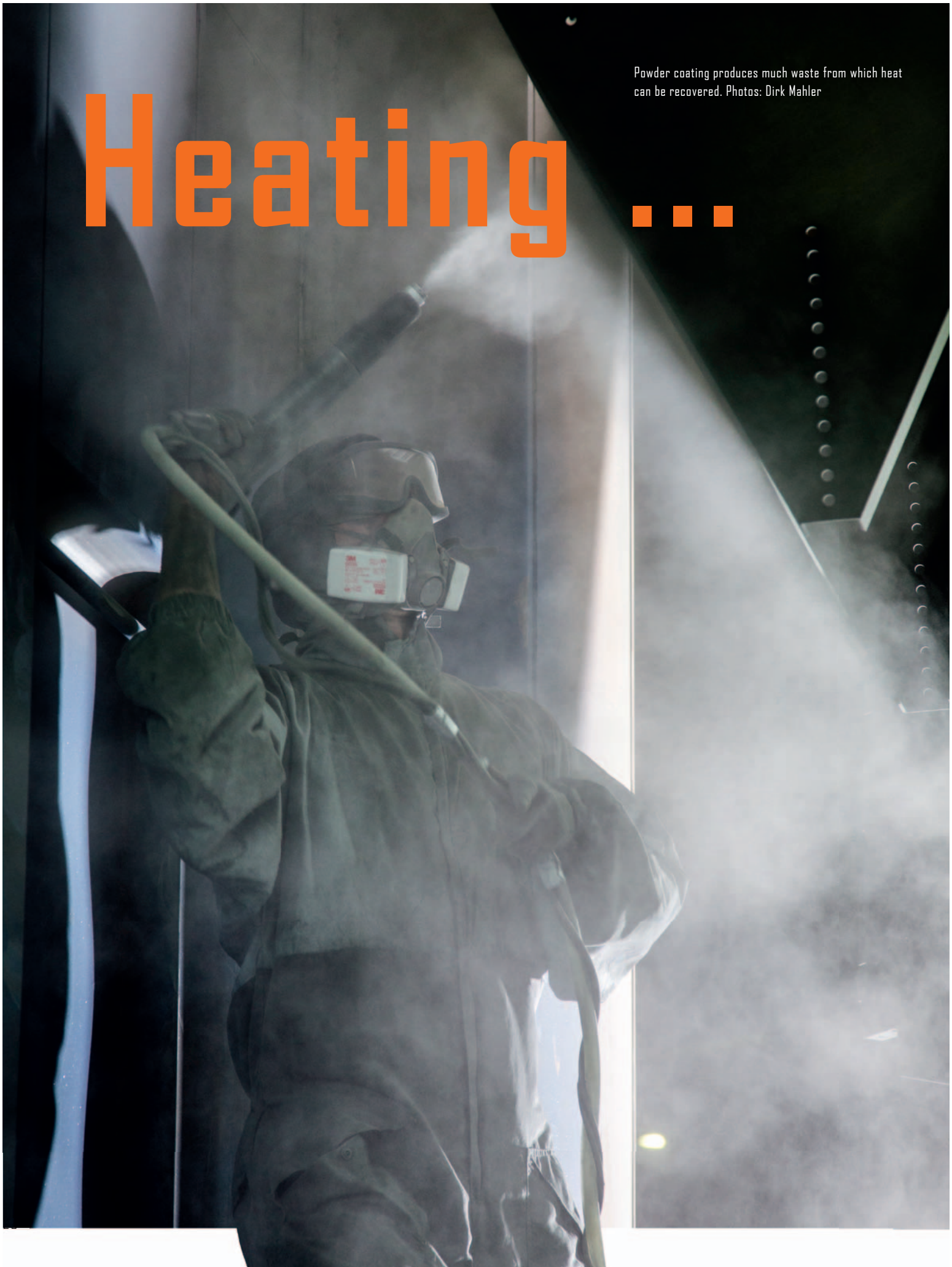
Heating ...



Powder coating produces much waste from which heat can be recovered. Photos: Dirk Mahler

Dr. Matthias Gohla, Marcus Kögler and Bernhard Kiep

... with Waste from Coatings and Plastics

Disposing of waste – whether it is coating powder or swarf – is expensive. In the future, companies will be able to cut disposal costs and heating costs simultaneously: With a combustor for powdery residues.

A great deal of powder is needed to coat parts and other objects. Only some of the powder lands on the part, though; the rest misses it and is suctioned up. Depending on the standards and the system, much waste can also be produced. Recycling of residual powder has limits: The quality of a coating suffers if coaters mix in too much "recycled" powder. Companies therefore have the majority of coating powder disposed of – an expensive undertaking. Grinding processes are similar: They also produce much waste and companies have to dig deep in their pockets for its disposal. Christian Würfel, CEO of MBG Metallbeschichtung Gerstungen GmbH thought about how manufacturing plants could cut disposal costs in the future and additionally reduce heating costs for facilities, kilns and many other high temperature processes.

This was made possible by a plant he developed jointly with the researchers from the Fraunhofer Institute for Factory Operation and Automation IFF in Magdeburg. The project was funded for three years by the Federal Ministry of Economics and Technology. The plant can recover heat from any combustible, powdery industrial wastes, whether they are coating powders, polymer powders or even wood constituents. The researchers expect large potential savings: Twenty-five percent of the natural gas usually used for heating can probably be saved and, additionally, one hundred percent of the disposal costs.

An Ideal Burner for Small Quantities of Waste

The plant consists of three basic units: The combustion chamber with a pulverized fuel burner, a boiler and a filter system. Powdery waste is conveyed pneumatically, i.e. with compressed air, into the burner where it is agitated systematically, brought into contact with air and burned. Water stores the heat produced and thus heats facilities or kilns. The flue gases produced during combustion are sucked off and purified in the filter system. The pulverized fuel burner is approximately fifty times smaller than conventional models and thus has only approximately two percent of their capacity. The advantage: This also makes the burner worthwhile for smaller quantities of waste, like those produced in small and medium-sized enterprises.

To develop it, the researchers first analyzed the residue this custom plant is supposed to utilize for MBG Metallbeschichtung Gerstungen GmbH. What happens to powder coating at temperatures of up to 600 degrees Celsius? It melts at 60 degrees Celsius. It rehardens when the temperature is raised to approximately 200 degrees Celsius. At 350 degrees and above, it bubbles, carbonizes and turns black. In another step, the researchers analyzed particle sizes. How large are the particles? The particles of ten micrometers, i.e. one hundredth of a millimeter, are very small in comparison with other residues. The material is even finer than flour. In and of themselves, such particles would be ideal for burning because they can be optimally mixed and fluidized with air.

It was not quite that easy, though, because the material presented some challenges: Since the powder coating already melts at 60 degrees Celsius, the particles agglomerate on their way to combustion and the average particle size would be approximately 200 micrometers. The material can additionally absorb water. The researchers want to prevent both occurrences. A very high flow velocity

Bernhard Kiep at work on the experimental plant in Gerstungen.

» Great potential savings: 25 percent of the natural gas usually used for heating can probably be saved and, additionally, one hundred percent of the disposal costs. «

is therefore needed in the burner so that the particles do not have any time to heat up all too much on their way into the furnace box. The researchers designed the furnace box, in which the particles are burned, to be large to give the individual particles enough space to react with one another and the air.

Simulations helped the experts from the Fraunhofer IFF when they were developing the burner. In order to be able to compute the temperature distributions and flow paths in this small burner, they first ran CFD (computational fluid dynamics) simulations. These simulations answered many of the researchers' questions: How do the powder particles flow in the burner? How can they be agitated optimally? How can the lowest emission levels be achieved? The temperature distribution in the furnace chamber could also be computed beforehand since the researchers incorporated extensive tools for reaction kinetics in the CFD simulations. In another step, the researchers further optimized the burner's settings and parameters in experiments.

Pilot Plant for Powder Coating

A pilot plant is already in operation at MBG Metallbeschichtung Gerstungen GmbH. It already achieves stable phases of several hours. The company holds a patent on the process for the recovery of heat from powder residues from coating plants, which was granted in conjunction with this project. The researchers from the Fraunhofer IFF customized the pilot plant specifically for the company's requirements, in this case the powder coating produced. It has a heating value of seventeen megajoules per kilogram and is thus commensurate with very dry wood. Waste-fired cogeneration plants, however, can only utilize wastes with heating values of ten to fifteen megajoules per kilogram. Their material is therefore difficult to dispose of: It must be distributed among several consumers and mixed with wastes that are difficult to ignite. Until now, disposal has cost the company approximately € 250 to € 400 per ton. This plant would enable Christian Würfel to cut these costs: The Fraunhofer IFF's process engineers estimate that the plant could utilize up to 130 tons of waste per year – more than sufficient for the quantities produced at MBG Metallbeschichtung Gerstungen GmbH. When that succeeds, the company would cut one quarter of its natural gas use by recycling waste.

Larger Plants Can Also Produce Power in the Future

The researchers have to modify a plant for the requirements contingent on the powder to be utilized. In other words, they have to engineer the pulverized fuel burner's combustion system for the size of the particular particles and design the filter system so that it optimally filters each of the flue gases produced

A briefing on the industrial client MBG GmbH's premises in Gerstungen.

out of the air. The researchers have already tested the burner, operating in the pilot plant with an output of 100 kilowatts, up to an output of 300 kilowatts – and assured that the emissions standards are met even at this high output. The experts from the Fraunhofer IFF can thus scale the plant both down, e.g. to 50 kilowatts, and up: They consider scaling it up to 500 or even 1000 kilowatts to be absolutely realistic. In the long term, the researchers are planning to interconnect several such burners into groups. "This would bring some advantages", explains Christian Würfel. "On the one hand, such a plant would also be interesting for operations with large quantities of waste. Such a plant could recycle around 10,000 tons of waste annually. On the other hand, such a plant would operate in a range in which the production of power becomes cost effective." Then, not only heat could be recovered from the waste but power could also be generated by a turbine in a cogeneration system, which could be supplied to the grid.

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Andreas Lehwald and Dr. Matthias Gohla

Ceramic Turbines

Powered by Fuel Gases

Anyone who needs power and heat is well advised to get a cogeneration system. Such systems in the upper performance range, used energy companies for instance, are often powered by gas turbines. Distributed systems in the lower performance range are not because the efficiency of small gas turbines is still too low. Researchers now want to use new materials to improve and, additionally, to power turbines with gases from waste instead of with natural gas.

Whether sun, wind or biogas – renewable energies are gaining ground fast. "Renewables" are supposed to deliver fourteen percent of the heat as well as thirty percent of the power needed in just seven years, i.e. in 2020. The German government has stipulated this in pertinent laws. That is not all, though: The share of cogeneration plants is supposed to be increased from around fifteen percent at present to twenty-five percent by 2020.

Distributed cogeneration plants are usually powered by conventional combustion engines. Such engines are complex,though, and incur high maintenance costs. Gas turbines provide an alternative: They have a simpler design and therefore do not wear as quickly. Energy producers, such as major utilities, already frequently rely on turbines. This is not the case in distributed systems, e.g. in manufacturing plants or large urban blocks. After all, gas microturbines have comparatively lower efficiencies than large turbines: While large turbines in CCGT plants achieve electric efficiencies of up to sixty percent, small turbines only reach efficiencies of around thirty percent.

Increasing Efficiencies – Boosting Market Opportunities

This is exactly the starting point for researchers from the Fraunhofer IFF in Magdeburg together with colleagues from four other Fraunhofer Institutes. In the project "Turbo-Keramik", they intend to replace some parts of gas microturbines with ceramic parts. One example is the turbine wheel, which basically consists of turbine blades. When a turbine wheel is made of technical ceramics, higher combustion chamber temperatures can be set and the turbine operates more efficiently. If the combustion chamber is operated in the usual temperature range, turbines last longer.

The researchers at the Fraunhofer IFF are in charge of selecting and procuring the turbine. Which turbine is best suited for the tests? They decided on a special turbine that produces thirty-eight kilowatts of electricity and sixty-eight kilowatts of heat. The distinctive feature of this gas turbine is the location of the turbine wheel, just like the other moving parts, on a shaft in an air bearing. Thus, the turbine needs neither lubricant nor coolant and it has to be serviced only rarely. Scheduled servicing once a year suffices even if it is running continuously.

Not only the temperature in the combustion chamber is instrumental efficiencies but also losses, above all gap losses. They occur since part of the gases flow in the gap between the turbine wheel and housing as a secondary flow, i.e. past the turbine instead of powering it. As far as gap losses are concerned, large turbines are more advanta-

The insides of a turbine with a combustion chamber, a recuperator and an injector. A compressor, a turbine and a generator are on a shaft. Compressed air flows through the recuperator to the combustion chamber. When it is burned, the gas expands, flows through the turbine and thus powers the compressor and the generator. Photo: Dirk Mahler

geous because small and large turbines have quite similar gap sizes. The larger the turbine, the less significant gap size is.

The demands on the material are immense: It ought to withstand extremely hot temperatures undamaged – this could raise temperature in the combustion chamber and increase efficiency. The material ought to expand as little as possible; otherwise the structure would increase gap losses. Moreover, the material must withstand high forces, be as light as possible and not break, either when bending or vibrating. It should also be chemically stable. Such material has to be almost impossibly versatile but the researchers are confident that advanced technical ceramics combine all of these properties. Initial model calculations with pertinent material properties have already demonstrated that rotors can, in principle, be made of technical ceramics. Researchers from the Fraunhofer IKTS are contributing the relevant expertise in materials. The project partners from the Fraunhofer IPK are lead managing the project and in charge of engineering the complicated rotor geometry and producing the right surface quality. The Fraunhofer IWS is in charge of coating and joining the parts.

Turbine Characterization

The commercial gas microturbine is already in the Fraunhofer IFF's facilities. At present, it is being operated – as intended by the manufacturer – with natural gas. Although the turbine unit's dimensions of approximately two by one by two meters make it much smaller than those in large centralized power plants, it functions according to the same principle nonetheless: A compressor, a turbine and a generator are on a shaft. The compressor sucks in and compresses air. This air flows through the recuperator to the combustion chamber where the fuel, natural gas,

Andreas Lehwald from the Fraunhofer IFF in Magdeburg preparing a test on the gas microturbine. Photo: Dirk Mahler

is added and the mixture is burned. When it is burned, the gas expands, flows through the turbine and thus powers the compressor and the generator. The generator produces electricity and the heat produced can be used for heating – that is the purpose of cogeneration.

Now, the researchers first have to characterize this commercial turbine. At the moment, it is a "plug-in" device – the researchers have no access to its internal data. A precise analysis of the turbine is therefore first on the agenda. What are the temperatures and pressures at different points of the turbine? How do these parameters change when the turbine is running in different operating states – when, for instance, it is operating at partial load and only producing twenty kilowatts of electricity instead of thirty?

Powered with Gases from Waste Instead of with Natural Gas

Once the researchers have concluded the characterization they want to tie the turbine in with the Process and Plant Engineering Business Unit's other fields of research such as heat recovery from waste. This will furnish a major advantage: The turbine could then be powered not only with natural gas but also with fuel gases from biological materials or residues. The researchers at the Fraunhofer IFF have already developed a suitable gas production system.

The step of converting the turbine for other gases harbors some challenges, however, because gases produced by gasifying residues, for instance, have a completely different composition than natural gas, which consists almost entirely of methane. The fuel gases may contain not only methane but also considerable percentages of hydrogen, carbon monoxide and, naturally, also nitrogen and carbon dioxide. The researchers must therefore modify and convert the burner properly for this gas.

The fuel gases must be treated before they can power the turbine: They may not contain dust or other solid particles. An appropriate filter assures this. The turbine is incompatible with fractions of any kind of liquid as well.

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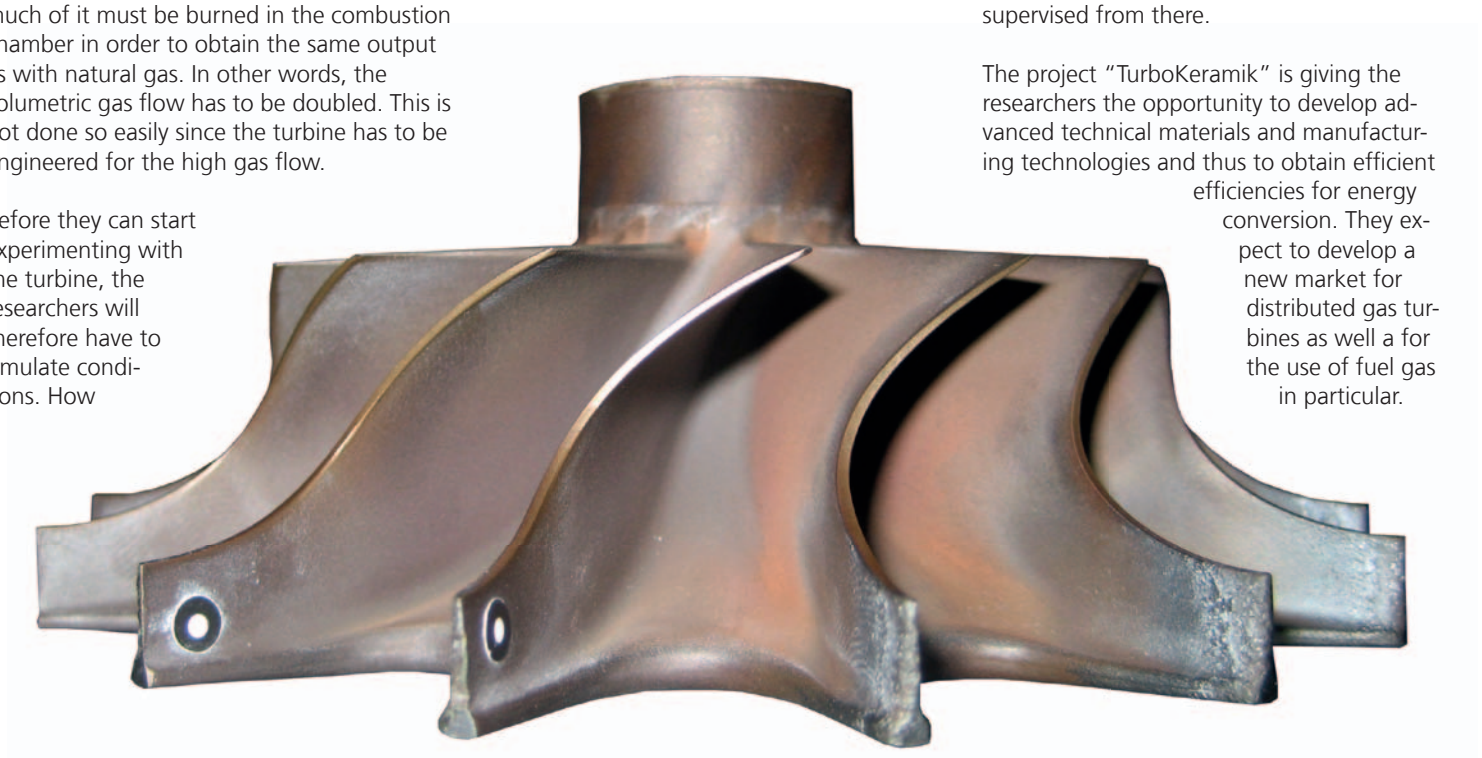
The project **TurboKeramik** is giving the researchers the opportunity to develop advanced technical materials and manufacturing technologies and thus to obtain efficient efficiencies for energy conversion.

Simulations Facilitate Optimization

The fuel gases not only have a different composition than natural gas. They also have different heating values. If, for instance, one gas has only half the heating value, twice as much of it must be burned in the combustion chamber in order to obtain the same output as with natural gas. In other words, the volumetric gas flow has to be doubled. This is not done so easily since the turbine has to be engineered for the high gas flow.

Before they can start experimenting with the turbine, the researchers will therefore have to simulate conditions. How would the turbine operate with different gases? How do the gas flows change? This will be revealed by flow simulations performed by researchers at the Fraunhofer IFF together with their colleagues at the Fraunhofer SCAI. Once these simulations have been completed and the parameters defined, the experiments will follow in a next step. Is practice as theory predicts? The researchers are additionally planning to automate the turbine's operation in the future. They want to achieve a level of automation that allows controlling the turbine from a control room – a kind of remote control. Then, it could also be monitored and supervised from there.

The project "TurboKeramik" is giving the researchers the opportunity to develop advanced technical materials and manufacturing technologies and thus to obtain efficient efficiencies for energy conversion. They expect to develop a new market for distributed gas turbines as well a for the use of fuel gas in particular.



A gas microturbine rotor, the heart of a distributed cogeneration plant. Photo: Andreas Lehwald

Robot Colleagues are Heading Our Way!

Sabrina Gorges

It will soon be possible to integrate mobile robots in production environments where they will work side-by-side with humans. A European consortium is developing such robots for the aircraft industry in the project VALERI. Enabling humans and machines to cooperate is one of the major challenges.

Calling this project an industry vision would not do it justice because it is in fact far more realistic than one might generally assume. We are talking about autonomous robots that will independently navigate factories quite naturally – industrious helpers that will perform a wide variety of jobs in the production process where they will lubricate, bolt, drill, assemble, transport, measure or inspect. They will be like colleagues for humans. One cannot be replaced by the other. They will work together hand in hand, day in and day out.

Mobile Robots in Industrial Environments

Mobile robots would be ideal especially in major industries such as the aircraft manufacturing, shipbuilding and automotive manufacturing. Among other things, they would make manufacturing operations faster and more flexible, enhance quality and free skilled employees from tedious jobs. Those are just a few of the ways they would give companies an important edge in global competition.

In the future, they will constitute a third element alongside stationary industrial robots and humans in the world of industrial work – one without cages and barriers. Nevertheless, no one will be in danger because the mobile robots will be equipped with a variety of smart sensor systems that enable humans and machines to interact safely. Each of these systems has been custom developed to execute specific tasks and monitor specific work environments with absolute reliability, thus assuring people's safety at all times.

A European Consortium

In the fall of 2011, the Fraunhofer Institute for Factory Operation and Automation IFF in Magdeburg and well-known European partners set out to make this idea reality in the project VALERI.

VALERI is an acronym for "Validation of Advanced, Collaborative Robotics for Industrial Applications". Kicked off in November of 2012, the three-year project is being supported by the European Union's program "Factories for the Future" with a budget of around € 3.6 million. The project partners are Airbus Military (Spain), FACC (Austria), IDPSA (Spain), KUKA Laboratories GmbH (Germany), PROFACTOR GmbH (Austria) and PRODINTEC (Spain) in a pan-European consortium uniting

researchers, manufacturers and end users. The project is lead managed and was originally conceived by the Fraunhofer IFF.

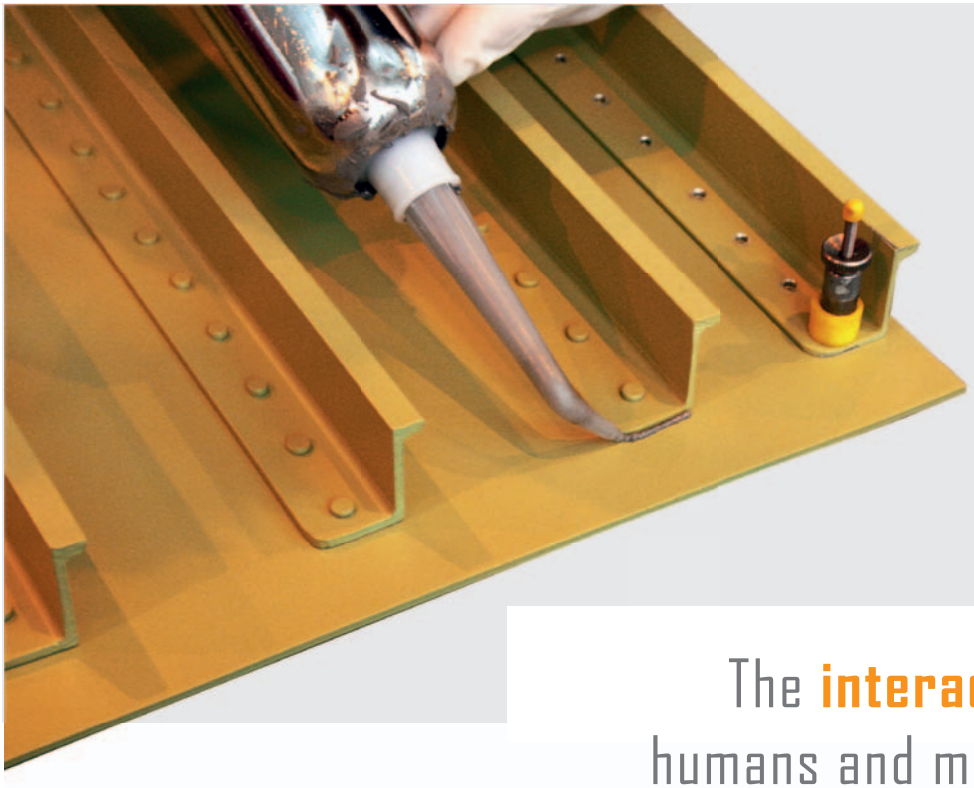
Ideal for the Aviation Industry

José Saenz is in charge of the project at the Fraunhofer IFF and the overall coordinator of VALERI. "The project is initially intended for the aviation industry. This production environment is perfect for the project," says the mechatronics specialist. The manufacture of large, bulky aircraft parts that are worked on stationarily over a longer period is an ideal setting for the use of mobile robots. They ought to be integrated in assembly and inspection jobs that are usually shaped individually by customer demands. The project partners have a clear idea of the tasks to be assigned to the robots. "They are supposed to applying sealing compound and perform inspection jobs," says Saenz. Sealing especially plays a big role in aircraft manufacturing. "Large quantities of sealing compound have to be applied when fuselage elements are assembled, for instance. Those are tasks that a robot can do well."

Airbus Military and FACC are specifying exactly where and how the VALERI robot will be applied. The two end users are formulating the application scenarios and will detail them over the course of project work. "With Airbus and FACC, we have partners that know exactly what is needed and where mobile robotic systems make sense in aircraft manufacturing and where they don't," says Saenz. Airbus Military and FACC are not just project partners. They are also providing the test environment and components for the prototypes. The other partners are contributing crucial know-how.

The primary concerns are more flexibility, higher speeds and the creation of added value in production. Stationary robots in a production environment where larger parts are machined in a single piece of equipment over a period of up to two weeks are expedient only to a limited extent. "Take an aircraft fuselage for example," says Saenz. "Its elements are too large to modify for the work of a conventional stationary production robot. You can't constantly twist and turn

Aircraft production at Airbus. Autonomous robots are going to be used in their production in the future. Photo: Airbus Military



Large quantities of sealing compound have to be applied when fuselage elements are assembled. Mobile robots can take over such jobs. Photo: Airbus Military

The **interaction** between humans and machines has to be one hundred percent **safe**.

such a part so that the robot can work on it. So, it has to work the other way around. The robot approaches the spot it is supposed to work on."

Safety Is a Top Priority

How safe will a lone worker be in an environment in which robots regularly cross his or her path? "The interaction between humans and machines has to be one hundred percent safe," says Saenz. "Take a common industrial robot: It is stationary and usually banished behind a protective barrier during operation." There is no physical contact between humans and the machine. "If somebody enters the safeguarded area, everything stops." If, however, a robot is freely moving on the factory floor and working with moving manipulators that suddenly expand its operating radius and thus the potential hazard exponentially, humans must be protected from collisions in some other way. In addition to contributing to the actual interaction, the Fraunhofer IFF will be developing technologies that provide such protection.

Tactile Sensor Systems Allow Robots to Sense Contact

One solution that minimizes risk is a tactile sensor system, a system that enables robots to detect unintentional contact. If such contact nevertheless occurs despite the presence of other, for instance optical, safety sensors, the robot will stop, slow or change direction.

Research on suitable pressure-sensitive surfaces is already very advanced at the Fraunhofer IFF's testing facility where the researchers have also constructed some models for various applications. They have integrated the sensors in different materials, ranging from highly sensitive to very robust to waterproof. This makes it easy to modify them later for a wide variety of robots. Such surfaces, covered with sensors, are stretched over robots like an artificial skin.

New Approaches in the VALERI Project

"For the VALERI project, however, we have to find new approaches together with the developer companies involved," says Saenz. "Depending on the application, the robot surfaces have to be cushioned, very robust in keeping with the production environment or even resistant to chemicals." Work on the safety concept is being augmented by know-how and concrete research findings

A mobile platform, KUKA's "omniRob", is serving as the basis for the joint developments in the VALERI project. Photo: KUKA

in the field of optical workplace monitoring. The Fraunhofer IFF specializes in this, too. Nothing is off the rack. Everything is customized and subordinate to the objective of the project.

Partners other than the Fraunhofer IFF are responsible the mobile colleagues' intelligence. Properly programmed, the robots will synchronize data, e.g. for recurring operations, on their own in the future. Autonomous coordination of paths of motion is also part of the research in the VALERI project.

The Goal is the Mass Market

How should one imagine mobile colleagues one day? The OmniRob robot from KUKA is serving as the basis for joint developments. Specific modules such as safety sensors, tools and camera systems that scan the environment are being be modified for the system in order to turn the platform into a veritable jack of all trades.

"At the end of the project, we intend to test the mobile robots thoroughly in a real environment," says Saenz, looking forward. "It should move autonomously, recognize parts, complete jobs and present absolutely no danger to people in the process." The first test model is supposed to be turned into a mass marketable tool in another three to five years. Saenz knows, "There is a market for this. And we are working on the major goal of supplying this market." What about people? Naturally, the VALERI consortium doesn't want to replace them. That wouldn't work, either. "People continue to have the highest level of flexibility in the working world," says Saenz. "You can't automate that."

José Saenz,
Robotic Systems Business Unit

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An RFID wristband clearly identifies products. Work in production and logistics can only be effective when sources of error are minimized, operations have been optimized and the work environment is ergonomic. That is why the Fraunhofer IFF developed a new RFID wristband that identifies moving objects. Warehouse workers or assemblers who wear it have both hands free as it automatically identifies the objects that they grasp. Photo: Dirk Mahler

Not only young researchers were astounded by the Long Night of Science in Magdeburg. Researchers from the Fraunhofer took them on a trip into cyberspace at the Elbe Dom in the Virtual Development and Training Centre VDTC. Thousands of visitors experienced captivating talks, fascinating experiments and hands-on research at Magdeburg's 8th Long Night of Science on June 1, 2013. Over 1300 visitors came to the Fraunhofer IFF, above all, to learn about logistics research and energy efficiency. Photo: Viktoria Kühne

From an idea to a product in time-lapse:
Together with the specialty chemical company LANXESS, researchers at Magdeburg's Fraunhofer Institute for Factory Operation and Automation IFF developed and built in record time a plant that produces reverse osmosis membrane elements for a water treatment system. Virtual engineering allows research and development to proceed simultaneously.
Photo: Dirk Mahler

Colloquium Honors Prof. Michael Schenk, Director of the Fraunhofer IFF, on His 60th Birthday

Prof. Michael Schenk didn't have a free minute on April 16. In the morning, staff from the Fraunhofer IFF and the Institute of Logistics and Material Handling Systems of Otto von Guericke University Magdeburg congratulated him and presented him with gifts. Among the staff were: Dr. André Naumann, Dr. Przemyslaw Komarnicki, Bartlomiej Arendarski and Dr. Matthias Gohla (l. to .r.) from the Process and Plant Engineering Business Unit at the Fraunhofer IFF. A colloquium in his honor followed afterward. Photo: Viktoria Kühne

On April 16, 2013, the Fraunhofer IFF, the Saxony-Anhalt State Chapter of the Association of German Engineers VDI and Otto von Guericke University Magdeburg hosted an academic colloquium honoring Professor Michael Schenk on the occasion of his 60th birthday. Entitled "Production and Logistics with a Future" the event at the Gesellschaftshaus in Magdeburg drew nearly 200 attendees. Guests included Minister President Dr. Reiner Haseloff, Saxony-Anhalt Minister of Economics and Research Prof. Birgitta Wolff, Magdeburg Mayor Dr. Lutz Trümper, University President Prof. Jens Strackeljan, VDI Director Dr. Willi Fuchs and the Fraunhofer-Gesellschaft Executive Board Member Dr. Alexander Kurz. Dr. Kurz presented Prof. Schenk with the Fraunhofer Medal in recognition of his contributions to applied research. It was designed to mark the 200th birthday of Joseph von Fraunhofer on March 6, 1987. The obverse is decorated with a portrait of Fraunhofer, the reverse with a view of Straubing, the city of his birth.

Prof. Michael Schenk has headed the Fraunhofer Institute for Factory Operation and Automation IFF in Magdeburg since 1994. In those nineteen years, he has guided it to become one of the leading organizations for applied research in production and logistics in all of Germany. Michael Schenk was born in Rosslau and grew up in Jena, His pursuit of a degree in mathematics brought him to Otto von Guericke Technical College in Magdeburg in 1972. Schenk earned his doctorate in 1983 and his Habilitation degree in 1988. He has been teaching at the university in Magdeburg since 1989. Prof. Michael Schenk was part of the founding team of the Fraunhofer IFF and has headed the institute since 1994. He was made a full professor in April of 2003 and holds the Chair of Logistics Systems at Otto von Guericke University Magdeburg. The VDI appointed Prof. Michael Schenk representative of the state of Saxony-Anhalt in 2006. The Institute of Logistics and Material Handling Systems was established at Otto von Guericke University under his leadership. International universities have honored Schenk's dedication to research with honorary doctorates. The first was Moscow State Automobile and Road Technical University MADI in 2007. Mykola-Schukowski National Aerospace University in Kharkiv, Ukraine even made Prof.Michael Schenk an honorary professor in 2009 in recognition of his contributions to research and education in the field of logistics. ■

All people are named from l.to .r. | Photos: Viktoria Kühne

The staff's gave their boss a gift of three trees. They will be planted in Herrenkrug Park, the Port of Science and the North Park as part of the campaign "My Tree for Magdeburg". They also gave him a photo book, "Trees of Research", filled with congratulatory messages and photos from the past.

Deputy Director Gerhard Müller emceed the round of congratulations on behalf of the staff.

Prof. Michael Schenk between two staff council representatives, Uwe Amreihn and Beate Ziller.

Bianca Zorn, Ines Schildt, Andy Gottschalk and Alina Heusmann from administrative services looking at the birthday photo book "Trees of Research"

Impressions

The staff of the Fraunhofer IFF and ILM at Otto von Guericke University **congratulated** the institute's director **Prof. Michael Schenk on his 60th birthday** on April 16, 2013

The staff of the Institute of Logistics and Material Handling Systems at Otto von Guericke University Magdeburg where Prof. Schenk holds the Chair of Logistics Systems.

Not only the birthday boy enjoyed Prof. Müller's charming and amusing words. Others in attendance included Dr. Eberhard Blümel, Wibke Pörschke, Sabine Conert, Ina Daehre, Anna Mahler and Simon Adler.

Pierre Möllers, Thomas Hartwig, Prof. Friedrich Krause, Sebastian Möser, Dr. Andriy Telesh, Thomas Seidl and Eric Bayrhammer

Only Thomas Seidl, Alexa Kernchen, Thomas Hartwig, Prof. Ulrich Schmucker and Prof. Michael Schenk. know what's behind "Movie-3D Mobile, Fully Immersive and Interactive Real-time 3D VR System".

The Sax'n Anhalt Orchester enlivened the mood later on in the evening. Their performance was a surprise from Gabriele Discher from the Maritim Hotel in Magdeburg and Manfred Discher from the Friends of the Corvette Magdeburg, Magdeburg City Commissioner for Culture Dr. Rüdiger Koch, Dr. Uwe Küster from the European SPD Office and Kathrin Budde, chair of the SPD in Saxony-Anhalt's parliament.

Prof. Michael Schenk receiving the Fraunhofer Medal for his contributions to applied research from Executive Board Member Dr. Alexander Kurz.

Prof. Dieter Spath, Director of the Fraunhofer AO in Stuttgart, and his wife.

Leopold Pilsner, Director of Logistik Center Leoben in Austria, Prof. Michael Schenk and his wife Sabine, Prof. Helmut Zsifkovits from the University of Leoben, Prof. Albert Oberhofer, President of the Logistik Club in Leoben, and his wife Emmi.

Prof. Vjacheslav M. Prikhodko, President of Moscow State Univeristy MADI, offered his congratulations in person.

Dr. Willi Fuchs, Director and Executive Member of the Executive Board of the Association of German Engineers, spoke about "Skilled Labor of the Future".

Prof. Birgitta Wolff, at that time still Saxony-Anhalt Minister of Economics and Research, Sabine Schenk, Prof. Sigried Wirth from the Technical University of Chemnitz, Prof. Michael Schenk and Dr. Reiner Haselhoff, Minister President of the State of Saxony-Anhalt, obviously enjoying listening to the speakers at the colloquium.

Manfred Maas (right), Managing Director of the Investitionsbank Sachsen-Anhalt, arrived with a unique gift.

All people are named from l.to .r. | Photos: Viktoria Kühne

»Applied Logistics«

Holger Seidel Still Spokesman of the Saxony-Anhalt Regional Chapter of the BVL

Holger Seidel, Manager of the Logistics and Factory Systems Business Unit at the Fraunhofer IFF, was reelected spokesman of the Saxony-Anhalt Regional Chapter of the BVL for the fifth time. Photo: Viktoria Kühne

Holger Seidel, Manager of the Logistics and Factory Systems Business Unit at the Fraunhofer IFF, was reelected spokesman of the Saxony-Anhalt Regional Chapter of the German Logistics Association BVL.

Holger Seidel has been supporting the Saxony-Anhalt Regional Chapter of the BVL, part of a strong network, for many years. In this job, he provides partners and interested companies the latest information on logistics and successful events. As the institute's representative, he connects researchers and practitioners. As vice-chairman of the logistics advisory board in the Saxony-Anhalt Ministry of Regional Development and Transportation he is also simultaneously the link to the state government.

The German Logistics Association BVL is a network for logistics and supply chain management with over 10,000 experts and executives from industry, retail, the service industry, research and academia. With over thirty regional chapters, it supplies ideas and impetuses for cross-industry and trendsetting logistical concepts that assure companies remain competitive at home and abroad. ■

A Human Resource Developer with a North German Heart Earns His Doctorate in Magdeburg

Jörg von Garrel started working at the Fraunhofer IFF as a research manager in 2006. He earned his doctoral degree "magna cum laude" in May of 2012.

Jörg von Garrel has always been interested in teaching and in numbers. In 1997, he began pursuing a teaching degree with a major in economics and a minor in mathematics at the university in Oldenburg. In 2004, he switched to the university in Magdeburg to pursue his Master's in vocational education and human resource development, specializing in mathematics and business administration.

His work at the Fraunhofer IFF has given him insight into different fields of research and practice. In very short time, he became a project manager in 2007 and was in charge of corporate development projects. All the while, he was writing his doctoral dissertation entitled "Retaining Knowledge: An Analysis of Knowledge and Innovation-Driven Collaborative Relationships in a Regional Context in Structure and Action". His dissertation examines collaboration among organizations and, in particular, the influence of employees who are directly involved. "The development of new strategies of resolution is what made my dissertation attractive to me. I immensely enjoy continuously being challenged by fascinating problems and working on an experienced team. I find the Fraunhofer IFF to be a very attractive employer that I would further recommend anytime," he explains in his North German dialect that gives away his origins.

He considers his professional future to be a combination of the two worlds of applied research and teaching. Dr. Jörg von Garrel hopes to achieve his primary goal of being made a professor one day.

Although Dr. Jörg von Garrel, with his North German heart as he puts it, is still firmly rooted in his home region, he has made a home he values here in Magdeburg. He enjoys life in the city on the Elbe and enjoys spending time with friends in one of its many cafés. ■

Dr. Garrel also underwent the traditional doctoral initiation at the monument to Otto von Guericke in downtown Magdeburg. Photo: Christoph Neumann

Riga Awards Honorary Doctorate to Dr. Eberhard Blümel

President Leonids Ribickis presenting Dr. Eberhard the diploma for his honorary doctorate from Riga Technical University.
Photo: Eduards Lapsa

Dr. Eberhard Blümel, manager of the Fraunhofer IFF EU Office, received an honorary doctorate from Riga Technical University on October 13, 2012. The awards ceremony was held during the festivities marking the Latvian university's 150th anniversary. The ceremony was also attended by the President of Latvia, Andris Berzins, who was named an "Honorary Member of Riga Technical University".

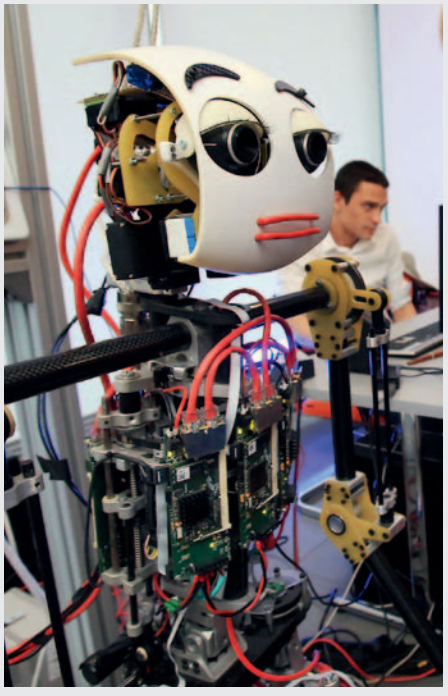
This accolade for Dr. Eberhard Blümel followed more than eighteen years of successful collaboration between the Fraunhofer IFF and the School of Information and Communications Technologies at Riga Technical University. Their collaborative relationship began in 1995 with the joint project AMCAI, a study of the use of digital simulation systems to improve logistics and port operations. Since 2007, their collaboration has increasingly been focused on the use of virtual reality technologies for education and training. Their collaboration is presently concentrated on the EU project eINTERASIA, which is transferring technology to Central Asia. Together with other regional partners, the Fraunhofer IFF and Riga Technical University are additionally supporting the establishment of an Aviation Research Center AVR in Riga. It will focus on the development and international use of education and training systems for aircraft maintenance. The Fraunhofer IFF is contributing a software platform for VR simulations and a mobile VR workstation to the project. ■

Why the Robot »Rotto« Sings the Beatles' Song »Yesterday«

Twenty-nine-year-old Dr. Andriy Telesh's resolve led him to earn his doctorate. He regards that time as very instructive: "You are intensively immersed in a discipline's various fields of research – that is the true discovery." The topic of his dissertation, "Development of Algorithms for Anthropomorphic Robot Motion on the Basis of Nonlinear Oscillations", literally helped get the robot "Rotto" on its feet. Previously, static motion models had been used to program legged robots' motion and movement. This earned the young doctor "magna cum laude".

Dr. Andriy Telesh majored in electrical engineering at Donetsk National Technical University in Ukraine. Right before he completed his Diplom degree in 2004, he

First, the robot "Rotto" learned to walk. Now it talks and sings. One of its "teachers" was Dr. Andriy Telesh. Photo: Viktoria Kühne



Always Been »Wired«

After successfully defending his dissertation, Dr Andriy Telesh was brought to the traditional initiation at the monument to Otto von Guericke in downtown Magdeburg. Photo: Andriy Melnynkov

Dr. Marco Franke, happy about earning his doctorate. Photo: Denise Sommer

intensified his study of the fundamentals in the dual-degree program in Germany and Ukraine. In 2006, he graduated with top marks and a Master's in electrical engineering from the university in Magdeburg as well as a Master's in electronic automated systems and electric drive engineering from the university in Donetsk.

Dr. Telesh sometimes still composes music for piano and guitar in his free time. Music, his passion, also affects his work as a developer. The Beatles song "Yesterday" was the first linguistic material, programmed into Rotto. ■

A great deal of mechanical power is needed to turn the heavy rotor blades of wind turbines away from the wind. The development of a powerful drive system that does this was the subject of Dr. Marco Franke's dissertation entitled "Multidisciplinary Modeling and Simulation of a Rolling Rotor Switched Reluctance Motor", which he successfully defended in July. He wrote his dissertation in cooperation with the Fraunhofer Institute for Factory Operation and Automation IFF, while also working as a graduate assistant at Merseburg University of Applied Science and as a doctoral student at Otto von Guericke University Magdeburg.

Franke started out at the Fraunhofer IFF as a student assistant in 2007 and has been a research manager in the institute's Virtual Engineering Business Unit since 2011. His career to becoming a full-fledged researcher at the Fraunhofer IFF could not have proceeded any faster. He liked the combination of academic theory and hands-on practice so much that he was happy to stay on. "My work is shaped by constantly changing fields of activity and multidisciplinary projects. I greatly enjoy precisely this dynamic combined with working with a dedicated and creative team." His fascination for electronics is constantly driving Dr. Marco Franke: "It is unbelievable what all is possible with electronics. Where would we be today without it? There is virtually nothing that makes our everyday life easier."

In his work at Otto von Guericke University and the Fraunhofer IFF, Marco Franke is researching the modeling and simulation of electrical machinery, machinery's heat and noise generation and multidisciplinary systems. In the project VierforEs, for instance, he is collaborating on the development of an autonomous excavator. Since this piece of equipment is intended to operate without a driver, special simulation models are needed to test its control systems beforehand. The young doctor also enjoys the work in a project for the special chemical company LANXESS. He helped his colleagues develop and build a new plant in record time, which produces reverse osmosis membrane elements for a water treatment system.

Dr. Marco Franke only relaxes when he is really able to give his all. His favorite sports are some of the most strenuous: volleyball, windsurfing, squash, waterskiing and wakeboarding, just to name a few. ■

Earning a **Dual-Degree** in Logistics in Moscow and Magdeburg

Prof. Jens Strackeljan (l.), President of Otto von Guericke University Magdeburg, and Prof. Vjacheslav Prikhodko (r.), Director of MADI, signing the cooperation agreement. Photo: Daniela Martin

Otto von Guericke University Magdeburg and Moscow State Automobile and Road Technical University MADI will start offering a dual-degree in logistics in the 2013-14 winter semester. Students from the two universities will be able to earn an intercultural, German and Russisan Master's degree. The presidents of the two universities made this official when they signed a cooperation agreement on April 8, April 2013 during a visit by a delegation from the Russian university here in Magdeburg. The agreement was presented at the German-Russian Economic Summit at the Hannover Messe.

The Fraunhofer IFF is involved in the exchange program as a partner. It will use its close ties to business and industry to provide exchange students practical experience while they are pursuing their degrees. It will also provide them advising together with Otto von Guericke University Magdeburg when they are writing their Master's theses.

Numerous joint research projects have established close ties between the Fraunhofer IFF, Otto von Guericke University and Moscow State Automobile and Road Technical University since 2004. With over 18,000 students and 3,500 faculty members, Moscow State Automobile and Road Technical University is one of Russia's most important universities. ■

Marketing at the Fraunhofer IFF Has a New Face

Wibke Pörschke is the new marketing manager at the Fraunhofer IFF. Photo: Dirk Mahler

Communications expert Wibke Pörschke has taken over marketing at the Fraunhofer IFF and has been working to market the institute's research services since November of 2012. This is an important job. Since only thirty percent of the Fraunhofer-Gesellschaft's budget comes from public funding, its researchers must obtain the remaining seventy percent of their funding through contract research with partners from business and industry.

Born in Magdeburg, she left her hometown behind her in 2003 to earn a degree in communications, specializing in economics, at the university in Stuttgart. After graduating, she worked at, among other places, a communications agency in Frankfurt am Main. After ten years, she has returned to her family and the Elbe flood plains.

Wibke Pörschke's search for an attractive employer ended at the Fraunhofer IFF. "It is the perfect combination of natural sciences, research and communication," she says, describing what she especially likes about her job. "What is more, I'm very happy to be living on the Elbe again. The Elbe flood plains are simply unforgettable. The Neckar or Main can't compare. I rediscovered Magdeburg's beauty from afar," she say all bright-eyed.

Wibke Pörschke relaxes by playing the piano. She especially likes tickling the ivories to play Robert Schumann's "Kinderszenen". Her new apartment finally has enough room for a proper piano again! ■

Otto von Guericke University: 2013 International Spring Logistics School

Dr. Tobias Reggelin guiding the students of the 2nd Spring Logistics School through a management game. Photo: Daniela Martin

The second Spring Logistics School hosted by the Institute of Logistics and Material Handling Systems at Otto von Guericke Universaíty Magdeburg continues to enjoy great popularity. Students from Moscow State Automobile and Road Technical University and the National Aerospace University in Kharkiv were in Magdeburg from February 24 to March 9, 2013. For two weeks, they attended interesting courses and worked on projects. Going on excursions to regional companies to learn about specific applied logistics solutions is just as much part of the extensive program as playing logistics management games at the Fraunhofer IFF. For two weeks, the students intensively study the latest methods of planning and analysis to assure quality and improve processes. "This was something completely new for most of us and, above all, a positive experience because this kind of teaching is not commonplace at home – an excellent tool to understand logistics and its technologies," says student Natalia Dubach, reporting on her experiences. ■

First Student in the German-Ukrainian Logistics Degree Program

Sergej Skritutskiy is the first exchange student in the dual-degree logistics program between the National Aerospace University in Kharkiv and Otto von Guericke University in Magdeburg. Having already earned a Master's degree in aerospace systems, Sergej Skritutskiy embarked on his adventure in Germany in March of 2012. He wrote his Bachelor's thesis on "Mesoscopic Simulation of Logistics Systems with ExtendSim" at the Fraunhofer IFF. He is particularly impressed by the inspiring environment and the interdisciplinary teamwork. "The researchers have a lot of creative latitude here. In the Ukraine, it is often essential to keep to a strict routine. Here, both are combined for a big gain in experience," says the student, describing his experiences. The two universities have collaborated closely on a number of research projects over the years. This program has been strengthening their ties even more since the summer of 2012. Students must spend at least one year at each of the host universities in order to earn both Bachelor's degrees in industrial engineering and logistics from Otto von Guericke University and in applied mechanics with a specialization in aviation logistics from the National Aerospace University. Graduates with this double degree have two national academic degrees from the partner universities. Students are supported financially by grants from the German Academic Exchange Service DAAD and by Ukrainian grants. ■

Sergej Skritutskiy playing the management game "Logistics-driven Corporate Management ULF" at the Fraunhofer IFF in 2012. Photo: Daniela Martin

Editorial Notes

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Outlook

Meet up with researchers from the Fraunhofer Institute for Factory Operation and Automation IFF at these events.

June 18 – 20, 2013
16th IFF Science Days, Magdeburg

June 3 – 5, 2013
Hafenhinterland-Konferenz, Magdeburg

August 13 – 18, 2013
MAKS, Moscow, Russia

September 3 – 4, 2013
Fachtagung Produktionsmesstechnik, Buchs, Switzerland

September 26 – 29, 2013
NUFAM, Karlsruhe

October 1 – 5, 2013
6th International Conference on Advanced Research in Virtual and Rapid Prototyping, Leira, Portugal

October 7 – 9, 2013
EXPO REAL – 16th International Trade Fair for Property and Investment, Munich

October 8 – 10, 2013
BIOTECHNICA, Hannover

October 16, 2013
Tag der Elektromobilität, Magdeburg

October 18, 2013
Fraunhofer IFF Research Colloquium, Magdeburg

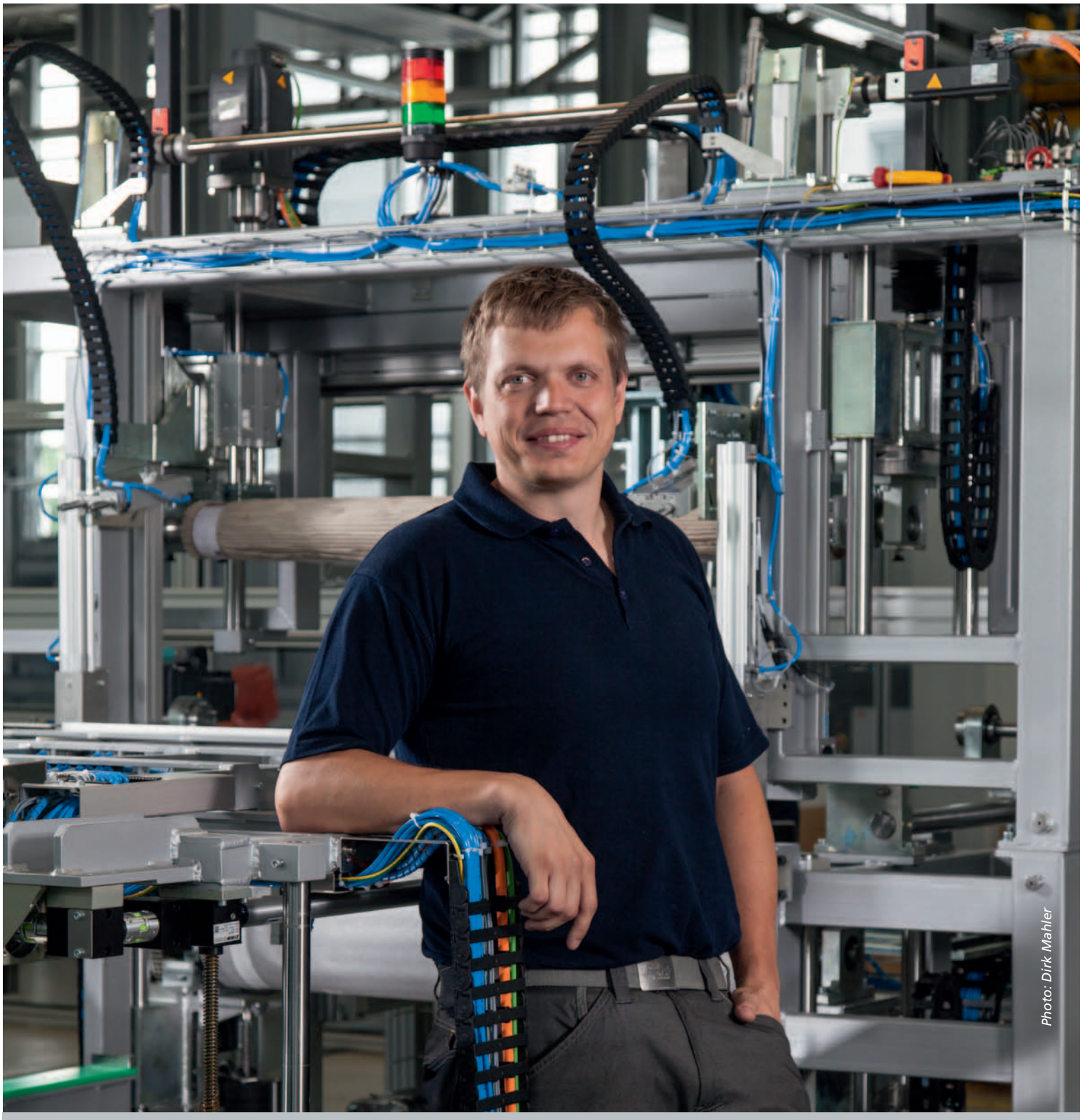
October 22, – 23, 2013
Fraunhofer Vision Technology Days, Munich

October 23 – 25, 2013
30th International Supply Chain Conference, Berlin

October 23 – November 27, 2013
"Humans and Machines in Interactive Dialog"
Virtual Reality Guest Lecture Series, Magdeburg

November 7, 2013
Laser Scanning and Virtual Reality in Plant Engineering Industry Working Group, Magdeburg

November 20 – 21, 2013
Optical 3D Metrology for Quality Assurance in Production, Magdeburg



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