Eastern Germany - Cleantech location
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Since reunification, the new federal states and Berlin have made astonishing progress: Many modern, efficient and highly innovative businesses have sprung up, from the Baltic Sea coast to the Ore Mountains, replacing the old, outdated industries and factories in many places. Particularly successful have been industries that were able to build on previous competencies. Eastern Germany has, for example, a long tradition of making use of scarce resources and seeking pragmatic and innovative answers to problems. After reunification, it also gained extensive experience in cleaning up contaminated sites and repairing environmental damage. Thanks to this know-how and with the new opportunities afforded by a technology-driven market economy, eastern Germany has advanced to become the ideal location for developing an entire cross-sectoral industry: cleantech.

The mission of CLEANTECH Initiative Ostdeutschland (CIO) is to provide continued support to these success stories. It is an umbrella organisation for eastern German cleantech enterprises in the lead markets of environment-friendly energies and energy storage, sustainable water management, energy efficiency, circular economy, raw material and material efficiency and sustainable mobility. To enable its member firms to achieve maximum commercial success, it links business and industry with the scientific community, galvanising the available potential and experience across sectors and states. The intention is also to develop eastern Germany into a major cleantech location and enhance its international reputation. CIO came about on the initiative of the Federal Government Commissioner for the New Federal States and the Parliamentary State Secretary at the Federal Ministry for Economic Affairs and Energy, Iris Gleicke.

CLEANTECH Initiative Ostdeutschland pursues three specific fields of action: innovation, internationalisation and investment. It helps advance innovations and supports companies in their internationalisation efforts and in accessing new markets. It also provides advice on acquiring funding and investment finance to successfully implement development strategies. Collaborations and joint projects are instigated in working groups. This way, CIO harnesses the available potential for generating progressive ideas and facilitating close information exchange among cleantech actors.

CIO organises information events (e.g. on a specific theme) and collaborations (e.g. joint projects to form a consortium) for this and supports cooperation among companies (e.g. supplier workshops), but also between business and industry and scientific institutions (e.g. CIO Campus events). It also provides an excellent information and communication platform with relevant databases for networking with other cleantech firms.

Find out more about CIO’s services at: www.cleantech-ost.de
Germany is one of the world's leading cleantech nations and eastern Germany in particular has developed into a strong and competitive location for environmental and energy technology.

Owing to the immense backlog in the new federal states, large-scale projects have been carried out in the environmental sector in the 25 years since reunification, including constructing or repairing water supply and wastewater treatment plants, building waste recycling facilities and recultivating post-mining landscapes. This has contributed to the emergence and growth of experienced, commercially successful and innovative enterprises.

In the course of implementing the energy transition, eastern Germany has played a growing role as a cleantech location. The renewables ratio has, for example, risen substantially, many projects have been carried out to improve energy efficiency and research and development in new storage technologies has reached an intensive stage.

Exciting projects and new ideas are surfacing in all six lead cleantech markets - environment-friendly energies and energy storage, sustainable mobility, sustainable water management, circular economy, energy efficiency and raw material and material efficiency. Combined with know-how and the desire to make a lasting improvement to our environment, inventive minds are spawning innovative products and intelligent solutions, with a large contribution also coming from the well-qualified specialists and excellent universities and research institutions in eastern Germany. Many of them are engaged at international level and are playing a major role in global know-how transfer.

On the following pages, we invite you to take a journey through the eastern German cleantech landscape and get to know some unique research institutions and remarkable companies.

See for yourself - the future in the making!

**Irena Bernstein**

Network Manager, CLEANTECH Initiative Ostdeutschland
Dear readers,

Not so many years ago, cleantech was still regarded as a technological niche for idealists championing environmental and climate protection, but that has changed: From being treated as a slightly odd fringe movement it has become a global megatrend.

Even some previously incorrigible skeptics are now also beginning to realise that the future of our planet is actually in danger, not just in the minds of a few eccentrics, and people seem to have finally grasped that the sustainable use of energy and resources also makes economic sense. The global backlog in cleantech has made it into a high-growth sector.

Germany is well positioned on cleantech markets, with German products taking a prominent place on all of the six leading ones. It is even acknowledged worldwide as one of the leading cleantech nations with eastern Germany also making a major contribution. A nexus of innovative start-ups, long-established businesses and research institutions has emerged, all of them dedicated to cleantech. In some cases, clusters have now developed that go beyond regional borders. Eastern German cleantech enterprises are also a match for their western competitors. There are many small companies here that are internationally competitive, with even the occasional hidden champion among them.

With this booklet, CLEANTECH Initiative Ostdeutschland provides an overall picture of the eastern German cleantech industry in its six lead markets and gives outstanding eastern German enterprises an opportunity of presenting themselves and their know-how to give the reader a better insight into eastern German cleantech.

This publication does not, however, just document the strengths of eastern Germany as a cleantech location, its international quality standard and the technological capabilities of its companies. It also provides an exciting insight into the state of the art of a fascinating technology. One more reason why I am sure you will find it an enjoyable and stimulating read.

Yours,
Iris Gleicke

Iris Gleicke, MP
Parliamentary State Secretary at the Federal Ministry for Economic Affairs and Energy
Federal Government Commissioner for the New Federal States
Federal Government Commissioner for SMEs and Tourism
Below is a list of the enterprises and research institutions included in this booklet. You can find information on additional cleantech firms and their contact data at www.cleantech-ost.de

Our current HUB partners:
- Germany Trade and Invest (GTAI) - Powerhouse Eastern Germany
  www.powerhouse-eastern-germany.de
- Saxony Economic Development Corporation (WFS)
  www.wfs.sachsen.de
- Brandenburg Economic Development Corporation (WFBB)
  www.wfbb.de
- envimV e.V. - Clean Technology & Innovation made in Mecklenburg-Vorpommern
  www.envimv.com
- Saxony-Anhalt Investment and Marketing Corporation (IMG)
  www.invest-in-saxony-anhalt.com
- Berlin Partner for Business and Technology
  www.berlin-partner.de
- State Development Corporation of Thuringia
  www.leg-thueringen.de
Cleantech encompasses many different industries that contribute to protecting or improving the climate and the environment. These belong to the growth markets of the future and are undergoing continuous development. Cleantech is divided into six lead markets:

- **Lead market - Environment-friendly energies and energy storage** - comprises renewable energies, energy storage, efficient grids and the environmentally cleaner use of fossil fuels.

- **Lead market - Sustainable mobility** - includes all alternative fuels and drive technologies as well as environment-friendly transport infrastructure and traffic control.

- **Lead market - Energy efficiency** - extends from energy-efficient buildings and industrial plants to energy-efficient equipment and production processes.

- **Lead market - Circular economy** - includes waste collection, transport, recycling and dumping as well as environmental remediation.

- **Lead market - Sustainable water management** - comprises water catchment and treatment, wastewater disposal and technologies for raising efficiency.

- **Lead market - Raw material and material efficiency** - includes new materials, material-efficient processes and cross-sectional technologies, such as nanotechnology or biotechnology.
No other lead market has had such a major influence on the eastern German cleantech landscape in the last 20 years as renewable energies. Over 1,300 different eastern German firms supply practically the entire value chain of the environment-friendly energy industry: Mechanical and plant engineering parts suppliers, project developers, system designers and many different smaller and larger manufacturers and operators of wind turbines and photovoltaic modules, biomass power stations and electricity storage technologies have set up business. These developments have continued even despite the drastic fall in the mass production of solar modules since 2012. Well-known producers of wind turbines and numerous offshore and onshore windparks have established in eastern Germany. One leading manufacturer of wind turbines with the latest technologies is Nordex Energy GmbH located in Rostock. With a factory in Magdeburg, Enercon GmbH is the largest German turbine producer. Eastern Germany is also a major location for photovoltaics worldwide, with companies serving the entire value chain. Major international module manufacturers and innovative suppliers and service providers are also located in eastern Germany, one of the largest system producers and power station operators being GEOSOL Gesellschaft für Solarenergie mbH. Besides the industry leaders in photovoltaic module and plant production, Solarwatt GmbH in Dresden and SolarWorld GmbH in Arnstadt and Freiberg, one company, Heliatek GmbH, has specialised in a globally unique and innovative solution: flexible organic solar films. Calyxo GmbH has succeeded in making major cost reductions in module production by means of a special coating process. Specialised in control technology, leitec Gebäudetechnik GmbH combines absorption technology with photovoltaics, reaffirming its long-term place in energy supply. Thanks to continuous improvements in decomposition methods, energy from biomass is playing a growing role. The LXP Group has made a name for itself in biomass and biogas power stations in eastern Germany by achieving higher efficiency through a new decomposition method. GETEC green energy AG has specialised in the production and distribution of renewable energies. Besides applied research, the German Biomass Research Centre (DBFZ) in Leipzig also provides policy advice, potential assessments and acceptance studies and scenarios for biomass use and instigates innovative research initiatives. Aside from production, there have also been further developments in efficient storage technologies and smart grids in the years since the beginning of the energy transition. One manufacturer of energy storage units is WEMAG AG from Schwerin, which has already set up an energy storage facility in the 5 MW range and sells other storage units to third-party companies. The growth and industry networking is the outcome of the energy transition introduced in the past few years, which besides production has also driven developments in storage technologies and smart grids. Despite keen competition, eastern German enterprises are well positioned for the future. Falling costs combined with rising efficiencies, the beneficial environmental properties of renewable energies and the robust and growing energy demand worldwide will channel investments into the environment-friendly energy industry and eastern German firms will profit from these. Find out on the next few pages what surprising developments this lead market has come up with in eastern Germany in response to the energy transition.
ENERGY FROM WIND

Nordex is one of the technologically most advanced suppliers of wind turbines in the megawatt range. The product line in the Gamma generation comprises the N90/2500, N100/2500 and N117/2400 turbines, one of the most efficient turbines produced in series for onshore use. So far, over 3,600 turbines have been produced on this platform. With the Delta generation, Nordex supplies the fourth turbine generation of the tried and tested multi-megawatt platform (N100/3300, N117/3000, N131/3000 and N131/3300 for the German market).

Altogether, the company has installed about 7,000 turbines worldwide with a capacity of over 12,000 MW. With an export share of approx. 70 per cent, Nordex is strongly positioned in international the growth regions as well. It also maintains offices and subsidiaries in more than 20 countries worldwide. Its production sites are located in Rostock and the group currently employs over 3,000 personnel worldwide.

www.nordex-online.com/en

ORGANIC PHOTOVOLTAICS

Heliatek is the world leader in developing and producing flexible organic solar films - HeliaFilm®. Launched as a spin-off company from the TU Dresden and Ulm University in 2006, it is today the global technology leader in organic photovoltaics (OPV) and currently holds the world record in cell efficiency with 13.2%. Its business model comprises the supply of customized HeliaFilm® to industry partners in the building material industry. Besides glass lamination, Heliatek is working on combinations with concrete, steel and PVC membranes.

At its headquarters in Dresden, Heliatek runs its first roll to roll production plant. Its solar film, HeliaFilm®, combines outstanding properties with individual design. It is ultralight, less than 1 mm thin, flexible and can be customized in colors, dimensions and transparency. The organic solar film is effective in generating electricity, maintaining its efficiency even under poor light conditions and high temperatures. Heliatek’s leading role is based on basic patents for the production of organic solar films with doped transport layers.

Thanks to its patented tandem cell technology, HeliaFilm® can absorb a very broad solar spectrum with extremely thin layers. All layers together are only approximately 250 nm thin.

The solar films are manufactured at Heliatek in the efficient roll-to-roll process in a vacuum or an inert atmosphere. Only 1 g of basic organic material is needed to produce 1 m² of HeliaFilm®.

www.heliatek.com/en

SOLAR ASSET MANAGEMENT

Since the foundation of GEOSOL Gesellschaft für Solarenergie mbH in 2001, the companies in GEOSOL-Gruppe Solarstromkraftwerke have planned, financed, built or operated solar power stations with a total capacity of over 125 MW.

With the construction of the then largest solar power station in the world with a capacity of 5 megawatts in Espenhain near Leipzig in 2004, GEOSOL helped pioneer the expansion of renewable energies in Saxony. The erection of another 3.5 megawatt solar power station on the premises of the former briquette factory in Borna in 2005 also marked a major milestone towards structural adjustment in the Free State.

www.geosol.de
Today, the GEOSOL Group draws on its long-standing and broad experience to provide its clients in Germany and Italy with an extensive range of services for owners of solar power stations. In addition to technical and commercial management, Geosol Italia s.r.l. and Solar Asset Management GmbH also provide asset management and a portfolio of other services.

After the GEOSOL Group was acquired by the Japanese Kokusai Kogyo Holdings Co., Ltd. in 2008, it returned to its roots in April 2015 as an owner-operated company. Together with its clients and business partners, it has turned a new page in its successful business development.

leitec Gebäudetechnik GmbH sees itself as a forward-looking, energy-conscious company. Setting an example in the use of efficient renewable energies to conserve resources and protect the environment is part of its corporate philosophy. It has, for example, developed an unusual energy concept for its company building that makes consistent use of renewables.

The company headquarters in Heilbad Heiligenstadt is seen as a reference project for applying, testing and demonstrating environment-friendly technologies combined with the integration of various renewable energies in one energy supply scheme. As renewable energy sources, photovoltaic and absorption technologies are connected via control technology to an ice storage facility, the air-conditioning plant, the radiators and the lighting system and effectively controlled and regulated to energy-efficiency and economic criteria. Drawing on the experience gained, further developments are being pursued in research projects, such as a PV-IT absorber with a leitec controller for retrofitting existing photovoltaic modules, upgrading control systems for energy technology, extending WAGO controllers for ice storage facilities, absorbers and thermal pumps and implementing energy-efficient solutions in built-up districts as part of energy-efficient urban development measures.

With its multifaceted service portfolio, leitec Gebäudetechnik GmbH is a competent partner for clients, contracting entities and research institutions in planning and implementing renewable energy systems and resource-saving control technology.

GICON is a group of independent consultancy and engineering firms. As a general contractor, it plans and advises in system/construction planning, environmental planning/permit applications, ecosystems, soil and water management and IT and as a medium-sized enterprise, it also researches and develops new technologies together with various research institutes.

Its work has already borne fruit in several patented processes and products that combine environmental and economic needs. Through its own plant engineering, it is able to introduce technologies onto the market and construct (pilot) facilities itself.

One of its outstanding innovations is the GICON® biogas process for
treat impure mixed organic substrates developed jointly with the Brandenburg Technical University in Cottbus. It is already in use in the largest dry fermentation biogas plant in Canada. The GICON® photobioreactor can be used for the efficient and stable cultivation of microalgae as a source of material and energy. The development partner for the innovation is the Anhalt University of Applied Sciences. The GICON floating offshore foundation can access large water depths for offshore windpower. Prefabricated completely on shore, it minimises costs and risks.

www.gicon.com

EFFICIENT MODULE PRODUCTION THROUGH SPECIAL COATING

Calyxo GmbH is headquartered in Central Germany, where it operates its fully automated production centre in Solar Valley in Bitterfeld-Wolfen.

Here, Calyxo combines technological progress with the vitality of a young, motivated company in one of the most innovative areas in photovoltaics. Since its foundation, it has continually upgraded the atmospheric coating process developed by Solar Fields to market maturity and advanced commercialisation.

As at the end of 2015, installations with Calyxo modules are in operation in about 40 countries worldwide. Calyxo thin-film solar modules are easy to install and pay for themselves in a very short time thanks to their high efficiencies.

By developing solar modules with the lowest energy input and the best carbon footprint compared with alternative products from other manufacturers, Calyxo will be able to ensure quality of life for generations. Based on its unique coating technologies, it has set itself the strategic goal of becoming the most cost-effective supplier of solar modules, systems and production facilities in the world. CdTe is already the cheapest PV technology currently available. The atmospheric coating process can cut costs through faster coating, and lower maintenance times, and servicing, and investment costs. The method and the semiconductors used afford a large efficiency potential. On balance, the production costs per Wp for a given output quantity are substantially less than for manufacturing conventional crystalline solar cells and modules.

www.calyxo.com

EFFICIENT BATTERY STORAGE

WEMAG AG’s 5-megawatt lithium ion storage unit in Schwerin is the first storage battery in this range in commercial operation. A particular strongpoint of batteries is their control power for stabilising mains frequency.

Following start-up finance under the innovation programme of the Federal Environment Ministry amounting to EUR 1.3 million, the high-capacity storage unit proved effective from the outset. Europe’s first commercial battery storage unit went online in mid-September 2014 in Schwerin and the large-scale unit has been earning revenue since its initial participation in the primary control power market on 22 September 2014. The fully automated facility designed by the Berlin grid and storage specialist, Younicos, offsets short-term frequency fluctuations in the power grid so that electricity from wind and solar energy can be reliably fed into the mains. The control software and technical systems of the WEMAG battery power station in Schwerin are currently being upgraded as part of the Kickstarter demonstration project.

In combination with renewable power facilities and a gas and steam turbine power station, it will in future be able to rapidly restore local power supply after a blackout and prevent millions in losses. It is the first project of its kind in Germany. The purely conventional power station technology used to date will be replaced in future with renewables. Together, the project partners are looking to bring a new innovative black start design to market maturity.

www.wemag.de

battery storage unit, Photo: WEMAG Stephan Rudolph-Kramer
SOLAR IN-ROOF INSTALLATIONS WITH ARCHITECTONIC GLASS-GLASS DESIGNS

aleo solar GmbH produces solar modules and cells in Prenzlau (Brandenburg) and supplies systems to the global photovoltaics market. It specialises in developing and producing monocrystalline, high-performance modules that deliver a particularly high energy output over a small surface. The assortment of modules manufactured in Prenzlau also ranges from elegant, all-black designs and in-roof installations to polycrystalline project modules for large-scale facilities to glass-glass solar power modules for integration into the building architecture.

With around 330 employees and manufacturing experience since 2001, the company has an excellent know-how in module production. Since 2014 aleo solar belongs to the wafer and solar cell manufacturer SAS (Sino American Silicon Products Inc.) headquartered in Taiwan Hsinchu. Thus, aleo solar is part of a powerful solar manufacturer, which maps the entire photovoltaic value chain, from development and production of high-performance ingots, wafers and cells to the delivery of the solar module. In 2015, aleo solar founded the wholly-owned subsidiary, aleo Sunrise GmbH, which now also produces solar cells as the main component of the solar module locally in Prenzlau.

www.aleo-solar.co.uk

SMART BIOENERGY - INNOVATIONS FOR A SUSTAINABLE FUTURE

The DFBZ (German Biomass Research Centre) was founded in 2008 by the former Federal Ministry for Food, Agriculture and Consumer Protection (BMELV) with the aim of establishing a central research institute for all relevant topics in bioenergy and collating all the relevant findings in the very disparate German research landscape in this sector.

The scientific mission of DFBZ is to provide broad applied research support for the efficient integration of biomass as a valuable resource in sustainable energy supply. This task includes technical, environmental, economic, social and energy-sector aspects along the entire process chain (from production to supply and use).

In close collaboration with its industrial partners, DFBZ supervises and supports the development of new processes, methods and concepts. It also networks closely with public German research institutions in the agriculture, forestry and environmental sector and with European and international institutions.

Drawing on this broad reservoir of research, DFBZ is also tasked with preparing evidence-based decision-making aids for policymakers.

www.dbfz.de
GREEN ENERGY: INNOVATIVE, SUSTAINABLE, INDIVIDUAL

belongs to the GETEC Group based in Magdeburg with operations throughout Germany. The company plans, builds and operates installations for sustainable energy supply and distribution from renewable energy sources such as biogas, timber, wind and sun.

REVITALISATION AND ENERGY-EFFICIENT URBAN DEVELOPMENT

JENA-GEOS® provides geo-scientific research and consultancy services at home and abroad. Since 1990, it has continued in the 95-year tradition of its predecessor institutions.

It has gone on to make a name for itself as a competent, independent office that can put its broad range of services and products to use in solving very specific questions, but it also contributes to sustainable solutions with systemic and interdisciplinary initiatives.

After a development path starting with rehabilitating contaminated sites then revitalising brownfields and finally the systemic harnessing of renewables potential - it focuses today on energy-efficient district development and resilient cities.

As part of an interdisciplinary, engineering co-operative, Energie-WerkStadt® eG, the company is underway in Germany, collaborating in revitalisation, energy-efficient urban development and urban climate protection projects. It applies its own methods for integrated district development, optirisk® (www.optirisk.de), and systemic district planning and sustainability assessment, effort-Energy efficiency on-site (http://bit.ly/2nNSY2C).

The systemic approach and the visualisation of feasible sustainability levels with the sun-of-sustainability yardstick, combining 22 groups of indicators, are what make the effort instrument currently unique. Via existing contacts in the USA and other lead markets, JENA-GEOS® is seeking international collaboration in energy-efficient urban development.

INDUSTRIAL CONVERSION OF BIOMASS TO ENERGY

LXP Group GmbH is a young company financed by professional investors that has developed a unique basic industrial biotechnology to enable the reuse of organic waste, e.g. harvest residue, such as rapeseed or rice straw (called 2G biomass).

About 13 billion tonnes of biomass with an annual turnover of almost US$ 700 billion are harvested worldwide today, of which some 10 billion tonnes come from the agricultural sector and of this approx. 6 - 7 billion tonnes are insufficiently recycled residues, affording a high value-added potential for the process. This globally patented decomposition process breaks up lignin gently, a naturally occurring, complex polymer responsible for the lignification of biomass.

Breaking up the lignin releases cellulose and hemicellulose (both complex carbohydrates) and makes all three components available for (biological or chemical) processing. Cellulose/Hemicellulose and lignin can be processed into a broad range of precursor chemicals, solid, liquid and gaseous energy sources and new materials.

Distinctive features of this technology include unprecedented yields, high efficiency, particularly favourable product properties and easy integration under mild process conditions.

The company is positioning itself as a process provider for this high-efficiency decomposition method, which makes up a key element of many, different biotechnological process chains. It is marketed worldwide through external (strategic) partners that are issued with master licences.
SOLAR MODULES FROM ARNSTADT: 25% HIGHER YIELD WITH BIFACIAL CELLS

Sunmodule Bisun consists of 60 bifacial cells, an upgrade of SolarWorld’s PERC high-performance cells. Duo-cell solar modules make use of incident light both via the front and rear side. A second glass pane on the rear side of the module allows indirect light to reach the cells through reflected sunrays from behind, raising module efficiency.

Bifacial electricity generation makes Sunmodule Bisun ideal for flat-roofs and ground-mounted photovoltaic panels, where light is reflected from underneath. How much light is absorbed via the rear side depends on the ground. With a white ground and optimum module mounting, the panels can deliver 25 per cent additional yield. Besides higher yield, their long service life also makes solar installations with bifacial modules more efficient: Thanks to embedding in a glass laminate, the cells are ideally protected against environmental and mechanical influences and last longer as a result. Sunmodule Bisun has a guaranteed lifespan of at least 30 years. The longer service life and higher yield make for a significant reduction in electricity generation costs per kilowatt/hour.

www.solarworld.de

INNOVATIVE PRODUCTS AND A PIONEERING COMPANY

For over 30 years, ENERCON has been a technological leader in the windpower industry. As the first manufacturer, the company in Aurich focused on a gearless drive design, which is a typical feature of all its wind turbines.

ENERCON still sets technological standards as well today in segments like rotorblade construction, control technology or mains connection. Its ongoing research and development are guarantors for its continuing business success and the same holds for production and service.

It manufactures all key components itself. This unparalleled large vertical production range guarantees the high quality standard and reliability of ENERCON wind turbines.

Besides Aurich, ENERCON has also been running its own production centres in Magdeburg since 1998. Its product portfolio comprises installations of 800 to 7,500 kilowatt capacity. The latest type of facility is E-115 with 3,000 kilowatts nominal capacity.

Photo: ENERCON
Besides Aurich, ENERCON has also been running its own production centres in Magdeburg since 1998. Its product portfolio comprises installations of 800 to 4,200 kilowatt capacity. The latest type of facility is E-141 EP4 with 4,200 kilowatts nominal capacity.

Altogether, ENERCON has built more than 26,500 installations worldwide with a total capacity of more than 43.5 gigawatts (as of 12/2016). Its wind turbines are equipped with a grid-infeed system that has been certified to the latest connection requirements, so they can easily be integrated into all supply and distribution grids.

ENERCON sees advancing renewable technologies worldwide as one of its major challenges. It is positioned on the major markets with production facilities and a decentralised service and distribution network and is expanding these.

HIGH EFFICIENCIES WITH GEOTHERMAL ENERGY

INTEC GMK GmbH is a global leader in manufacturing organic Rankine cycle (ORC) power stations in a broad electrical capacity range between 50 kW and 4 MW.

The group can look back on a 25-year corporate tradition in ORC and steam power plant construction in its own factories in Bruchsal, Chemnitz and Rostock-Bargeshagen, where ORC geothermal power stations are also developed and manufactured for clients in Europe, Asia and America.

With their distinctive very high overall efficiencies, INTEC GMK’s ORC installations are sold worldwide under the brand names, INDUCAL®, GEOCAL® and ECOCAL®.

INTEC achieves this efficiency by adjusting the individual ORC modules to the respective local technical and climatic conditions. The use of specially adapted ORC fluids, high-performance German turbines and the patented installation designs ensure very high electricity yields and availabilities.

INTEC GMK’s scope of delivery includes ORC power station components for converting geothermal energy, industrial waste heat or biomass into electricity. INTEC GMK participates in more than 15 patents and registered designs in ORC technology.

ALWAYS ONE STEP AHEAD - MEYER BURGER (GERMANY) AG

Die Meyer Burger (Germany) AG is one of the world’s leading suppliers of plasma-based and ion radiation-based production equipment, with anti-reflective coating systems for the production of photovoltaic panels accounting for the largest part.

Its portfolio also includes innovative, turnkey solar cell production lines at the highest technological standard as well as special installations for the semiconductor and optics industry. With these products, the Saxony company is keeping up with the latest trends and thanks above all to its innovative heterojunction (HJT) technology is ideally positioned for future solar cell production.

HJT combines the advantages of crystalline silicon solar cells with those of thin-film technologies. The solar cells deliver much higher efficiencies while reducing production costs. To be able to manufacture these promising cells itself on site, Meyer Burger (Germany) AG began with the construction of a demo line for HJT in 2015 in Hohenstein-Ernstthal.

An excellent, dedicated team is working every day to raise volume and efficiency. In a next step, the company will soon switch to multi-shift operation.

Selected clients and partners are already being supplied today with the latest generation of cells.

With the heterojunction technology, Meyer Burger (Germany) AG has already taken a large step towards establishing a new standard in the solar industry.
As the second main pillar of the energy transition along with renewables, raising energy efficiency is a major intervention point for sustainable cost savings in companies. Energy efficiency is of crucial importance for almost every industry. The energy transition has also been a driving force behind the new developments in eastern Germany, which have brought the issue of energy efficiency to bear on all areas in industry and buildings. From energy-efficient power stations in the renewables sector to vehicles for sustainable mobility and low-energy recycling methods in the circular economy to efficient wastewater treatment, a great deal of energy-efficiency know-how has been built up over the past years in all these areas.

A key market for energy efficiency is the construction and renovation of buildings and their technical services.

Because know-how plays such an important role, energy efficiency is a major consultancy topic. There are excellent companies with outstanding experience in this sector in eastern Germany that are developing many different ideas. EA Systems Dresden GmbH and Tilia Effizienz GmbH advise enterprises on energy savings, adopting an integral cost/energy-efficiency approach. Ultimately, energy efficiency only brings about savings if it is carefully planned and successfully implemented. Faktor-i3 GmbH devises energy schemes and supervises their execution at local and regional level. As an energy service provider, Getec Wärme & Effizienz AG delivers customised contracting solutions for the housing sector and public institutions. Efficient equipment is not the only thing that helps save energy; industry and the building sector are also in need of software solutions. To raise corporate energy efficiency, the firm, TeDaPro GmbH, provides these for monitoring all in-company consumption data.

Increasing specialisation in all production segments affords opportunities for businesses that provide products and solutions for raising energy efficiency. Due to rising energy costs, energy efficiency is also bound up with cost effectiveness and this dynamic market is constantly in search of production advantages. In response to this, over two hundred innovative enterprises have already been established in eastern Germany so far and have developed new ideas and specialised products.

Energy recovery measures make a major contribution to energy efficiency in industry. DUROPAN GmbH has specialised in the energy-efficient conversion of heat that has so far been lost in exhaust air or wastewater into electrical energy. InvenSor GmbH accesses heat sources for cooling using maintenance-free chillers. WälA Wärmetauscher Sachsen GmbH provides the latest production technology for individual energy-efficient heat exchangers. Raising energy efficiency is also the subject of all kinds of research projects in higher education and research institutions. The Fraunhofer Institute for Factory Operation and Automation (IFF) is researching into closed energy cycles, for example.

On the next few pages, you can find out how innovative the energy efficiency lead market in eastern Germany can be.
TOTALLY EFFICIENT

The energy architects of EA Systems are committed to modern, sustainable and efficient energy supply. They link together architects, planners, power suppliers, control engineers, operators, developers and research institutes. They lay the overall calculation and assessment foundation for complex power supply systems and their components (heat, electricity, cooling energy, storage, user behaviour, weather, building features, e-mobility, etc). This includes both the building and the district or town.

Key criteria here are manufacturer independence and a pragmatic approach aimed at efficiency. Specific services include, for example, designing, assessing and optimising local heating systems in districts and municipalities.

One of the core competencies of EA Systems Dresden is the integration of renewable energies, (large-scale) storage units or charging infrastructure for e-mobility in existing energy systems. A unique feature here is its ability to visualise the real behaviour of energy systems as a whole in a multi-domain model. The model can test and assess any scenarios, regulatory and system options or operational states quickly and precisely. The tool applied for this, GreenCity/SimulationX, is very well suited for power suppliers, system manufacturers, planning offices, universities and higher education institutions. With many libraries and modules, it can be selectively adapted to individual user requirements.

ÖKOTEC - YOUR EFFICIENCY EXPERTS IN ENERGY AND RESOURCES MANAGEMENT

ÖKOTEC Energiemanagement GmbH has been successfully developing intelligent ways to reducing energy costs since 1999. This innovative consultancy company combines farsighted thinking with many years of experience from industrial processes and clients. With a systematic approach to maximising energy efficiency, they can reduce energy demand and CO₂-emissions as a result. With projects at over 800 industrial and business locations at home and abroad, ÖKOTEC is currently the leading energy efficiency expert in Germany.

With its self-developed EnEffCo® software and services for Energy Efficiency-Controlling, ÖKOTEC provides industrial and business enterprises with a user-friendly tool for the analyse and visualise of all energy media, process and current state data. With its dynamic plant monitoring function based on real measured data it can provide information on-screen and by e-mail when the efficiency of a facility declines. This way, efficiency performance indicators can be analysed in real time and available flexibilities of production and consumption installations can be evaluated to rationalise scheduling.

NEW LIGHT, EFFICIENCY FOR ALL

The philosophy of the P-lamp project is to produce and market healthy, glare-free light. Research projects and developments, awards and successful pilot projects culminated in the foundation of the companies, ACRYLAMP®, as a production firm and WATTCONTRACT® as a contracting and financing service provider for clients.

ACRYLAMP® works with local partners in producing the P-lamp and the resultant lights. WATTCONTRACT® provides all-round finance and services for healthy light.

P-lamp projects have already been carried out in schools, hospitals, workplaces and animal keeping facilities and for protecting people with light to prevent the transmission of diseases through insects and these will remain fields of application for the technology in future. The patented P-lamp itself is constructed to emanate healthy, glare-free and flicker-free light in all colours with negligible heat emission and its energy efficiency and lifespan are outstanding compared with all other known illuminants.

The ACRYLAMP® P-lamp project is aimed at everyone who wants to use, operate and co-design healthy artificial lighting.

www.oekotec.de/en

www.acrylamp.com

www.ea-energie.de/en
THERMOELECTRIC POWER GENERATION/ENERGY PRODUCTION

As a member of the Cooperation Network for Self-sufficient Power Supply from Waste Heat Use under the Central Innovation Programme for SMEs (ZIM), the company, DUROPAN, develops thermoelectric generators (TEGs) that can convert heat directly into electrical energy with no mechanical motion.

The core business of DUROPAN comprises the development and production of a thermal transmitter that converts (waste) heat in the low temperature range of up to approx. 100°C previously lost to the atmosphere directly into electrical energy - without the use of any mechanical components. Thermoelectric generators (TEGs) are able to convert heat directly into electrical energy without any mechanical motion.

In the past, the main unforeseen problems in applying TEGs have been with heat coupling. The centrepiece in the development of the thermal transmitter is a plastic component with carbon nanotubes doped with semiconducting nanoparticles that enables the absorption of large amounts of thermal energy and its direct transmission to a thermal generator embedded in this plastic to generate electric voltage by means of the Seebeck effect.

In present, DUROPAN can safely attain 800 watts/m² at ΔT = 80 K with the use of waste heat from radiation but also in fluids. www.duropan.de

InvenSor – Using heat for cooling

InvenSor adsorption chillers are among the most user-friendly and reliable devices on the market. The switchover to the sustainable technology begins to pay off with cooling capacities from 10 kW.

The systems are used for cooling needs ranging up to 300 kW and perform particularly well at 65°C. Energy cost savings achieved using an adsorption cooling solution are generally up to 70%. The microcontroller developed specifically for the chillers enables a host of configuration options and adjustments to the respective requirements of the overall system and the user.

ActiVac® - the automatic pressure system developed by InvenSor ensures constant optimum operating pressure. Maintenance is needed
only on the hydraulic components. The vacuum chamber is maintenance-free.

Typical heat sources are, for example, cogeneration power stations, process heat and district heating. Numerous projects have already been carried out in industry, computing centres, sales rooms and municipal institutions.

**ENERGY MANAGEMENT AND ENTERPRISE AUTOMATION**

With its EnterpriseAutomation solutions, TeDaPro GmbH enables its customers to merge their whole machine and system automation with classic data processing technologies - across all company levels.

TeDaPro GmbH’s energy management system, for example, can capture, display and evaluate all the necessary energy consumption data in a clear and uncomplicated way, so that companies can quickly identify specific opportunities for energy savings. New control mechanisms and operational procedures can also be developed for energy-intensive processes to reduce production costs and extend long-term competitive advantages.

TeDaPro GmbH does not just supply and install the necessary metrology and data loggers, but also an energy management software that can be used via the web browser and stored on a central in-company server. This meets the technical requirements for certifications to ISO 50001 or DIN 16247 and for eligible tax rebates.

**GUARANTEED EFFICIENCY AND ENERGY SAVINGS**

Tilia Effizienz GmbH is an enterprise for energy efficient projects and provides innovative products and services for the industry with solutions which are independent of manufacturers. Some of the areas in which Tilia Effizienz GmbH specialises include: lighting, compressed air, and process heat and steam.

Tilia Effizienz focuses on analysis-based efficiency models delivered in a holistic manner to meet the specific energy reduction requirements of its clients. Various contracting models are offered by Tilia Effizienz to allow a much more individualised approach to fulfilling its clients needs. Whether through joint investment models or through general contractor agreements, Tilia Effizienz GmbH guarantees energy-savings results on a variety of customisable options. Naturally all models offered by Tilia Effizienz include long-term efficiency and savings based on high-quality maintenance and servicing strategies.

In order to be able to supply all-inclusive services to its clients, Tilia Effizienz GmbH also operates as part of a nationwide network of German manufacturers and consumers of energy-efficiency technologies. This network has carried out approximately 80 projects throughout Germany in the last 10 years.

Energy savings of 30% - 85% can be attained in the various production areas, depending on the application and static payback periods ranging from 6 months to 5 years. The systematic approach can also be easily adapted to meet the needs of the non-manufacturing sector and public clients.

**INDIVIDUAL HEATING EFFICIENCY**

WätaS Wärmetauscher Sachsen GmbH has been on the market since 2003 as an individual producer of fin heat exchangers, special moulded parts and heatpipes with a wide vertical production range. At two locations in Saxony, it manufactures heat exchangers made of copper, aluminium, steel, nickel, stainless steel in 1.4301, 1.4404 and 1.4571 grades and thermal pumps.

The company has achieved a high rate of growth thanks to job-order production on the lean production principle and the use of the most modern machinery available on the market. Customers are supplied with individual solutions, single pieces and series, as needed. Customer relations have continued to improve thanks to shorter delive-
ry periods and high quality products as well as the development of unique selling points.

WätaS has achieved close customer proximity through the gradual introduction of automated 3D construction, the automated compilation of parts lists in offer preparation and automated direct machine control on order confirmation by the client. Currently, the firm is organizing the introduction of assembly and processing units supported by lightweight robots, which will enable it to produce in large series.

Heat exchanger and heat pump products are essential for the tasks of carrying out current energy-policy measures in Germany and Europe. These products must be used to meet energy efficiency/effectiveness targets, setting the parameters for the current and future growth market.

WätaS supplies a broad clientele in mechanical and plant engineering, shipbuilding, energy and power station technology, renewables and facility management.

CLOSED ENERGY CYCLE FOR HIGHER EFFICIENCY

As technology partners for production firms, the scientists at the Fraunhofer Institute for Factory Operation and Automation (IFF) research into and develop technologies, processes and products for factory operation and automation from the idea to series production and put these into practice together with companies. Digital engineering for the development, production and operation of products and production systems plays a special role.

In its research, the Fraunhofer IFF focuses on resource-efficient production and logistics, smart work systems and convergent supply infrastructures. As part of this portfolio in the cleantech sector, the Institute develops new, smart technologies for the efficient conversion and sustainable supply of energy.

For this, researchers are concentrating, for example, on setting up optimally closed energy cycles in production processes or the use of renewable energy sources in efficient conversion systems.

One building block is planning new, innovative, biomass-fuelled cogeneration plants for heat and electricity supply. They also provide specific assistance to enterprises in converting their operations to energy-efficient production.

The researchers are also developing solutions for the broad monitoring, control and protection of the smart energy systems of the future, catering for production, load and storage capacities.

EFFICIENT CONVERSION OF ENERGY SYSTEMS

FAKTOR-i³ GmbH handles everything relating to the conversion of existing energy systems. After drawing up energy schemes at local and regional level, the company also then supervises and executes the specified fields of activity.

Its consultancy services do not end with the submission analytical studies and recommendations; it then goes on to put these into practice and successfully generate projects. Renewable and conventional energies, decentral power generation, smart energy distribution and storage and efficient energy use all play a major role here. FAKTOR-i³ GmbH mainly operates in the following three fields of competency:

- i² Innovative, integrated concepts: potential, locational, market, industry, consumption and cost-efficiency analyses (electricity, heating, mobility), energy, climate protection and district development schemes as well as project assistance for heat supply schemes/plans, local heating cogeneration systems and building solutions
- i² Intelligent solutions: energy and energy-efficiency consultancy, energy management, developing solutions for forward looking heat and electricity supply, energy services, contract reviews, consultancy on financing and funding, moderation and mediation as well as strategic, corporate and project development
- i³ Investive implementation through process facilitation: business matching, networking and collaboration management, directing, supporting and implementing regional and local projects, knowledge and R&D transfer as well as joint projects, communication

Besides project planning and management, Faktor-i³ GmbH develops energy-specific information and consultancy tools (GIS-based information systems, Internet portals), prepares print media and technical booklets and organises/coordinates events.

IPROconsult - A HOLISTIC VIEW

IPROconsult GmbH concentrates the expertise gained over decades and merges it efficiently into one individual project. As a general planner, it has branches throughout Germany and is engaged in international operations. Close networking ensures that every building project is well thought out at all levels, from development and use scenarios (project development), the foundations and infrastructure (civil engineering) to the architectural form, design and construction of the building (architecture and structural engineering) to the installation of all the supply and disposal media (technical facility services).

The necessary know-how, capabilities and experience for these tasks is bundled into one company with approx. 350 specialists: IPROconsult. The requisite technical expertise is pooled for each project. As sound plans are drawn up at all levels and affect future use, the project must be seen as a whole. To gain this overall picture, IPROconsult draws on its own knowledge of the many, different efficiency requirements when constructing and using a building. This know-how also includes the appropriate integration of high-performance and, increasingly renewable, energy and supply systems. The architects and engineers naturally employ the latest technologies when constructing and fitting out buildings.

ACHIEVING HIGHER EFFICIENCY THROUGH MAXIMUM PERFORMANCE - GFR

GFR - Gesellschaft für Regelungstechnik und Energieeinsparung mbH has been automating buildings and rooms since 1978. GFR with its main locations Verl and Jena and 13 additional branches has a workforce of 260 employees and has specialised in integrated and upward compatible building management and building automation system solutions. Its Energy Management Department provides innovative commercial and technical energy services throughout Germany; contracting solutions and energy audits in accordance with DIN 16247-1 are performed for our clients and professional support is provided for companies which are introducing energy management systems pursuant to DIN EN ISO 50001.

The latest example for GFR’s innovations and developments is a new method for the optimization of fans that are operating with changing air quantities by means of the DIGICONTROL proportional pressure control and the path-breaking DIGICONTROL Economizer. These two optimisation processes were retrofitted into an existing ventilation plant at the Fraunhofer Institute for Ceramic Technologies and Systems (IKTS) in Dresden. Impressive savings were proven after an operating time of 140 days.

By applying the DIGICONTROL Economizer, GFR was able to save almost 70% of the energy consumption and reduce energy costs by approx. 45% in strict compliance with the required comfort data for temperature (20° - 22°C) and humidity (40% - 60% RH) of a laboratory at the Fraunhofer Institute Dresden.

The success of these measures has also been proven by the fact that GFR was the winner of the German TGA Award in 2016.

www.iproconsult.com

www.gfr.de
After reunification, eastern Germany faced great challenges in the lead cleantech market of sustainable water management: thoroughly rehabilitating major water management utilities, separating water supply from wastewater disposal and remunicipalising operations, that is, delegating organisational responsibility to municipalities. All federal states have now aligned with the national German and European system. Drinking water meets the highest quality standards and the most advanced wastewater treatment plants set an example for international projects.

Over three hundred eastern German enterprises now operate in the lead market of water management, have gained extensive experience and supply the whole value chain of drinking water supply/wastewater disposal. These include the newly founded municipal utilities and the many private companies that have carried out all kinds of projects and grasped the opportunity to occupy leading positions in international research, consultancy and management in the water sector. Many firms from eastern Germany are engaged on this lead market abroad and contribute to international know-how transfer, such as Stadtentwässerung Dresden GmbH, which has specialised in recycling residue from wastewater for energy production with one of the most advanced wastewater treatment plants worldwide. Sachsen Wasser GmbH also operates internationally and with over 130 projects worldwide has taken on a leading role in international drinking water treatment to secure drinking water supply in many countries in the world.

Many innovative engineering firms are also doing business in eastern German water management. aquaconsult Ingenieur GmbH, for example, has gained know-how in wastewater treatment at particularly low and high temperatures. Biogest International® GmbH is engaged in wastewater planning and has developed a turbine aerator for wastewater treatment with a large oxygen input and intensive mixing capacity. C&E Consulting und Engineering GmbH, which has already carried out numerous international projects, can draw on competencies in the business fields of environmental and structural engineering.

The various kinds of untreated effluent discharged in the course of modern industrial production call for new treatment methods. For this, Loser Chemie GmbH develops environment-friendly chemical products for water treatment. MAB GmbH and IB Linnekogel have developed a wastewater treatment method that can filter out medical residues from wastewater. The Leibniz Institute for Plasma Science and Technology (INP), in contrast, researches into reducing pharmaceutical residues in water with plasma. In decentral wastewater treatment, the company, alles klar GmbH, supplies mini water treatment plants for all kinds of applications.

Technologies and schemes for water management play a special role. The regulation of running waters has an effect on water supply, but also flood protection. DHI-WASY GmbH uses many of its own software solutions for the complex calculation of interacting water systems and for practical application the G. König engineering firm has developed a multifunctional lifting lamellae weir for a broad diversity of applications.

On the next pages, you can find out about the many different eastern German firms engaged on the water management lead market.
As part of international competency transfer, Sachsen Wasser GmbH (SW) provides consultancy and training services in the drinking water and wastewater sector.

In 130 projects, the company has imparted know-how on efficient, sustainable water management to public and private clients in 35 nations. In development cooperation projects, the Leipzig experts contribute to improving water infrastructure worldwide.

SW engages in water-scarce and political crisis regions, where there is a huge shortage of capacities, specialists, technology and funds.

Its clients include utilities, facility operators, ministries, educational, financial and development institutions. The special experience gained during the transition in eastern Germany after 1990 sets SW apart from many of its competitors. Numerous projects have to do with the institutional development of enterprises on their way from state-run corporations to commercial, customer-friendly service providers.

SW was founded in 2000 as a wholly-owned subsidiary of Kommunale Wasserwerke Leipzig GmbH (Leipziger Wasserwerke today). Many project partners have a high appreciation of its municipal origins. SW has been independent since 2015.

TREATMENT PLANT’S ENERGY SELF-SUFFICIENCY MAKES IT INTERNATIONAL PIONEER

The Stadtentwässerung Dresden GmbH (SEDD) has functioned under shared ownership between the city of Dresden (the capital of the state of Saxony) (51%) and GELSENWASSER AG (49%) since 2004. As such, the company serves as a successful example of the highly regarded public-private partnership model.

About 400 personnel provide services in wastewater treatment, environmental assessment and planning and constructing wastewater plants. Among the company’s assets is the approx. 1,800 km-long sewerage system and the central treatment plant in Dresden-Kaditz. The corporate strategy focuses on the sustainable development of wastewater management in Dresden.

With the Energy 21 Project, SEDD is currently aiming at energy self-sufficient operations of the Dresden treatment plant by increasing efficiency and using renewable energy sources. It plans to achieve this through energy savings and the co-treatment of bio-waste in sludge treatment (co-fermentation). The commissioning of the new sludge treatment plant marked a milestone in 2012. About 70% of the energy demand can be met with recovered sewage gas. As the operator of municipal water supply and sanitation management facilities, the Stadtentwässerung also shares the technical and economic experience it has gained with ministries, associations and operators in the new EU member states and other countries.

WASTEWATER MANAGEMENT UNDER EXTREME CONDITIONS

As an independent consultancy firm, aqua consult Ingenieur GmbH can provide references from its activities over the last 30 years in over 1,000 completed projects worldwide in drinking water supply, drainage plants, industrial and municipal wastewater treatment, biogas, waste and exhaust air. About 100 personnel work in the whole aqua consult Group; approx. 50 at locations in Erfurt, Hanover (headquarters) and Oldenburg.

In wastewater management, aqua consult Ingenieur GmbH is specialised in conceptual planning, design, project management, site supervision, operational support and project management of entire treatment plants, including wastewater transport. Through its operations in northern Europe, the Emirates and India, it has gained specialist experience in planning and operating treatment plants at low and high temperatures.

In Estonia, winter temperatures can reach -25°C. aqua consult has been able to gain experience here in designing, planning, constructing and operating a treatment plant under extreme climatic conditions.
Another special feature of aqua consult is its ability to cope with all scales of municipal wastewater treatment projects, from small compact plants for 50 to 200 persons (e.g. in some border areas in Estonia) to the world’s largest municipal wastewater treatment plant in Athens, Greece, with 4.5 million residents. www.aqua-consult.de

**SMALL TREATMENT PLANTS**

**alles klar GmbH** is located in Leipzig and provides innovative, customised and cost-efficient decentral wastewater treatment plants. One product alles klar GmbH offers is a unique outdoor system called “KLÄRCHEN,” which has been specifically designed for households to treat wastewater without the use of electricity.

The system has been available on the market for over 5 years now and specialises in treating the wastewater in an organic and biologically focused manner. Thanks to its variable size it can also be used by municipalities and wastewater associations as an interim solution. “KELLERCHEN” is another exceptional product offered by alles klar GmbH that is a fully biological treatment plant, unique in its small, compact and transportable size. What makes “KELLERCHEN” different from other treatment plants on the market is its suitability for buildings without surrounding properties, buildings built on stony ground, or those located in areas with high groundwater levels. It can be dismantled and therefore it is a feasible system. That allows to use it as a temporary solution or to offer it with special financial modules such as rental or leasing contracts.
All products from alles klar GmbH are low-maintenance, energy-efficient and reasonably priced wastewater treatment plants, which can be operated without complicated control and regulation technologies and also require only a minimum of technical equipment. www.allesklargmbh.de

SPECIAL-PURPOSE WEIRS

The lifting lamellae weir (HLW) developed by the G. König engineering firm from Sondershausen/Thuringia, a newly developed contiguous, segmented plank regulator gate (Tightness class 1), is a multifunctional and ready-to-install hydromechanical steel construction for Class III weirs. Overflow, undercurrent and throughflow modes can be optionally combined at the static cross-section. Full or partial locking is possible wherever required by means of two bayonet-type latches.

Applications range from closed to perforated single gate operation with constant or variable head. Unlocked, the dam body is particularly suitable for groundwater regulation and also partially locked with an optional separator function for floating matter.

It can also be used, for example, as a bypass weir, for sedimentation plants, solar ponds, a water source for firefighting, aquaculture, for intermixing, as a discharge flow controller and much more. It can be combined into a multi-stage weir. The lifting lamellae consist of a Z-shaped steel core and double planking made of recycled plastic certified for hydraulic engineering and specially reworked for the HLW weir.

Maintenance is confined to the regular lubrication of the spindle gears and the removal of blockages when necessary. www.Ingenieurbuero-Koenig.de

TREATMENT OF MEDICAL WASTEWATER

For more than 15 years, the companies, MAB GmbH and IB Linnekoigel, have relied on a team of businessmen/women and engineers, from graduates to experienced experts, to synthesise and analyse their complex problems and tasks. This job is performed by economists, engineers and experienced personnel. The companies can also draw on a well-established network of service providers and manufacturers.

This enables them to provide planning and construction services, manufacture special machinery and devices, identify special solutions in metrology, provide measurement services and supervise production.

Their scope of services includes planning plant and machinery, CAD construction, special machinery and fixtures, project management and selection of suppliers, component calculations and FMEA analyses, gauges/test equipment simulations with their own software and preparation of documentation.

The particular focus in cleantech is placed on developing O2 generators of medical-grade oxygen or low-oxygen air. In addition, the companies also develop and design water/wastewater treatment plants for the elimination of all residues.

Close collaboration takes place in both areas with the Fraunhofer IKTS in Dresden. The environment-friendly generation of oxygen using a ceramic membrane and the treatment of fluids is currently in development worldwide and gaining increasing importance. www.mabweimar.de

Photo/Graphic: MAB GMBH
Coping with heavy rainfall and maximising the energy efficiency of urban water management are among the complex challenges facing the smart city today. **DHI WASY** provides an answer, Water 4.0 - networking online sensors and multidimensional physical models, whose results are channelled into decision-support systems or can intervene fully automatically in control.

DHI has applied this kind of system in the Danish city of Arhus. An online radar forecasts volumes of rainfall and transmits the data to a multidimensional model chain made up of a water balance model, a 1D sewage system model and other multidimensional hydraulic models (1D/3D).

In a predictive or semi-real-time simulation, this calculates the sewer loads and actuates the use of rainwater storage tanks in the event of overload. This largely prevents sewage overflow into the receiving waters. The capacity of the treatment plant plays a major role here.

The DHI software can model and control all biological, chemical and physical processes in the treatment plant. The software-assisted rationalisation of the plant has already saved approximately EUR 700,000 a year and makes up a major element in the integrated networking of water management systems.

**SURFACE AERATOR FOR WASTEWATER TREATMENT**

In the last 25 years, **Biogest International® GmbH** in Dresden has developed schemes for turnkey wastewater treatment plants for connected loads of up to 150,000 population equivalent, whereupon energy efficiency and power self-supply are major aims. The largely foreign projects it has carried out beyond European borders also attest the international scope of its operations. Drawing on the know-how gained and applied in the course of its history, it now develops special products for wastewater treatment that have been singled out for awards (e.g. the Infrastructure Bulgaria Award 2016).

It has, for example, developed the BSK®-Effluent Decanter or the BSK® Surface Aerator (BSK®-Turbine). Especially in the case of the BSK®-Turbine, cooperation with local producers and well-known drive manufacturers culminated in a mature product with outstanding features. With an oxygenation rate of > 2.50 kg O₂/kWh using high-efficiency IE4 motors, its cost effectiveness is unrivalled for new plants and for upgrading existing facilities and it also meets today’s standards for sustainability and operational reliability.
PHYSICAL PLASMA FOR WASTEWATER TREATMENT

With more than 170 scientists, engineers and specialists, the Leibniz Institute for Plasma Science and Technology (INP) is the largest extramural research institute for low-temperature plasmas in Europe. True to the motto, ‘from idea to prototype’, it combines basic research closely with the development of new applications. Besides plasmas for materials, energy plasmas for environmental protection and health are currently a focus of attention.

A priority in research is attached to new technologies for removing pharmaceutical residues from water, because with the annual increase in the consumption of medical drugs and the concurrent rise in the number of medicines with new active substances, the environmental concentration of pharmaceuticals is on the rise. As the body excretes the ingested medicines in part unaltered, these also enter into our sewage water.

In response to this problem, the INP in Greifswald is researching into how physical plasma can effectively remove pharmaceutical residues and organic compounds from water.

This is the aim of the PLASWAS project begun in 2015. It is investigating how effectively plasmas generated with pulsed high voltages can remove pharmaceutical compounds.

For this, the researchers are looking into decomposition rates and energy efficiency under various water conditions to pave the way for the technical application of the process in water treatment plants.

Compared with conventional water treatment methods, physical plasma has proven to be far more effective for bio-resistant substances and current findings indicate that it leaves no toxic process waste. The individual plasma components then simply recombine to form water.

www.inp-greifswald.de

TECHNICAL AND SERVICE COMPETENCY FOR WATER TREATMENT

Veolia Water Technologies is part of the Veolia Group. The company, which goes under the brand names Berkefeld and ELGA LabWater in Germany, groups the former firms, ELGA Berkefeld, Krüger WABAG, Aquantis, PMT and RWO, and is one of the world’s leaders in planning and delivery of water treatment, water recycling and wastewater treatment facilities and technologies.

Based in Leipzig, the team serves Saxony and the eastern federal states in particular. The focus is on facilities for treating processing water, drinking water and recycling and treating wastewater. Our engineering and sales team in Leipzig has special competencies in power generation, chemicals, mining and other large industries.

The product range also comprises solutions for technical facility services and swimming-pool technology, beverage, food and pharmaceutical producers as well as laboratories, municipalities and international aid organisations.

As part of its Mobile Water Services portfolio, Veolia Water Technologies provides services for almost all sectors of water treatment.

Thanks to its close-knit network of specially trained service technicians, it can respond at short notice and provide competent support on site:

- Maintenance/Repairs
- Facility audits for optimising operations
- Regeneration and replacement of filter materials
- Replacement of spare parts and UF and RO membranes
- Delivery of HYDREX dosing chemicals
- Remote diagnosis and maintenance
- Mobile water treatment plants for temporary use on a rental basis in case of emergency or planned maintenance
- Water sample analyses

www.veoliawatertechnologies.de

TECHNICAL AND SERVICE COMPETENCY FOR WATER AND WASTEWATER TREATMENT

KSB Aktiengesellschaft is a leading international producer of pumps, valves and related systems for process technology and technical facility services, water management as well as energy technology and mining. The group has its own sales companies, production facilities and service providers on all continents.

KSB manufactures pumps and valves at 32 production locations in 19 countries. With a workforce of about 16,196, the group recorded a turnover of approx. EUR 2.2 billion in 2014. Its activities in its own research concentrate on hydraulics, sealing technology, materials and production technology. Control and regulation technology are playing a growing role in product development.
The pump and valve manufacturer provides suitable automation technology for connecting new or retrofitted installations to the building or the operational control technology and of course the software for commissioning the pumps. KSB’s automation technology is suitable for connection to new control technology systems or retrofitted or existing facilities.

For years, KSB has maintained a wastewater competence centre in Halle. Thanks to its consistent development and upgrading of submersible mixers, the location operates as a one-stop supplier of wastewater management technology for the world market.

Products from Halle transport and regulate wastewater in treatment plants from Berlin to Singapore. KSB pumps transport municipal and industrial effluent, drain water from households and property and are also put to use in pumped drainage systems. About 480 personnel are available to deal with the daily challenges on the market.

RECYCLING DISCARDED PHOTOVOLTAIC MODULES

Besides producing chemical products largely for use in very water-intensive branches of industry, such as paper, textiles and leather, with its three locations in Zwickau, Lichtenau and Tangermünde the Loser Holding GmbH group is also primarily engaged in resource conservation.

For the above-mentioned industries, water plays a major role as a resource, the aim being to enable its reuse and recirculation with the group’s own technological developments. In selected sectors, such as renewable energies or electronic scrap, Loser Holding seeks to make a contribution to improving resource efficiency.

For example, Loser Chemie GmbH has developed a worldwide unique recycling technology for discarded photovoltaic modules, which won the Saxony Environmental Award in 2015. The hydrometallurgic solution based on bio-degradable chemicals in combination with an optophysical process with the help of the affiliate TESOMA is being developed into an automated, turnkey facility.

The general focus is placed on the highest possible material recycling rate to be able to also capture small amounts of rare and strategically important elements and prevent their loss, as is accepted in the widespread bulk reutilisation rate approach.

www.ksb.com
Lead CLEANTECH market

Sustainable water management
Although this lead market centres on operational issues that are generally seen as the basis for all good business management, many eastern German enterprises have specialised in material savings or optimising current resource use particularly by means of special modes of production and processes or through the use of new cross-sectional technologies. This is where special innovations can afford decisive competitive advantages in the cleantech sector. Simple measures in niche markets (e.g. special manufacturing technologies or the application of cross-sectional technologies) also contribute to reducing material and raw materials costs. These manufacturing technologies are key for upgrading material-efficient products and processes.

Among others, biotechnologies and nanotechnologies provide the basis here for developing new materials from renewable raw materials (e.g. hybrid biomaterials, fibres and platform chemicals). These technologies are enhanced by the sustainable design segment, which in combination with provisional fields of application marks the starting point for developing very environment-friendly products throughout their whole lifecycle. The central task of sustainable design in this connection is to analyse all environmental aspects of production and subsequent use - from raw material extraction to production and environmentally clean use to the end of the product lifespan. There are some excellent examples of firms operating on this lead market in eastern Germany. For instance, with its company, Novo Solar GmbH, the Hörmann Group has specialised in replicating solar modules that are no longer available, while ITS Cell GmbH has made the preparation, repair and processing of defective solar cell modules into a speciality. IBU-tec advanced materials AG applies thermal methods for the resource-saving and sustainable treatment of very diverse materials.

Waste avoidance through modified processes has developed into a separate market and is a major concern of many eastern German companies. Ökoplast GmbH has developed its own modular system of workpiece carriers for cleaning and transport to avoid non-returnable transport packaging. UGN-Umwelttechnik GmbH applies a special filter technology consisting of filter material made from recycled substances. As these companies illustrate, the management of solid waste and its processing through recycling intersect at many points with this lead market, as the technologies applied there can put raw materials to efficient reuse.

Raw material and material efficiency is highly relevant to all branches of industry and can support the development of eastern German companies: It affords many, different additional and new fields of activity and business opportunities in the cleantech sector.

On the next few pages, you can see what innovative ideas are being put into practice on this lead market in eastern Germany.
MANUFACTURING AND REFURBISHING PV MODULES

As part of the Hörmann Group, the company, Hörmann Novo Solar GmbH, in Laubusch in Saxony has specialised in producing small batches of PV modules.

In particular, it primarily replicates modules that have already disappeared from the market. This way, it can offer insurance firms, installation technicians, park operators or also private individuals comparatively cheap options when individual photovoltaic modules have been irreparably damaged or become defective. It produces very small batches in particular, also including modules with 4”/5” cells that are no longer available on the market today.

Besides replication, it also repairs defective PV modules and refurbishes them for resale. Its high flexibility and broad variety of module types gives Hörmann Novo Solar a unique selling point.

In addition, Hörmann ITS Cell GmbH produces photovoltaic cells that have been rejected by other manufacturers as off spec for module production. The cells are put through a high-tech laser process, sorted and supplied to module manufacturers.

Alongside cell processing, ITS Cell also provides other services to do with photovoltaic cells, including sorting by capacity and cutting. Its research and development activities are carried out in close collaboration with the Fraunhofer CSP in Halle.

Hörmann ITS Cell GmbH manufactures photovoltaic cells that are rejected by other manufacturers as off spec for module production. The cells are processed through a high-tech laser process, sorted and supplied to module manufacturers. ITS Cell also offers services such as sorting by capacity and cutting. Its research and development activities are conducted in close collaboration with the Fraunhofer CSP in Halle.

www.hoermann-its.de
www.hoermann-novo.de

Raw material and material efficiency

Specialists in Thermal Process Technology

IBU-tec advanced materials AG is an independent service provider for thermal processing solutions based in the historic city of Weimar. The company has a comprehensive capability for carrying out thermal processing trial work with laboratory support and associated activities: An unprecedented service portfolio, that includes material and process development, scale-up trials and industrial size toll production.

With over 4 decades of experience in rotary kiln and Pulsation Reactor technology, IBU-tec has extensive experience, handling substances ranging from battery materials, building materials and rare earths to high performance ceramics. We specialize, among others, in the thermal treatment of catalysts and catalyst carriers.

A 150-person strong team with experience and expertise, is ready to support international clients across a multitude of industries, making contributions to the sustainable use of raw materials and the circular economy (e.g. recycling rare earths), raising material and energy efficiency (e.g. new building materials), reducing pollutant emissions (e.g. catalyst materials) and sustainable mobility alongside innovative energy storage (e.g. battery materials).

www.ibu-tec.com

Workpiece Carriers for Washing and Transport

For several years now, Ökoplast GmbH has been producing customised workpiece carriers made of plastic that are used for transport and cleaning of individual parts produced in large series (primarily in the motor-vehicle sector, hydraulic components).

For cleaning operations, mechanical parts are often dropped into washing baskets (problem of damaging functional surfaces) or placed there by hand (large labour input). There are ways of placing the individual parts in workpiece carriers and cleaning them together. Besides those made of stainless steel, workpiece carriers made of a combination of stainless steel and plastic elements or just of plastic are coming into increasing use.

For transport mechanical parts are often placed on deep-drawn plastic trays, unclean mechanical parts soil these and they must be cleaned. One solution is non-returnable packaging that is then disposed of.

www.ibo-plast.de
The better option are workpiece carriers made of suitable plastic with a lattice structure. During the washing process, the lattice allows the soiled cleaning agent to flow off. This way, the workpiece carrier performs 2 functions: transportation and washing, obviating the need to remove and insert the mechanical parts.

Ökoplast provides workpiece carriers made of plastic that have to meet high requirements in dimensional accuracy, evenness, resistance to chemicals and heat stability, depending on the function and process.

This is also where the company has gained the experience that has enabled it to occupy a good market position in this line of business.

With its own Ökoplast-system, which is currently being developed and set up, Ökoplast plans to expand and consolidate this position.

ENVIRONMENT-FRIENDLY FILTER MATERIALS

When it comes to purifying industrial exhaust air of gaseous pollutants, impurities and odorants and desulphurising biogenic fuel gases, UGN-Umwelttechnik GmbH is the competent partner. It offers all-inclusive solutions for these processes (facility planning, installation and supervision) or carries out measures for optimising existing plants (operating costs, operational conditions, etc.).

The company owes its innovative strength to its dynamic, professionally competent team of specialists in environmental technology, mechanical engineering, construction, biology, etc.

As of 2010, UGN-Umwelttechnik GmbH is a member of the Rietzler Group, which is committed to a sustainable corporate policy of environmental protection and resource conservation.
With the support of extensive engineering competencies from the Rietzler Group and its own research department, UGN provides a broad range of services, from process solutions to executing entire technical plants.

The centrepiece of the plant engineering or the basis for plant optimisation are UgnCleanPellets® and UgnCleanTubes®. Made of recycled materials and local raw materials, these filter materials are particularly sustainable and environment-friendly. UGN guarantees the highest quality standard and maximum flexibility through its own production of UgnCleanPellets® and UgnCleanTubes® at its location in Gera.

The filter materials can also be defined, adapted and continually upgraded with special filtration properties for customised application.

www.ugn-umwelttechnik.de
Besides waste disposal and landfilling, a special focus on the circular economy lead market is the recycling of all reusable residues, but also the disposal and deposition of hazardous materials and the purification of liquids or gases. The various services have been traditionally performed by experienced eastern German firms as contaminated sites and the remnants of the socialist planned economy already had to be remediated in the post-reunification period and the available funding set incentives for carrying out rehabilitation measures. On this lead market, some seven hundred different eastern German firms have gained many years of experience in disparate circular economy technologies and have developed special solutions. Major companies in solid waste management located in eastern Germany include REMONDIS Ost GmbH & Co. KG or the ALBA Group plc & Co. KG, each of which handle huge flows of waste and recyclable materials in their operations worldwide and have specialised primarily in recycling and disposal. A good example for the implementation of an excellent idea is the company, H. Nestler GmbH & Co.KG, which besides its activities in solid waste management will soon be producing a construction system from recovered recycled material.

Eastern German enterprises provide various innovative solutions to alleviate the growing problem of air pollution. Dr. Födisch Umweltmess-technik AG develops and produces suitable sensors to measure the concentration of harmful substances in the air. To reduce inner-city air pollution, Green City Solutions GmbH & Co. KG has developed a product that filters the air with the help of a combination of the Internet of Things and special plants, especially selected moss varieties. Aquafil Engineering GmbH also employs a special filter technology that operates with aerosol separators using reusable filter candles. The research landscape in eastern Germany makes a major contribution to strengthening innovation in the circular economy, providing many different intelligent solutions for recycling substances: The Fraunhofer Institute for Ceramic Technologies and Systems (IKTS) is developing filtration technologies for water treatment and the Helmholtz Centre for Environmental Research (UFZ) is researching into closed flow cycles and reducing soil contamination with biological methods.

Another issue that is coming to the fore in eastern Germany is recultivation, especially in the removal of old production sites and the remnants of lignite opencast mining in the central and eastern new federal states. In addition to the Lusatian Central German Mining Administration Company (LMBV), whose specialism is the redevelopment of mining landscapes, other eastern German companies and research institutes are turning their attention to the issue, have gained extensive experience and have come up with some remarkable developments. C&E Consulting and Engineering GmbH, for example, has specialised in mining installations and the remediation of contaminated/disused sites and contributes to international know-how transfer. Besides the deposition and recovery of strategic raw materials, the circular economy lead market makes a special contribution to environmental rehabilitation, recultivation and the reclamation of new spaces and landscapes.

On the next few pages, you can view a selection of successful businesses operating in the circular economy lead market in eastern Germany.
CONSTRUCTION ELEMENTS FROM RECYCLED MATERIAL

Specialised in particular in container services, reuse and recycling, demolition and civil engineering, gardenscaping and landscaping and building materials, H. Nestler GmbH & Co. KG makes a particular contribution to the cleantech industry with the production of its Nestler block, a flexible construction system of interlocking concrete blocks.

The Nestler block comes in different shapes and sizes. Two-thirds is always made from recycled material, using various reusable residues: brick and concrete recyclates, but also natural stone. It has a compressive strength of 30 N/mm² - 34 N/mm². This easily and simply stackable material-saving system can, for example, be used for the simple and flexible construction of bulk goods boxes, partition walls, mobile silos or warehouses, but it can also be dismantled again, without the use of fastening materials.

In addition to the blocks, Nestler GmbH can also extend its services to provide all-inclusive solutions: drawing up a construction plan, calculating the statics, carrying out excavation work and transporting and assembling the blocks with possible roofing.

The Nestler block construction system can be delivered at short notice and is assembled on delivery directly from the vehicle. The only requirement for a construction with Nestler blocks is an even and stable foundation ground. After assembly, the walls can be put to immediate use. Thanks to its flexibility, the system can be used for temporary or permanent constructions. Nestler sees its block system as a contribution to implementing the Closed Substance Cycle and Waste Management Act.

www.nestleronline.de

INNOVATIVE AIR PURIFICATION WITH SMART BIOFILTERS

The young start-up, Green City Solutions, provides smart solutions in environmental services, cleantech and sustainable urban development to help residents lead a healthier life in clean and connected cities.

The company has specialised in reducing air pollution in urban areas, already the cause of every seventh death worldwide today. Exceeding thresholds for nitrogen oxide, ozone and fine dust is subject to heavy penalties imposed by the EU. Green City Solutions’ answer to this problem is based on a patented combination of the latest Internet of Things (IoT) technology with special moss cultures that have a natural ability to filter pollutants from the air.

Attached vertically to a free-standing wall, supplied with water and optimal nutrients through IoT technology, the moss filters the air as effective as 275 urban trees. This free-standing vertical plant display, the so-called CityTree, can be set up mobile and flexible in nearly any space. The selected moss variety is very robust and therefore ideal for use in urban environments. A CityTree performs the environmental services of 275 conventional planted urban trees, at only 5% of the costs and takes up 99% less space.

As part of its product development, Green City Solutions focuses on using recycled material to reduce its carbon footprint. This makes the city tree itself sustainable: Compared with 4 tonnes of CO₂ emissions during its production, the installation sequesters 240 tonnes of CO₂ equivalent in just one year.

www.mygcs.de

LEADER IN RECYCLING

As part of the REMONDIS Group, REMONDIS GmbH & Co. KG has specialised in particular on providing regional services in recycling, service and water.

Our experts in the region have access to the whole range of facilities, services and know-how of the internationally operating REMONDIS Group with its many specialist companies. As the leading company in recycling and water management in Germany, REMONDIS also ranks among the major suppliers worldwide.

The Group’s professional services for the economic and efficient use of natural resources are currently available at over 750 locations in 33 countries on four continents. Altogether, REMONDIS provides comprehensive services for over 30 million citizens and many thousands of businesses and municipalities.

One of REMONDIS’ special services is handling huge material flows. Each year alone, it collects, processes and markets 30 million tonnes of recycled commodities and products. The Group’s technology network comprises more than 800 facilities closing numerous materials cycles with a fleet of 8,000 commercial vehicles that ensure smooth logistics 24 hours a day.

www.remondis-ost.de
POLYMER RECYCLING AND EXHAUST AIR PURIFICATION

AQUAFIL Engineering GmbH is one of the world's technological leaders in plant engineering for polyamide and polyester. It provides its clients with the latest technology combined with high quality, flexibility, performance and sustainability. It is known for its outstanding developments and technologies, some of which are unique.

One of its current innovations in particular is EverPET®, a unique engineering technology and the latest development in polyester recycling. In this process for consumer waste, the ‘raw material’ is recovered from the pre-cleaned polyester residue, which is then processed via polycondensation into high-quality polyester equivalent to the original product. This ensures a closed materials cycle without downcycling or raw materials loss as with deposition (biodegradable polyester such as PLA, for example).

The product range of AQUAFIL Engineering also includes modern aerosol separators that are used especially in the chemicals, fertilizer, plastics, metals, paper and rubber industries.

Exhaust air flows must also be removed and purified in many processing operations, especially those involving thermal treatment or coating and thermosetting. The exhaust air/gas flows through the filter candles filled with fibreglass and is purified through adsorption. Depending on the degree of contamination and service time, the filter candle material is cleansed or replaced and the filter candles themselves can be reused - a simple but effective process with a particularly high separation rate and longevity thanks to the hand-made filter candles.

www.aquafileng.com

CLOSED CYCLES

In response to the global challenges of climate change and rising demand for resources, the Helmholtz Centre for Environmental Research (UFZ) focuses its research on environmental technology and biotechnology on the decentral and integrated use of renewable resources and waste materials.

It seeks nature-based solutions to enable the decentral production of platform chemicals and energy sources from renewable raw materials (e.g. renewable carbon sources, non-food biomass, carbon dioxide or hydrogen as well as electric energy).

Based on its natural science and engineering expertise, UFZ has already developed and patented initial technological (sub-)modules for this. Overall, the process modules aim at closing the cycles of existing materials and proactively establishing closed cycles for future substances.

The activation of natural microbiological degradation processes at contaminated natural and industrial sites also plays a key role in this research focus. In recent years, UFZ has developed many different technologies for soil decontamination and for groundwater, process water and wastewater issues, and has successfully applied these in field trials or introduced them onto the market together with partners from industry.

The main target group for this research are the chemical/biotechnology industry, the agricultural sector, industrial estate operators and stakeholders in the development of viable urban development schemes/infrastructure.

www.ufz.de
SENSOR FOR CLEAN AIR

Air is our lifeblood, but it also contains harmful substances such as fine dust. Thanks to the FDS 15 compact sensor developed by Dr. Födisch Umweltmesstechnik AG, it is now possible to measure this continuously, precisely and cheaply.

The instrument is intended for industrial application. It is easy to use outdoors and indoors, in stationary or mobile operation and the measurements can be made independently of weather conditions. With preconditioned air, the fine dust content is measured every two seconds. A WLAN module for networking with other sensors makes the instrument into a genuine allrounder. It can, for example, also be used for measuring ambient air at the workplace.

FDS 15 is another addition to the product line of dust monitors at Dr. Födisch Umweltmesstechnik AG, which has been developing and selling high-tech environmental measuring devices worldwide for 25 years.

WATER TREATMENT AND RECOVERY OF RAW MATERIALS

The Fraunhofer Institute for Ceramic Technologies and Systems (IKTS) is engaged in applied research in high-performance ceramics and with its 3 locations in Dresden and Hermsdorf (Thuringia) it is the largest ceramics research institute in Europe. One of its priorities are ceramic material, component and system solutions for efficient and closed cycles for industrial and municipal users.

Fields of application range from water/wastewater treatment, partic-
ALBA GROUP: THE WHOLE RANGE OF ENVIRONMENTAL SERVICES

With its two brands, ALBA and Interseroh, the ALBA Group operates in Germany, Europe and in Asia with a total workforce of about 7,500 personnel. In 2014, it earned a turnover of EUR 2.45 billion, making it one of the leading recycling and environmental service providers and raw material suppliers in the world. Thanks to its recycling activities, the ALBA Group was able to reduce greenhouse gas emissions by approx. 6.6 million tonnes compared with primary production in 2014 alone and save on more 48.3 million tonnes of primary raw materials.

The ALBA Group provides the whole range of environmental services, from consultancy on disposal issues to packaging licensing on the so-called dual system market to the latest sorting technology and reliable recycling methods. Also included are logistics schemes, innovative product developments, allround facility management services and raw materials deliveries all over the world.

Together with the financial director, Dr Markus Guthoff, the two owners, Dr Axel and Dr Eric Schweitzer run the family business.

www.alba.info

ENVIRONMENTAL ENGINEERING PROJECTS – THE WHOLE PICTURE

Headquartered in Chemnitz, C&E Consulting und Engineering GmbH is one of the largest, independent engineering firms in Germany today.

It provides engineering services for contamination and site remediation, environmental engineering, landfill and hydraulic design, mining consultancy and planning, geotechnical investigations and assessments as well as project control and management. The certification according to DIN EN ISO 9001 standard is the result and permanent criterion of an internal project management in order to meet the quality requirements of public and private clients.

Due to its broad range of services, C&E considers projects as a whole, involving all planning disciplines. Projects for national and international executing agencies, banks and development institutions, primarily in Central, Eastern and South-East Europe as well as in Central Asia are carried out.

In the scope of international contracts, C&E has cooperated successfully with national, international and local partners, contributing specific, scientific-technical experience and regional knowledge to the projects. It is registered with the EU, the World Bank, EBRD, ADB, GIZ and many national agencies.

www.cue-chemnitz.de

Photo: C&E
PLASTICS RECYCLING REDEFINED

With its pilot facility in Schwerin, FVH-Folienveredelung Hamburg GmbH & Co. KG serves the entire value added process from plastic waste to cleaning/treatment to the production of base granules for primary industry.

With the unique HydroDyn technology, the FVH pilot facility processes plastic waste to produce blowable granules that can be used for manufacturing new products, such as garbage bags.

Plastic waste is usually so badly soiled that the customary traditional washing methods are unsatisfactory and large amounts of refuse must still be incinerated or even dumped as a result and are unavailable as raw material.

The worldwide patented and extremely energy-efficient HydroDyn process technology can clean used, soiled polymers with unprecedented high efficiency, especially those with large cleaning surfaces, such as films, plastic bags and packaging.

After processing, the granules are upgraded to specific types and sold under the brand name Ecophoenixx.

This way, plastic waste can be used by the raw-material processing industry and make a major contribution to improving resource and material efficiency.

www.ecophoenixx.de

CLEAN AIR IN THE CIRCULAR ECONOMY

With raw material consumption continuing to grow worldwide and the concurrent increase in the amount of waste, recycling remains a high priority. On the other hand, overcapacities in this sector have led to fierce competition and the winners will need to have much better technical and economic solutions.

NESTRO® Lufttechnik GmbH helps its partners to meet these new challenges by aiming at the best operational outcomes, energy efficiency and clean air. Effective systems remove dust and separate materials to help achieve the best sorting purity and ideal working conditions.

Depending on client needs, the residue material is transported, shredded, separated, stored or compacted. Competent advisers are always available to help with relevant issues.

NESTRO® was founded in 1977 and is today one of the largest established manufacturers in Europe of products and systems for extraction and filter technology made in Germany. It designs, plans and produces dedusting and filter systems, wind screening plants and fresh air systems for complex recycling-sorting plants, sorting cabins and other processes in industry.

www.nestro.com

Photo: NESTRO, separator airlocks
There is no doubt that drinking water is an increasingly scarce and highly sensitive commodity. Nevertheless, plants are being used worldwide that are not able to take adequate account of sustainability (eg. Membrane filter based RO plants).

Against this background, after six years of research, we have developed a proven safe method for treating drinking water from fresh water. In 2014 we introduced our solution in the form of different, high-performance system. In this area, ARISU’s mobile drinking water treatment plants range from 500 litres to 2,500 litres / hour, their stationary water treatment plants can process up to 5,000 litres per hour. All systems can be combined with one another in order to prepare larger amounts of drinking water as required.

All ARISU systems are 100% chemical-free, extremely energy-efficient and low-maintenance; ideally suited for use in regions where water resources, technical expertise and / or the power supply are scarce. And while, for example, RO plants produce chemically contaminated waste water up to 25%, ARIUS's sewage rate is less than 1% and as the rinse water is not contaminated with chemicals, could even be returned to the raw water again.

www.arisu-gmbh.com
Currently there is no user-friendly solution which enables the consumers to dispose of their old or broken electronic devices. They either have to make a lot of efforts by travelling to recycling centres far from city centres or they are just not aware of what are the available solutions.

Electronic waste collection rates are very low because there is no system which makes it economically viable for recycling centre to collect the waste. With binee the cost of collecting it becomes a revenue. We call it ad-sponsored recycling.

binee develops a network of interactive collections points placed in practical locations, like local electronics shops or shopping malls. Whenever you walk to your local binee to dispose of your old device, you can choose a discount coupon among our partners. Our binee thus becomes a marketing tool for brands and other companies who would like to advertise their brands through our platform. binee is an e-waste collection system which raises awareness of this environmental problem as well as making the waste disposal an enjoyable and rewarding experience.

From an environmental point of view, binee shifts the illegal export of e-waste to landfills in emergent countries by monitoring the waste route. We are able to monitor the journey of the waste from the binee to its recycling and we inform the user when and where his device has been recycled. For this, we have partnered with a recycling centre in Sonneberg. Once our partner receives our box and recycles the content, they inform us and we inform the user. In this way we increase the transparency of the entire waste stream.

Our system is also a way to exploit the urban mine. Instead of mining primary raw materials, binee enables the recycling and re-using of existing devices. With our system, the existing devices which are forgotten in drawers either becomes secondary raw materials for the production of new devices or the device which are still functional, they are re-used by new owners. In addition, it comes spontaneously that our system contributes the creation of a circular economy. What is called „electronic waste“ is actually no waste at all! It is actually a valuable resources, which is just waiting to be used! We just need to find a business model which enables it to be used. This is what binee is all about!

binee has raised funds from the European Union and the EIT raw materials which enabled the production of several prototypes and a pilot phase. After testing the market the team was impressed by the positive response from users. Currently binee is looking for location partners who would like to install a binee within their premises as well as coupon partners who would like to use our platform as a marketing channel

www.binee.com
Due to its history, eastern Germany has an innovation lead in organising mobility, but also in devising mobility concepts. Due to limited individual motorisation in the pre-reunification era, public transport had to cope with large volumes of traffic between homes, schools and factory combines. This know-how has also been mobilised for the relatively new challenge of sustainable mobility. It is no coincidence that three federal states in eastern Germany, Berlin, Brandenburg and Saxony (in a project network with Bavaria) have already successfully carried out projects under the Federal Government’s Electromobility Showcase Programme as of 2012. The showcase projects were set up to promote electromobility as an environment-friendly alternative. With over 2,000 registered electric vehicles and more than 500 charging stations, Berlin is the national leader. The capital region, but also the other new federal states supply the whole electromobility value chain: Over 160 transport and infrastructure planning, vehicle production and parts-supply and transport companies have set up business on this lead market. Consultancy firms make a major contribution to building intelligent transport networks. With international operations, the successful company, VerkehrsConsult Dresden-Berlin GmbH, provides advice on transport issues and services for problems in the transport sector and has developed a tool for analysing and assessing the practicable and economic deployment of electrobuses. Managing sustainable mobility calls for complex software solutions. VIOM GmbH analyses transport data, applying suitable tools to evaluate all eligible information and communications technologies for their innovative and commercial potential and provides these to firms for managing sustainable mobility schemes. Eastern German city transport operators are traditional leaders in sustainable mobility in passenger transport: They own extensive tramway networks that can be run in energy-efficient operation using environment-friendly energy or they are currently working on their conversion. The prime concern in vehicle manufacturing for sustainable mobility are hybrid mobility and electromobility options, but the latest manufacturing technologies in lightweight construction and software and hardware development for autonomous driving also play a central role for this lead market.

Various cleantech enterprises have specialised in electric mobility in eastern Germany and are putting their concepts into successful practice: Apart from the large-scale producers, e-power-drive GmbH produces various commercial vehicles with e-drives and has set its sights beyond local transport. On a far larger scale, BMW is already producing all-electric driven vehicles in series for everyday use in Leipzig. Instead of manufacturing complete new vehicles, CITYSAX Mobility GmbH has been successfully converting cars with conventional drives since 2009. Here you can see the different solutions companies have come up with on the sustainable mobility lead market in eastern Germany.
LOCAL ELECTROMOBILITY

Made by e-power-drive GmbH, the e-power-trike, CARGO, is one of a new generation of small electric-driven commercial vehicles to spearhead innovative and sustainable mobility concepts. It is an extremely manoeuvrable, efficient and versatile vehicle for all-round use by local authorities, industry, tourists and the private sector.

CARGO sets standards for economy, energy efficiency, environmental sustainability and price-performance. The made in (eastern) Germany vehicles are designed solely for local use. They can be charged at any 230 V socket, with no need for costly charging stations.

Thanks to the many attachments available, they can be put to very efficient use. Combined with minimum operating costs in service, the quality and functionality of these electro-vehicles make for high everyday utility and cost-effectiveness. Added to this is their suitability for all-round use, their special design, driving safety, high payload and environmental sustainability. As part of sustainable, carbon-neutral mobility, these products will make a contribution to the success of the energy transition.

Electric vehicles are largely supplied from renewable sources and the drive batteries function at the same time as energy sources. They contribute to making substantial reductions to CO₂, dust, noise and nitrogen oxides emissions.

E-VEHICLE IN SERIES PRODUCTION

At the BMW Group works in Leipzig, about 100 vehicles roll off the i-production line a day: BMW i3 and BMW i8. The i3 model is an all-electric driven car in series production designed for new, sustainable urban mobility.

With this, BMW is meeting today’s social, environmental and economic challenges, including in particular the design of an unprecedented vehicle architecture that requires the use of modern, lightweight building materials, but also new production processes. Here too, the issue of sustainability is a foremost concern of the BMW Group.

CONVERTED TO AN E-CAR

In 2009, CITYSAX Mobility GmbH brought the first electric car for everyday use onto the market in Germany. The experience gained since then has been channelled into converting all kinds of vehicles, off-road, sports or cult cars. CITYSAX has specialised in converting vehicles with petrol engines to electric drives.

Why convert? Because transforming a vehicle with a conventional drive into an electric car means additional energy and materials savings. No new body, chassis or interior need to be produced. The old ‘sweetheart’ is given an overhaul with a modern drive technology. There are not many better ways to save resources. Adjustments can also be made to meet individual needs, which is not possible with large-scale production. The signals of the new electric vehicle can also be integrated into the old dashboard.

CITYSAX cars are therefore easy to handle and meet a high safety standard. Based on its experience and capabilities, the company CITYSAX is the ideal partner for special vehicles and solutions and now provides assembly kits for ambitious hobby mechanics.

Its latest products are the electro-roadster MICT-è, Steyr-Puch Haflinger, the electro Trabbi together with a caravan as a range extender and the Trabbi assembly kit.

www.e-power-drive.de

www.bmw-werk-leipzig.de

Sustainable mobility

BMW i3 meets the demands of sustainable mobility, because it is the first vehicle project with agreed sustainability goals that have been pursued with the same commitment as cost and weight or quality targets. The aim is also to keep the environmental impacts of local production as low as possible. This includes the use of renewable energies as well as a new level of energy efficiency, the reduction of solvent emissions and recycling schemes. These objectives apply to all locations in the BMW i-production network.

Lead CLEANTECH market
Through its participation in the project, Personalised Mobility, Assistance and Service Systems, sponsored by the Federal Ministry of Science and Research, CITYSAX Mobility can provide more professional support to improve the interaction between older persons/with disabilities and mobility.

WIRTSCHAFTLICHER EINSATZ FÜR ELEKTROBUSSE

VCDB VerkehrsConsult Dresden-Berlin GmbH assists transport companies and local authorities in developing economically viable services to meet needs.

The intention is to make public transport an attractive, cost-effective and environment-friendly alternative to individual transport, but local public passenger transport also affords enormous scope for climate-friendly mobility development. This is why VCDB already set up a business line in electromobility in 2009. It sees itself as an interface among research and development, electromobility components and the practical requirements of transport operations. With BeSystO, an evaluation method for system innovations in local public passenger transport, the specialists in VCDB have now developed a (software-based) tool for analysing and assessing the practicable and economically efficient use of electrobuses in local public passenger transport.

Using standardised algorithms and variable parameters, BeSystO can generate implementation options for the systemic integration of electromobility in transport companies as a basis for making practical recommendations.

The other business divisions in VCDB can also draw on extensive competencies for environmental planning calculations to be able to quantify the impacts of measures in service delivery (e.g. timetable scheduling), infrastructure (e.g. route extension or depot construction) and vehicle procurement (entire lifecycle) on the carbon footprint of municipalities and transport companies.

GEO-INFORMATICS AND OPTIMISATION SYSTEMS FOR COMMERCIAL TRANSPORT

VIOM GmbH ("Visions of Mobility") was founded in April 2002 with a focus on the application of new technologies for a mobile society. Classical software engineering strategies are expanded in the VIOS solutions to account for new mobility concepts, integrating wireless technologies, mobile terminals, sensors and data input. These new mobility concepts include energy, infrastructural, environmental and economic aspects. VIOM offers customised solutions, standard products, SaaS for third-party applications and data processing - especially for the logistics, traffic and geo-information sectors.

VIOM development specialises in sustainable mobility solutions, shaping its operations towards user needs, while always focusing on corporate innovation and operational concerns. Part of its expertise is designing products for the strategic and operational expansion of mobility (e.g. energy and user strategies). The VIOS platform takes models designed in corporate research as frame of reference and upgrades them with newly developed procedures to supply companies with technology supporting Mobility 4.0. Thus VIOM takes a cross-sectoral approach, e.g. via funded projects such as MULi (car-
bon footprint calculation using vehicle operating data analysis in conurbations) or ViBE (virtual companion to improve mobility for older persons).

In the showcase project, SMART e-User, VIOM developed IT for route planning and simulation scenarios for a hybrid-drive fleet.

www.viom.de

EXTRAORDINARY ELECTROMACHINES - EXTRAORDINARILY INNOVATIVE

E-mobility applications are a major area of research and development and (small) series production at Krebs & Aulich GmbH, a medium-sized enterprise in Wernigerode in the Harz District.

As early as 2009, for example, it developed, produced and delivered a small series of the all-electric driven Audi A2 for the first time in the Harz pilot region. For efficient e-mobility operation, it also developed and built a bidirectional DC-DC converter for traction and charge operation in electric vehicles with the option of energy feedback into the low-voltage grid. The e-mobility portfolio of K&A also includes wheel hub motors for hybrid buses and for driverless, all-terrain reconnaissance vehicles in watertight design.

Currently, the researchers and developers at Krebs & Aulich are looking at drives for vehicles in small series and the recovery of braking energy in municipal vehicles and autonomous trailers.

Its permanent-magnet-excited high-performance drives, especially traction and wheel motors, and its lightweight generators are particularly well suited as motors and drives for hybrid and e-vehicles.

Especially for small batches, drive and wheel motors for all-terrain hybrid and for civilian and military use, wheel motors for automotive applications and generators for serial hybrid drives.

The medium-sized firm from Harz is capable of manufacturing samples/single pieces and small batches and has a large portfolio of customer references - from private clients to original equipment manufacturers.

www.krebsundaulich.de
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As we have seen in the Federal State of Saxony over the past years, investments in environmental sustainability bring value added to a region and create new jobs. Therefore the environmental and energy technology sector has advanced to become one of Saxony’s key industries. The Saxony Economic Development Corporation (WFS) has supported and promoted these developments – by facilitating the location of innovative, competitive enterprises to the Federal State, helping local companies to promote sales and liaising cooperation between companies and research institutes. The main concern of our projects has always been to develop core growth segments with extensive R&D competencies.

The Saxony Economic Development Corporation successfully performs the following duties and tasks on behalf of the Federal State of Saxony:

- Promoting the Federal State of Saxony at home and abroad
- Acquiring, advising, and assisting companies seeking to relocate to and expand in Saxony
- Intensifying the support for Saxony’s companies to promote their growth
- Providing information and contacts to enter and expand on domestic and foreign markets
- Planning and implementing sales promotion measures at home and abroad
- Accompanying and assisting foreign business delegations in Saxony
- Intensifying the cooperation with Saxony’s networks, research and training facilities to encourage business founders from Germany and abroad to come and found their business in Saxony and to generate growth
- Initiating projects for interregional cooperation as part of various initiatives of the European Union (particularly INTERREG) together with partners
enviMV e.V. association, established 2008 in Rostock with recently 24 members, is active in both waste disposal, recycling, reutilization and waste-to-energy; sustainable land management and infrastructure engineering, special component construction, energy techniques, operation and services; internal quality, safety, environmental and energy management; and consulting, analytics and process steering.

enviMV-members represent important parts of the circular economy by efficient resource management.

enviMV supports the bilateral cooperation of members and third parties and supports the joint venture on emerging markets, with specialities in developing countries.

enviMV promotes clean technology by networking, e.g. with local and regional business associations such as Rostock Business and Invest-in-MV, as the local resp. country wide business promotion companies; the network CleanTech Initiative East Germany and the South Baltic Clean Technology Network (www.southbaltic-cleantech.eu) with partners from Baltic Countries, Scandinavia and Poland. In this network, enviMV is the Clean Technology Contact Point South Baltic for consulting, study tours, workshops and B2B.

enviMV offers clustered competences, is partner for complex solutions and clean technology interfaces, is mentoring start-ups and market access seeking innovation, and is the link to decision making and support structures.

The Investment and Marketing Corporation Saxony-Anhalt (IMG) is the economic development agency of the German federal state of Saxony-Anhalt. As a service provider on behalf of the Ministry of Economic Affairs, Science and Digitalisation, we market Saxony-Anhalt as a business and science location and are also responsible for tourism marketing at home and abroad. We research our location and property database to find the right place for you. From greenfield or brownfield to office buildings or production facilities, we keep a record of more than 250 industrial and business estates in our database and provide you with initial locational information within 24 hours. There are many funding facilities for businesses looking to invest in Saxony-Anhalt. We advise you on state support programmes and bring you together with the respective partners.

We are familiar with all administrative procedures and will clarify the necessary steps in order to expedite your investment. We sound out and coordinate your official contact partners in the public authorities and guide you through negotiations at federal state, district and municipal level and with other authorities and institutions. We are mandated by the Saxony-Anhalt Ministry of Economy, Science and Digitalisation as a one-stop agency to help you carry out your project.

All enquiries are treated confidentially and our service is free of charge.
The Berlin Partner for Business and Technology provides economic and technological development assistance to firms, investors and scientific institutions in Berlin. With customised services and excellent contacts with the scientific community, our many specialists will offer you the best possible assistance to make your innovation, locational, expansion and locational consolidation projects a success.

By national and European standards, the German capital region is a pioneer in innovative energy and environmental technologies. The future generation and use of energy affords new and diverse opportunities for developing technologies and related services, provided they advance the integration of renewable energies. The capital region is also a leader in developing smart grids, power storage facilities and innovative solutions for synchronising energy demand and supply. With its multifarious industrial and research landscape and excellent infrastructure, it is the largest testing ground for the energy transition and urban environmental technologies in Germany.

Energy Technologies, one of five clusters in the capital region that bundle innovative growth and cutting-edge sectors, groups about 6,200 enterprises with almost 75,000 employees earning a turnover of about EUR 17 billion. Over 6.4 per cent of socially-insured employees in Berlin develop energy-efficient technologies and products or provide energy and environmental services, an above-average employment rate in the sector compared with other cities.

Germany Trade & Invest is the economic development agency of the Federal Republic of Germany. By securing and creating jobs, it strengthens Germany as a location for business and industry. With over 50 locations worldwide and its partner network, Germany Trade and Invest assists German companies on their way abroad, promotes Germany as a business location and helps foreign firms locate here.

Germany Trade and Invest provides extensive foreign-trade information to businesses seeking to expand into foreign markets. Experienced economic analysts at home and abroad post ongoing reports on 125 countries. GTAI’s continuous information services include:

- Market and sector studies
- Economic & tax law information
- Customs & tariff regulations
- International projects, calls to tender & business contacts
- Practical business tips
Brandenburg Economic Development Corporation (WFBB) is the central contact in Brandenburg for investors, entrepreneurs and technology-oriented business Start-ups. With our expert knowledge, our contacts and close networking with our partners as well as tailor-made service packages, we offer all services for business and employment promotion from a single source - individually, confidentially and free of charge.

Brandenburg Invest (WFBB) provides support with set-up and expansion, innovation, internationalisation and networking, provides referrals for acquiring skilled labour as well as continuing education of employees, provides advice on questions regarding financing and promotion and acts as a guide for bureaucratic procedures. As Energy Saving Agency, WFBB is also closely involved with implementing Brandenburg’s energy strategy. We also engage in location marketing.

We approach these tasks interdisciplinarily and thus provide a decisive basis for the further development of the industry-related economic clusters in Brandenburg and the German Capital Region.

The company is represented with its Head Office in Potsdam and Regionalcenters in Cottbus, Eberswalde, Frankfurt (Oder), Neuruppin and Potsdam in the whole state of Brandenburg.

The State Development Corporation of Thuringia (LEG) is the economic development agency of the Free State of Thuringia. It offers investors an full-service support, promotes Thuringia as a business location, manages international contacts and actively promotes technology and innovation transfer.

The Thuringian ClusterManagement (ThCM) as team of the LEG supports and coordinates activities of Thuringian clusters, networks and platforms in the five areas of specialization defined by the Thuringian Innovation Strategy (RIS3). Acting as in intermediary, the ThCM helps to interlink various fields and manages public relations.
The CleanTech Business Park (CBP) is the largest industrial estate in Berlin and is designed to meet the needs of cleantech manufacturing firms. Situated in the Berlin district of Marzahn-Hellersdorf, it offers everything that young as well as established companies from the sustainable and efficient technology sectors need:

- 90 hectares of developed land in the inner city, designated as an industrial zone (GI)
- Ideal transport connections
- Individualised plots of land at attractive prices
- Planning reliability due to set land development plan (10-56)
- A Seveso-II protection zone for potentially hazardous production processes (German Federal Immission Control Act, BImSchG)

The CBP is primarily designed for businesses engaged in environmentally friendly energies, energy storage, energy efficiency, sustainable mobility, circular economy, sustainable water management, raw material and material efficiency as well as green chemistry. The entire physical infrastructure is in place – power, water, wastewater and telecommunications. The CBP thus offers perfect operating conditions combined with a short start-up period.

Due to its location in the City of Berlin, the CBP is embedded in an active network, offering access to extensive research and funding opportunities. More than 2,500 businesses and manufacturing companies are located in direct proximity to the CBP on the business estate Berlin eastside, also including the CleanTech Innovation Center - a co-working space for startups.

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