

hi!tech

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How a new kind of  
medicine and smart  
technology will  
support us

# Healthy till Eighty

## Voltage is Key

Transformers for safe grids  
and low-loss transmission

## New Production

Simulation and production  
merge completely

## Green Mobility

The rail of the future safes  
energy and resources

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## Editorial



## Dear Readers,

life expectancy is rising around the world. As individuals, we have a lot to look forward to – living to the ripe old age of 80, 90 or even older. However, experts fear that this demographic development will lead to skyrocketing healthcare costs. But this trend does not have to continue: We can stay fit and healthy into old age and remain in the same living environment. With modern medical technology and intelligent homes, Siemens is helping to make this possible.

Molecular medicine has the potential to detect and cure diseases at the cellular level. These kinds of developments will help to keep patients healthy over the long run with minimal intervention, and they will cost less than the current methods. An aging population does not have to be nearly as expensive for the

healthcare system as politicians fear. Healthcare policies should place a greater focus on prevention to be able to fully take advantage of all the new opportunities. By combining laboratory and imaging diagnostics, screening will deliver accurate results even faster, easier and more reliably.

Read more about healthcare in old age in this issue's cover story. You will also find articles about environmentally friendly trains, the first production-ready electric cars, the importance of transformers for the future of power grids, the merging of virtual planning and real production, new drinking water analyses and public lighting.

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*CEO of Siemens Austria*



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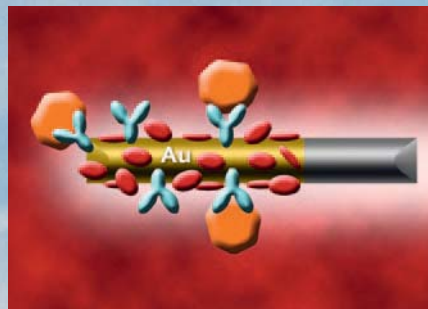
# Staying Healthy as We Age

**Babies born in Austria today have a life expectancy of around 80 years.** And this number is continuing to rise. People are living longer than ever before, and not only in Western industrialized nations.

Even in China, the life expectancy has increased over the last fifty years, from just over 40 to over 71. According to United Nations estimates, in 2050 there will be more people in the world over age 60 than under 14 for the first time. There are already around 50,000 people over the age of 100 in the United States. The hope of living to be 80, 90 or even older is good news for individuals. Yet politicians fear in particular that **healthcare costs** will explode due to the changes in demographics, therefore healthcare is considered a major challenge for future decades. But the trend doesn't have to continue. We can also stay healthy and fit into our later years, all while staying in the same living environment. Modern

medical technology and intelligent homes are helping to make this possible.

Of course a healthy lifestyle that includes a lot of activity and the right eating habits is the most important factor. But even those who do not lead such strict and sensible lifestyles will have a far better chance of staying healthy as they age. A brand new medical approach is making this possible: **molecular medicine** will be able to detect and cure illnesses at the cellular level. One example: scientists are working on finding individual cancer cells and their genetic characteristics at an early age and using tailored and targeted methods to fight them. These technologies will help keep patients healthy with minimal interven-




**DISEASES** can be detected at the cellular level and treated very early on.

tion and thus at a far lower cost than previous methods. An aging population doesn't have to be nearly as expensive for the healthcare system as one would have you believe.

Healthcare policies should place a greater focus on prevention to be able to take advantage of the full extent of all new opportunities. Screening is already used successfully in many countries and in the future will return accurate results even faster, easier and more reliably thanks to new combinations and laboratory and imaging diagnostics. Detailed images from modern equipment will keep patients from having to undergo most biopsies, which have until now been necessary for diagnosis.

The following treatments are increasingly becoming possible with minimal intervention. Doctors can use catheters to navigate through the vascular system and remove blockages in blood vessels for example. Certain tumors can also be removed using this method. Alzheimer's and degenerative musculoskeletal diseases will be able to be treated better in the future thanks to early detection.

And research with the new 7 Tesla magnetic resonance imaging scanner,



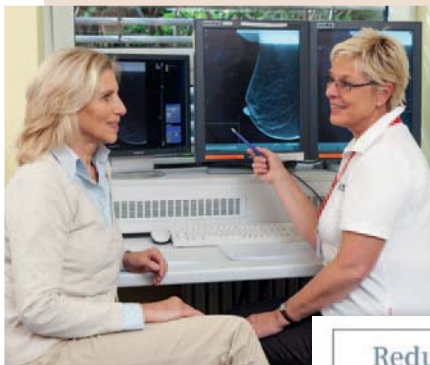
We can stay healthy and fit into our later years, all while staying in the same living environment. Modern medical technology and intelligent homes are helping make this possible.



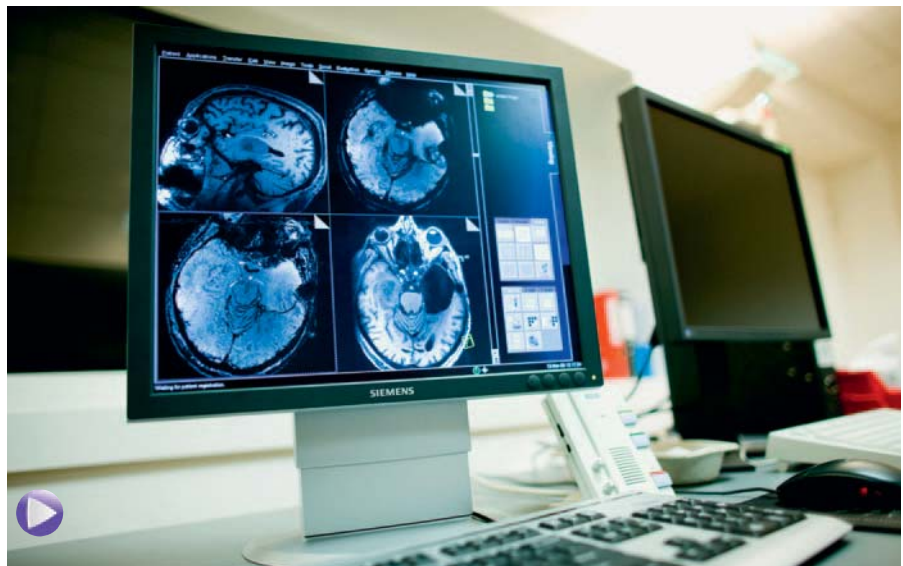
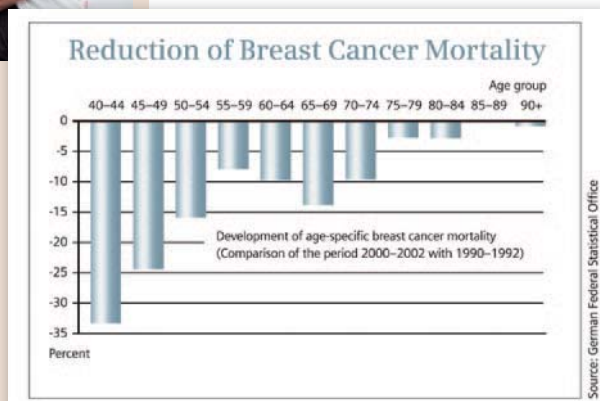
## Early detection success

**Breast cancer screening** has proven to be especially effective. Global mortality due to breast cancer in women between 50 and 69 has dropped by 15 to 25 percent. The combination of different imaging procedures like ultrasound, mammography and magnetic resonance imaging could further improve the trend. In addition to traditional mammography, 3D breast tomosynthesis was recently introduced, which can show even tumors that may otherwise be hidden by overlapping tissue. Combining it with 3D ultrasound generates even more precise images. When doctors search for metastasized malignant tumors, procedures that show not only cross-sections of organs but also biochemical processes that visualize tumors are also valuable.

■ [siemens.com/healthcare](http://siemens.com/healthcare)



Combining different imaging procedures like ultrasound, mammography and magnetic resonance whose results can be viewed on one screen improve early detection.



**A PRECISE LOOK AT THE BRAIN.** The 7-Tesla MR at the Medical University of Vienna can detect changes in the brain at a very early stage. Scientists are currently studying whether this can be used to improve the prognosis of Alzheimer's or Parkinson's.

which was installed at the **Hochfeld MR Center at the Medical University of Vienna** at Vienna General Hospital in cooperation with Siemens, is playing a role. It can detect vessels with a 0.2 millimeter diameter and visualize metabolic processes. According to Siegfried Trattnig, professor of radiology, "The scanner will be used to detect microhemorrhages, abnormal iron deposits or morphological changes in the brain at a very early stage to determine whether Alzheimer's and Parkinson's can be treated successfully." The scanner also detects osteoarthritis, one of the most common musculoskeletal diseases, at a very early stage when the process can still be reversed.

At the same time, advances in laboratory diagnostics are also being made. Lab diagnostics look for **biomarkers**, which patrol the vessels like the cells of the immune system. One example is troponin, a protein that occurs only in the

heart and can enter the bloodstream only when heart muscle cells die off. Concentration of the biomarker troponin 1 ultra in the blood is a sure sign that the heart muscle has been damaged, for example by a heart attack. Another parameter in cardiology is the hormone BNP, which forms when heart output is weak. A BNP test during preventive exams can help determine the cause of unclear symptoms. Advances are also being made in the search for a reliable indicator for prostate cancer. A variant of the traditional PSA protein test, which has proven error-prone, is being tested. Special MR procedures could be used in addition to the test.

Modern laboratory diagnostics has only one disadvantage: evaluations currently require complex procedures and equipment. "To determine whether a patient may have experienced a heart attack, we need fast and inexpensive tests that can provide the treating doctor on site reliable information," explains Walter Gumbrecht, Siemens. He was involved in developing an electrochemical camera, which, when used with a reagent-soaked paper strip, can return extensive information from any liquid it is programmed to analyze. According to Gumbrecht, "This procedure lets stroke or heart attack tests be performed directly in a doctor's office or emergency room."

Diagnosis systems that fit on the surface of a catheter are also being developed. The idea behind the systems is the

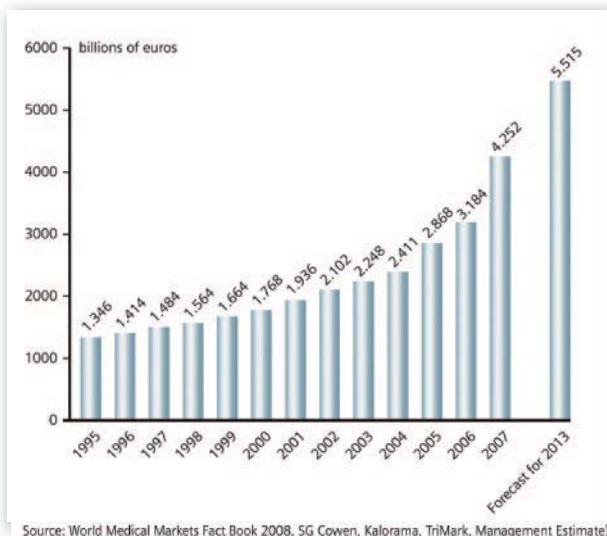
fluid biopsy, which Siemens is currently developing. The aim is to trap and identify circulating tumor cells. This would be an early warning system for millions of people who are already being treated for cancer and for whom there is a risk of metastasis.

**Diabetes** is also one of the chronic diseases that is on the rise. The new procedure could be used to develop a rapid test for diabetes, helping eliminate millions of expensive check-ups. Tests for a gene fragment that controls the body's insulin production, have also been developed. This would establish a basis for new treatment methods.

All of these new developments are representative of the main trends in new medicine toward more precise, faster, gentler, more economical and customized care. We're looking forward to a new, healthy age – but we should be able to afford it. ■

### More information

- [siemens.com/healthcare](http://siemens.com/healthcare)
- [siemens.com/pof](http://siemens.com/pof)



**EXPENSIVE HEALTHCARE.** Global healthcare expenditures will rise to over 5 trillion euros by 2013. But this trend doesn't have to continue. New diagnosis and treatment methods are less invasive and cut costs, making staying healthy affordable.

## What can nanotechnology accomplish?

**Dr. Mukesh G. Harisinghani**, Director of the Clinical Discovery Program at the Center for Molecular Imaging Research, Massachusetts General Hospital, is working on treating diseases at the cellular level.

### What opportunities are made possible in medicine through the use of nanoparticles?

In the lab we can already identify individual cells using magneto-optic sensors, magnetic nanoparticles combined with fluorescent molecules. Optical imaging will enable highly precise surgical interventions. Pathologies can be visualized and localized and then removed surgically using optical fluorescence



procedures. In many cases, surgical interventions can even be avoided altogether. If, following a medical treatment, the light of a fluorescent indicator that triggers only cancer cells is no longer visible, this objectively proves that the cancer cells have successfully been eliminated.

**Are these treatment possibilities available for other diseases?**

With a few modifications, this scenario can be applied to many other diseases and in most parts of the body. Nanoparticles can be combined with substances that trigger only certain objects. For example, you could use compounds that attach only to cancerous or infected tissue, for example due to arteriosclerosis. At the MGH, we are currently working on a sort of library of these compounds. We are creating an ever expanding compendium for early detection and treatment of diseases.

- [siemens.com/pof](http://siemens.com/pof)



**INTELLIGENT LIVING.** Lights, blinds and heating can be pre-programmed or controlled from any location in the home.

control the heartbeat of the foetus in cases of pregnancies with high risks. “A very sophisticated algorithm is used for this,” says Notbauer.

The austrian chip developers are in their element when it comes to ensuring the chip responsible for all these processes uses as little energy as possible. The project is being funded by the Federal Ministry for Transport, Innovation and Technology as part of the FIT-IT Initiatives and **ENIAC Joint Undertaking**. Partners are the University of Graz, the Vienna University of Technology and Infineon.

The next step could be to enable a car to communicate with its driver’s heart monitor to relieve older people’s fear of driving. “The small devices can also be used as a fall monitor,” says Notbauer. Falls are a serious problem, especially among older people. The risk can be greatly reduced by motion detectors connected to light sources. This can eliminate the need to search for the light switch when standing up. Pull switches in critical locations such as showers and toilets provide more safety. They can be combined with an alarm module that forwards the emergency call to multiple mobile telephones.

In general, all important functions in a home such as switching lights on and off and dimming them, opening and closing blinds and controlling the heating can be done using a hand-held remote from a table or bed. Programming these steps with Siemens **Synco Living** is even more convenient – combined with controlling blinds according to the sun or the heating based on the outdoor temperature. This system also saves energy and improves safety since it can simulate the presence of residents.

All home automation functions can also be operated and monitored online or by telephone. The system can switch on the heating or check windows and

# Intelligent Helpers

**We are growing older and of course we want to be able to enjoy our longer lives – even if we have to accept certain restrictions in our vision and mobility or if we suffer from**

chronic illnesses. Most senior citizens want to continue to live in their familiar environment as long as possible. And it is becoming increasingly easier for them to do so. In the future, modern sensor, control and communication technology will reduce the number of consultations and make homes safe and comfortable for older people. As part of **mobile ambient assisted living**, a mini-computer worn

on the body monitors the state of health. “Whether blood clotting, blood sugar or the heart are being monitored, the patient sees the results first before they are transmitted to the doctor who can then react accordingly,” says Johann Notbauer, Siemens CT in Austria, of the model.

The necessary ultra-compact mini-devices that record and transmit medical data and that are also tough, safe, convenient, inexpensive and even power themselves are still in development. The challenge is great, especially for devices equipped with microphones, which have to filter out details of the heartbeat. In addition, the mini-computer also needs a communication unit to transmit the collected data to a local display device and then to the hospital.

Actually the CT Team is working on a device for pregnant women, which will



blinds while residents are out.

Of course it would be nice to have people around to help keep the household in order and to serve you in old age. But not only is that expensive, given the rising life expectancy, it will be impossible to have sufficient care staff. Scientists are therefore working hard on robots to make our lives easier and even to show humanlike reactions since loneliness is the biggest problem for many senior citizens.

Last year a team of German sociologists at the **University of Duisburg-Essen** tested how well robots perform as caregivers. They studied the best-known examples, the Care-O-Bot developed by the German Fraunhofer Institute and the Casero from MLR System. “We discovered that robots can relieve some of the burden on caregivers in our aging society but cannot replace them,” says study coordinator Diego Compagna. The reason: they cannot encourage older people to do certain things, such as drinking more, and face acceptance problems.

Nevertheless, robots can handle important tasks without becoming tired. Asimo from Honda carries objects and can also help people who have fallen and trigger an alarm in the event of imminent danger. Thanks to cameras, sensors and laser scanners, the **Care-O-Bot**, a 1.50 meter tall service robot, can discover unfamiliar environments independently to learn new tasks and perform them on its own. It can even serve trays with meals, and plans call for it to be able to play board games with patients. But this robot in particular is not very well liked. Its competitor, Casero, fares better when it comes to acceptance. The small L-shaped cart transports laundry, meals and mail. “Residents, employees and visitors are not bothered due to its simple navigation and understated design,” reports Karen Shire, project supervisor.

Residents of nursing homes do not



**CARE-O-BOT** can serve meals and in the future may even be able to play board games with senior citizens – but it is not yet very well liked.

have any emotional problems with the animal robot **Paro**. With his big black eyes, soft fur and cute snub nose, the baby white seal has taken senior citizens in Japan by storm. Paro improves the well-being of nursing home residents and is said to help slow diseases like dementia and Alzheimer’s. He relieves staff and is a source of fun and conversation for senior citizens. ■

### More information

- [siemens.com/buildings](https://www.siemens.com/buildings)
- [siemens.com/syncoliving](https://www.siemens.com/syncoliving)
- [siemens.com/innovation](https://www.siemens.com/innovation)

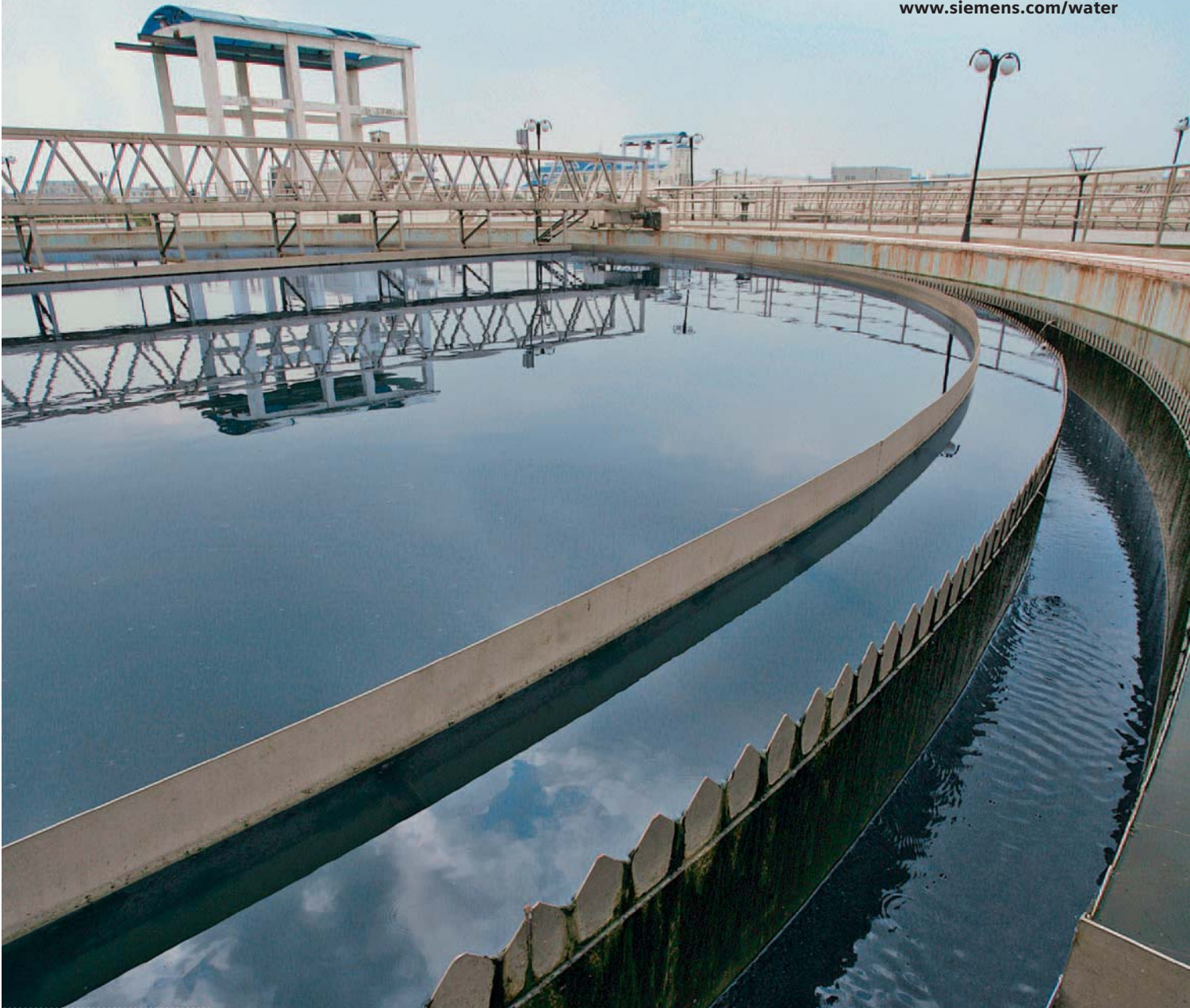


**PARO, A ROBOT SEAL**, improves the well-being of Japanese nursing home residents. It is also said to help slow the progression of Alzheimer’s and dementia.

## WATER IS BECOMING SCARCE

Global water consumption is set to increase 40 percent by 2025 and the quality of raw water continues to decline. Siemens is developing full process solutions for the water cycle, from treatment plants and systems for transporting water to energy management concepts. These solutions will enable environmentally friendly and efficient water use.

[www.siemens.com/water](http://www.siemens.com/water)



### News-Snack

#### REDUCING LOSS:



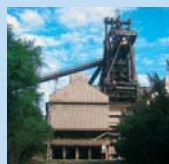
Siemens is researching new diode material that hopefully will cut energy loss in frequency

inverters for large electric motors and for large machines by around 15 percent. The semiconductor silicon carbide is used instead of pure silicon.

[www.automation.siemens.com](http://www.automation.siemens.com)

#### EFFICIENT OLDIE

The world's oldest blast furnace has been producing pig iron since 1984. The veteran will be now dismantled, upgraded and rebuilt by Siemens in just 80 days. In the process, 17,000 tons of material will be moved.



[www.siemens.com/innovation](http://www.siemens.com/innovation)

#### RELIABLE TECHNOLOGY

Siemens' building solutions at the China Pavilion at Expo 2010 were praised. "Energy savings went into every part of the design of the pavilion. There have been no electrical outages to date thanks to the reliable maintenance from Siemens," reports Yao Jianping, General Manager of Expo Construction Management.

[en.expo2010.cn](http://en.expo2010.cn)

#### WIRELESS

Siemens recently presented the first WirelessHART products for wireless communication in the process industry. The advantages include lower installation costs, faster startup, more effective maintenance, and greater flexibility and mobility.

[www.siemens.com/wirelesshart](http://www.siemens.com/wirelesshart)





**COAL'S VALUE** can be measured using infrared spectroscopy. The results help to precisely control coal power plants.

## Inner Values

**Not all coal is the same. Some kinds are better than others, have a higher or lower heat of combustion, and have different moisture and sulfur content. These different qualities influence the capacity of a power plant. Ideally, if the capacity of a coal-fired power plant is to be optimized without losing efficiency, the amount of coal in the combustion chamber should always be adjusted based on its qualities. This is an important task for process control, particularly when it comes to fossil fuels.**

The problem is that differences in the quality of coal deliveries are not so easy to detect. Coal's inner values can be visualized using infrared light. And that's precisely what Siemens researchers are working on: detecting the composition of coal using **infrared spectroscopy**.

Working with infrared light in the medium wavelength range (MIR with 2.5 to 50 micrometers) returns results that are relatively clear and easy to interpret. But **MIR spectrometers** are expensive.

Spectrometers for near infrared light (NIR) with a wavelength of 0.7 to 2.5 micrometers are much less expensive and thus ideal for use in industrial processes. However, they return less precise results about the molecular structure, which have to be processed further and made more precisely.

Siemens experts have managed to detect different types of coal using NIR. The researchers are now working on determining the different qualities of the coal more precisely. The first pilot plant is expected to go into operation as soon as 2011.

Once the equipment is less expensive, smaller spectrometers also could be used in other ways. They could monitor food in refrigerators for spoilage or ones in the oven could ensure that roasts develop a perfect crust. And washing machines could analyze their loads and sound an alarm if someone accidentally tries to wash a silk tie on the cotton setting.

"In medicine, we could examine suspicious spots on the skin using IR spectroscopy," says Fleischer. "Cancer cells contain different proteins than healthy cells, which would make it possible to identify melanoma from the spectrum." ■

### New infrared-sensors



**BLACK FIRE BEETLES** can detect infrared radiation from 80 km away.

The black fire beetle can do what humans can't: see or sense infrared light. The beetles can detect forest fires up to eighty kilometers away. Zoologists think that they have pressure-sensitive receptors in cavities filled with water, which are especially good at detecting infrared radiation and then pass it on to the receptor. A brand new type of infrared sensor has been developed based on these findings.

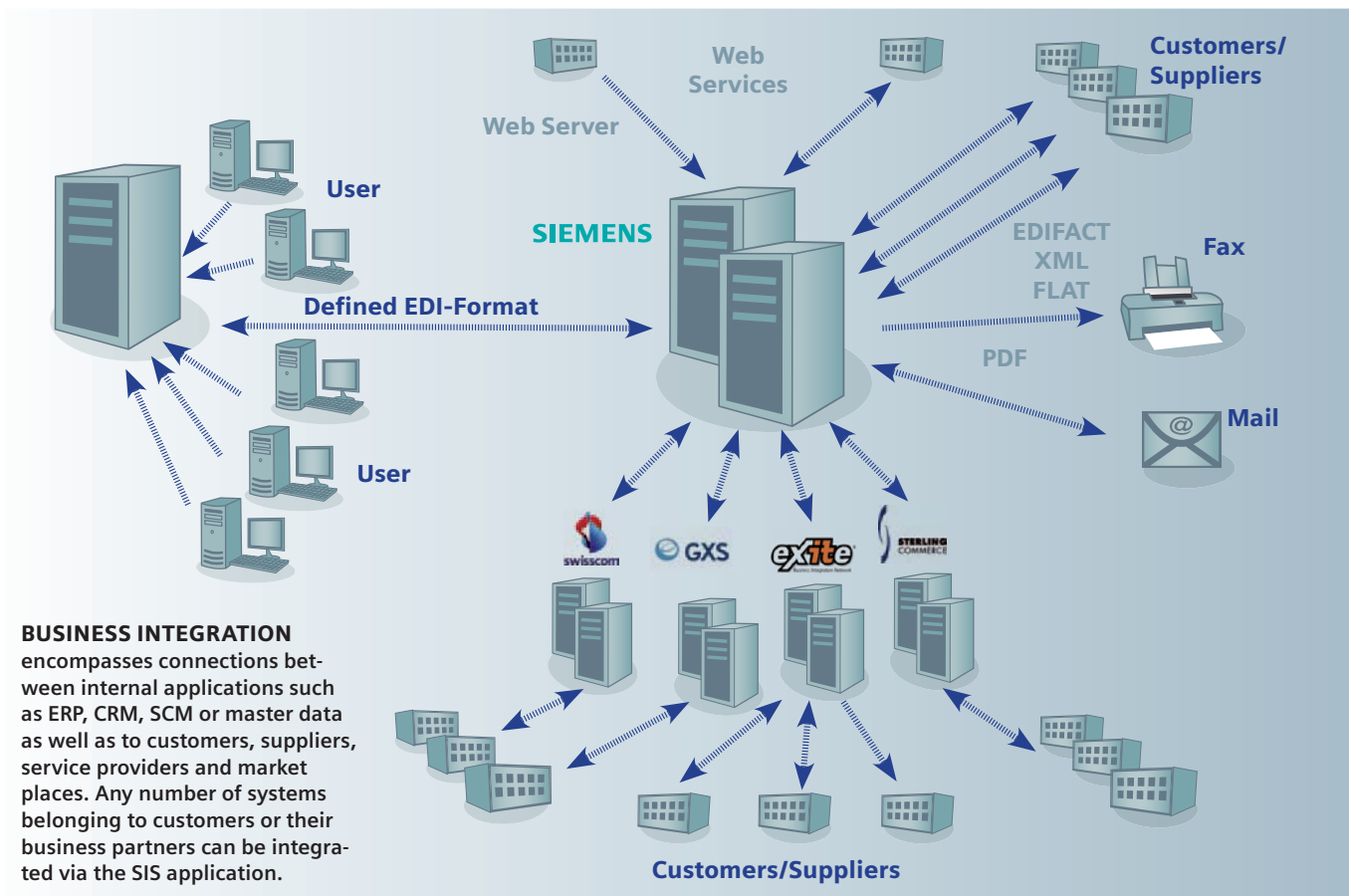
■ [www.caesar.de](http://www.caesar.de)

■ [www.cfn.uni-karlsruhe.de](http://www.cfn.uni-karlsruhe.de)

### More information

■ [siemens.com/innovation](http://siemens.com/innovation)

■ [siemens.com/pof](http://siemens.com/pof)



# Good Connections

**Integration of all business processes, paperless data exchange with customers, suppliers, forwarders and banks. The business world could be this simple! The reality is**

quite different, of course. Large companies often use different data formats and communication methods, many suppliers only send invoices on paper and web stores are not connected to the business accounting system etc. The evolved and familiar business processes with media gaps, point-to-point interfaces between applications and various integration islands cost unnecessary time and money.

“One solution offers flexible business integration that is individually adapted to the needs of the partner,” reveals Dieter Holmann, Siemens IT Solutions and

Services (SIS). “It encompasses connections between internal applications such as ERP, CRM, SCM or master data as well as to customers, suppliers, service providers and market places. The customer only needs one interface per system to our application.” However, an optimal integration of several sub-areas is often sufficient to significantly increase the efficiency of the business processes. “Electronic processing avoids double entries, shortens the throughput and processing times and optimizes the processes even beyond the borders of the company,” explains Holmann. “This drastically reduces the costs per document.”

Processes can be automated with high availability and security – 24 hours per day, 365 days per year. Henkel is one of the SIS customers using this service for the CEE portion of its business – with a high transaction volume: 200 international

business partners are integrated. In total, roughly 12 million interchanges are processed per year for the roughly 1,150 partners currently integrated.



**Dieter Holmann:**  
“Less expensive thanks to synergies.”

SIS solutions are also interesting for small and medium-sized enterprises since they can utilize the existing infrastructure and partner connections without having to carry the costs for the high availability. “We connect companies via various providers much less expensively and more conveniently than it is

possible for small individual customers,” explains Holmann, stating the advantages of using a service provider. The billing models are based on the needs of the customer. Hardware and licenses are unnecessary in all cases since SIS offers a service. The costs depend on the scope of services and the volume of data. ■

■ [BIS.at@siemens.com](mailto:BIS.at@siemens.com)

# Eco-Electricity from Waste

Depositing in a landfill or burning are not the only options for dealing with household waste. There is an alternative that makes optimal use of the recycling and energy potential of the waste: an additional separation process, combined with optimized burning. This new model is offered by KELAG Umwelttechnik and Siemens Industry Solutions. To ensure waste management that also conserves resources, materials that can be reused are first removed from the waste for the recycling industry. This is followed by simple process and handling steps that separate out hard particles such as stone and glass. Iron as well as other valuable metals and films are separated for the recycling industry and fuels with high calorific value are extracted for the cement industry. A portion of the waste heat from the subsequent incineration process is used to dry the organic waste obtained from the recycling process,



**NEW WASTE UTILIZATION.** Optimally using the recycling and energy potential of waste.

which improves its burning properties. What remains is a uniform fuel with a calorific value of 10 to 13 MJ/kg and largely constant burning properties that is well suited for producing eco-electricity in the reject power plants designed by Siemens.

The innovative spinning wheel process – a combination of fluidized bed and moving grate incineration – allows for even distribution of the fuel on the

grate and delivers optimal combustion results with minimal emissions. The heat obtained is used to produce steam, which can be used, for instance, to supply district heating networks or to generate electricity. Depending on the country where it is operated, it is also possible to utilize local incentives for the generation of eco-electricity and eco-energy. ■

■ [siemens.com/is](http://siemens.com/is)  
■ [www.kelag-ut.at](http://www.kelag-ut.at)



**LOW-ENERGY MOTOR.** Particularly effective in an optimized drive train.

## EU mandates energy conservation

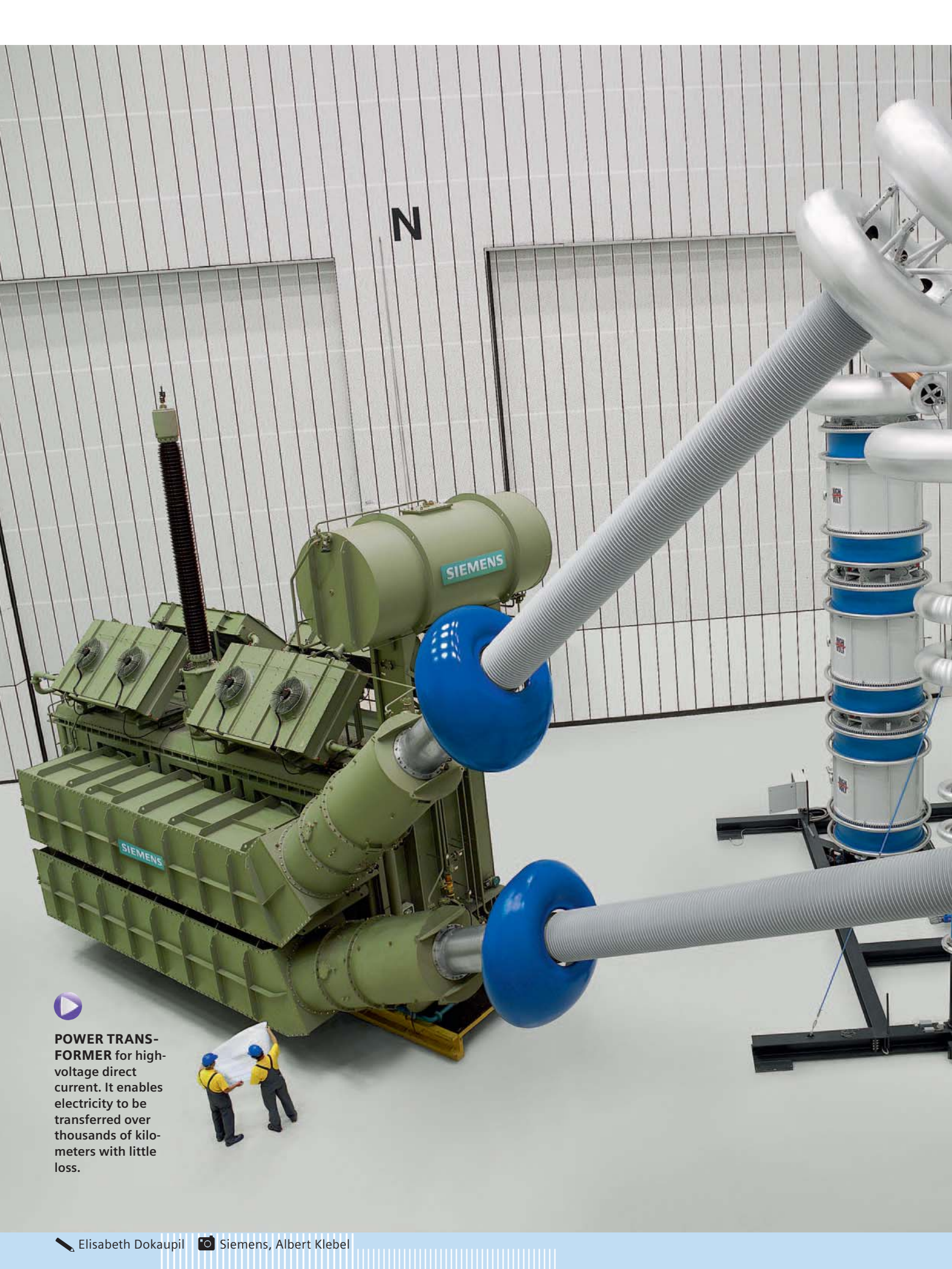
No later than 16 June 2011, manufacturers of electric motors will only be permitted to place standard electric motors with efficiency class IE2 or better – formerly EFF1 – on the EU market. This change applies to electric motors up to 1,000 V, 50/60 Hz, in the output range between 0.75 and 375 kW and covers all designs for continuous operation.

Worldwide, 20 million industrial motors consume 65 percent of all industrial electri-

city. Frequency inverters control the speeds as needed. In combination with low energy motors, this could reduce industrial electricity consumption by up to 70 percent. Thanks to these savings, an investment generally pays off in less than two years.

The Siemens Division Drive Technologies is the only provider on the market that can offer all technologies along the entire drive train.

■ [siemens.com/drives](http://siemens.com/drives)



**POWER TRANSFORMER** for high-voltage direct current. It enables electricity to be transferred over thousands of kilometers with little loss.



# Voltage is Key



Transformers, which are becoming increasingly quiet and environmentally friendly, ensure that the lights never go out even in giant power grids. An interview with **Jürgen Vinkenflügel**, CEO of the Transformers Business Unit at Siemens, and **Ernst Knoll**, head of the plant in Weiz, the largest in the Siemens Transformers Business Unit.



**What role do transformers play in the power grid?**

**Vinkenflügel:** Transformers are one of the key components for transferring and distributing power in power grids.

**Knoll:** Low voltage electricity comes from the power plants' generators. Transformers step up voltage to keep loss to a minimum during transmission. The voltage is then stepped down to the voltage used by our appliances as close to the consumer as possible. That's why there are thousands of transformers in the large power grids in Europe and the United States.

**What happens when a transformer is down?**

**Vinkenflügel:** This causes a critical situation, which can lead to an outage in larger parts of the power grid. Transformers absolutely must be reliable.

**Knoll:** And they are, since the theoretical meantime between failure of Siemens transformers is 650 years.

**That almost sounds like an eternity.**

**What does this mean for transformer production?**

**Knoll:** Longevity is the focus during the entire production process. It is taken into account as early as the design stage. We also make a point of using high-quality materials, which are purchased only from carefully selected subsuppliers. Following the production process, which is especially painstaking, transformers undergo extensive testing before delivery.

**Vinkenflügel:** Building transformers still involves a lot of work by hand. Specialists take many hours to manufacture the windings. That's why the employees' qualifications and dedication are extremely important. Customers are aware of this and often request transformers from a particular plant because they trust the employees there.

**In what condition are the grids where most transformers are used?**

**Vinkenflügel:** Almost all grids in devel-

## ELECTRICAL SUBSTATION.

In the power grid, transformers adjust the current for transmission and according to consumers' needs.



oped countries are forty to sixty years old. Given the ever growing demand for electricity, they are at their limit, but often no funding is available to upgrade them.

**Will these grids be able to handle the demands placed on them by the growing use of alternative energy?**

**Vinkenflügel:** Only if the grids use new, more intelligent technologies. The smart grids of the future will continuously collect information about the condition of the components in the grid and what they can handle. Transformers will also need to be able to communicate with other grid components and transmit information about how much load they can handle and how much longer they will be able to be used.

**Can traditional technologies bridge the great distances between power plants and consumers?**

**Vinkenflügel:** Due to transmission losses, traditional high-voltage lines are rapidly reaching their limits. Traditional lines cannot be used with offshore wind farms, which are located over fifty kilometers off the coast. Or for solar power generated in African deserts, which the Desertec project aims to deliver to Central Europe.

**Knoll:** High-voltage direct current (HVDC) offers one solution. It makes it possible to cover several thousand kil-

ometers. Giant power transformers handle converting the voltage. HVDC has another advantage in addition to reducing transmission loss: the line only needs to be half as wide as AC high-voltage lines.

**Large power grids, like those in Europe, include countries that can score points with large hydropower reserves for example, rather than with stability.**

**Vinkenflügel:** Converting to direct current can also act as a kind of firewall between grids with considerable voltage fluctuations and stable grids since fluctuations in the one grid are eliminated. The transformer would then act as a back-to-back station, enabling all types of grids to use the energy.

**Is there a disadvantage to using direct current in the grids?**

**Knoll:** Direct current can increase noise emissions from transformers. There have already been several attempts to reduce the noise level at the transformer plant in Linz. The first direct current compensation circuit was successfully installed early this year, which has a positive impact on these transformers and eliminates increases in noise due to direct current.



**ENVIRONMENTALLY FRIENDLY AND STYLISH.** Whisper transformers, which are as quiet as normal speech, and transformers with biodegradable ester-based insulation fluids can be housed in any type of building. This opens up many opportunities for interesting architectural design.







**PLANT IN WEIZ.** Specialists take many hours manufacturing the windings.

#### What is the normal noise level of transformers like? Is their humming tolerable?

**Knoll:** When transformers are used for power distribution in cities, they have to be as environmentally friendly as possible and of course quiet. Special “whisper transformers” were developed in Weiz whose noise level is the same as normal speech. Normally transformers can easily be as loud as street noise.

#### How do you get a transformer to whisper?

**Knoll:** Transformers essentially have three noise sources: the magnetic core, which oscillates, the forces that are generated in the windings and the fans that cool the transformer. Our principle is to reduce noise at the source whenever possible and keep additional necessary protective measures to a minimum. Low-frequency transformer noise is especially hard to absorb.

#### What specific measures are possible?

**Knoll:** The easiest would be to build bigger. This reduces the flux density in the core and the transformer runs quieter. But this solution is expensive.

**Vinkenflügel:** Another option is to use active noise control. Faster computers make it possible to measure noise at all times and essentially switch off the noise by generating an anti-noise.

#### How can transformers be designed to be more environmentally friendly?

**Knoll:** Transformers can be made environmentally friendly by reducing losses as much as possible and by using biodegradable insulating fluid. Research is being conducted on the use of ester-based fluids among other things.

#### Where in the transformer do losses occur?

**Vinkenflügel:** The numerous distribution transformers near consumers use electricity even when we don’t need any, for example at night. They have to remain live so we can use electricity at any time, for example to switch on a light. One way of reducing transformers’ lost power is to use amorphous, very brittle material in the core.

**Knoll:** Using amorphous transformer cores cuts loss by over half. Special production processes are required for making these types of cores since the material must be rolled, not cut and layered like in conventional transformers.

#### In terms of architecture, transformers aren’t exactly nice to look at. How can they be integrated into the cityscape?

**Vinkenflügel:** Whisper transformers with ecological insulation can be housed in any type of building. This opens up many opportunities for interesting architecture even if what’s behind it is still the traditional technology, which has been used successfully since 1881. ■

### More information

■ [www.siemens.com/energy](http://www.siemens.com/energy)



**HVDC TRANSFORMER** for connecting grids and transmitting electricity with little loss.

## What can HVDC do?

■ **The Nordsee Ost wind farm** is connected to the grid using high-voltage direct current. One of the key components of the grid connection is a transformer platform in the middle of the sea, which houses all the power converter equipment.

■ Xiangjiaba (XJB) between Fulong and Fenxian is currently the world’s **most powerful HVDC plant**, with a transmission capacity of 6,400 megawatts and a distance of 2,100 kilometers to cover.

The world’s first transformer that can generate 800 kilovolts (800,000 volts) of direct current has already proven itself. Ten of the new super transformers are used in the Yunnan-Guangdong HVDC plant, which transmits 5,000 megawatts of power over 1,400 kilometers between Yunnan province in the Southwest and Guangdong province in the South. It brings the environmentally friendly electricity from several hydropower plants to the rapidly developing industrial region of the Pearl River delta.

■ **Two HVDC back-to-back stations** connect the Georgian power grid with the Turkish grid. Electricity is transmitted from hydroplants in Georgia to Turkey via this back-to-back station.

# Feat of Engineering

On the construction site of the highest-output thermal power plant in Austria, components are handled with high-tech systems of gigantic scale. This true feat of engineering is taking place in Mellach in southern Styria on behalf of **Verbund**. Just the first of two gas turbines delivered during the summer is 13 meters long and weighs 300 tons. Nevertheless, this is not even the largest or heaviest component: the block transformer, which is coming from **Weiz**, weighs in at 350 tons even before being filled with oil.

When finished, the dimensions of the power plant are even more impressive: the two turbine sets – in other words gas turbine, generator and steam turbine – will each be 46 meters long, weigh 1150 tons and sit on foundations built from 3000 cubic meters of reinforced concrete and 500 tons of reinforcing steel. The **boilers** will each weigh 1800 tons and have 35,000 weld seams per boiler. The gas turbines will each draw in 2.2 million cubic meters of combustion air per hour, and the cooling water lines will transport seven cubic meters of water per second. “The masses and energy flows in play here are very impressive,” says Martin Hochfellner, overall project leader at Verbund.

However, it is another value that is truly key. The efficiency of the new power plant, which will be connected to the grid at the end of next year, lies at 58.8 percent – “Placing it at the peak of what is

possible in large thermal power plant engineering, even in an international comparison,” explains Hochfellner. If the district heating is also used, the efficiency is over eighty percent; a fuel can hardly be used any more efficiently. Specifically, this means: a gas and steam power plant such as in Mellach produces roughly 60 percent fewer CO<sub>2</sub> emissions than other coal power plants with the newest technology, which achieve at best 46 percent efficiency. This excellent performance is due in part to the use of gas as

two percent per year up to 2020 according to some forecasts).

When finished, the **Mellach power plant** will have an output of 832 megawatts and generate five billion kilowatt-hours of electricity per year. For comparison: in order to produce the same amount of energy, it would be necessary to put 1,200 windmills into operation. This will bring the installed output of thermal electricity generation by Verbund roughly back to the level of the year 2000. After the liberalization of the

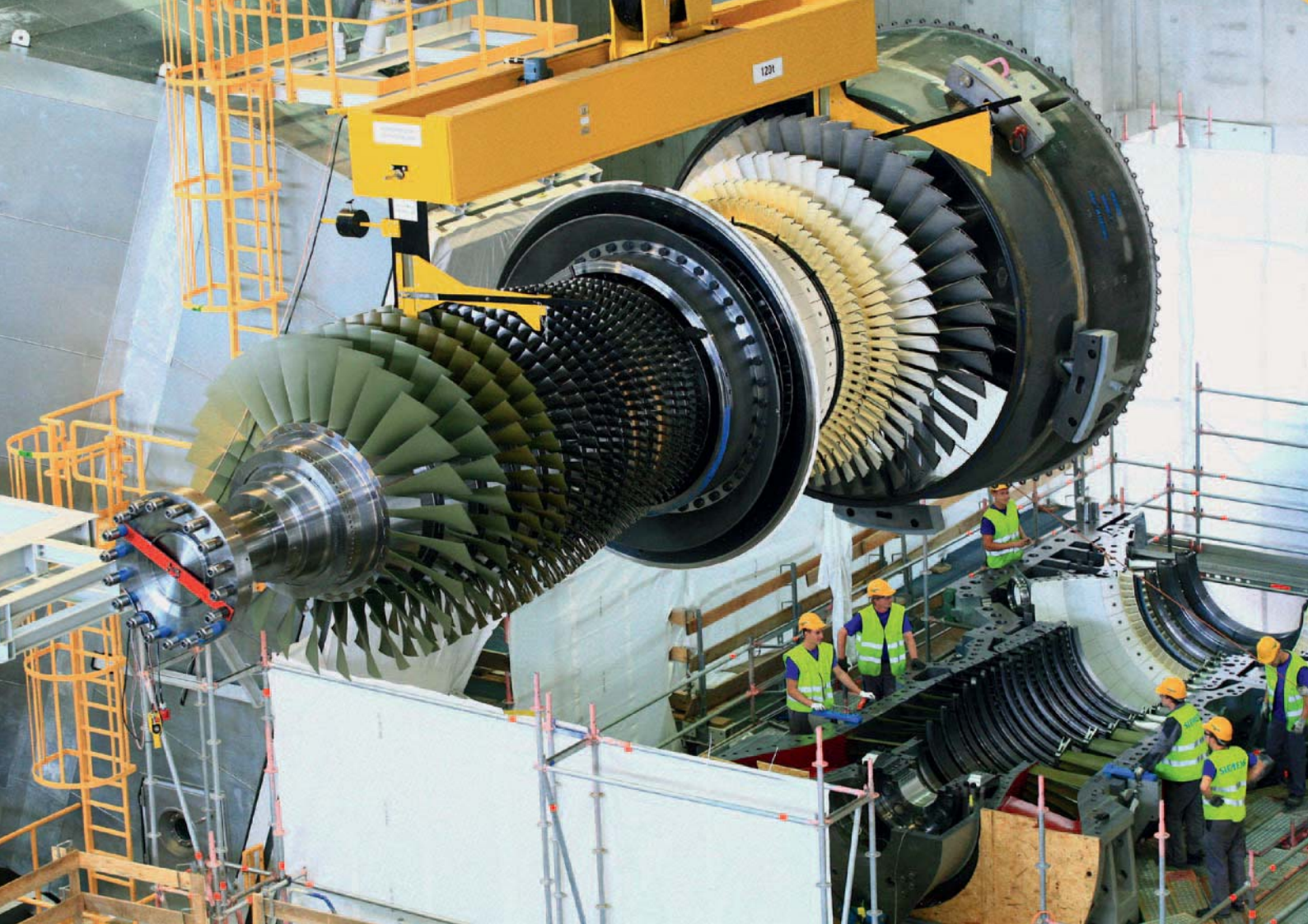


## Big job

- 550 million euros of investments by **Verbund**
- 260 million euros for Austrian partners
- Concrete and steel engineering: **Arge Porr / Strabag**
- Piping: **Arge Integral / Bohr und Rohr**
- Waste heat steam producer and de-NOx systems (flue gas denitrification): **Austrian Energy & Environment**
- Transport of the large components: **Felbermayr**

a fuel, which is the cleanest of all fossil energy carriers, and to the optimal utilization of the fuel by the second flow process in the steam turbines. Based on environmental considerations, this makes such a power plant the best alternative to using regenerative energy sources, which will not be sufficient in the near future to cover the constantly growing demand for electricity (around

electricity market, a number of thermal power plants had to be shut down in recent years because they were no longer competitive. For a number of reasons, Mellach was a good location for building a new power plant, according to Hochfellner: “The secured supply of natural gas as fuel, the connection to the 380 kV high voltage line, the availability of cooling water from the Mur, the potential for



**TURBINES FOR MELLACH.** The ceramic-coated turbine blades with integrated air cooling will withstand temperatures up to 1500 degrees.



integration with a district heating network and naturally the synergies with the power plants already located there.”

The gas and steam power plant is a type of double power plant since it consists of two lines that are fundamentally identical in technical design but differ in two ways. One line is cooled with fresh water from the Mur – which improves efficiency by one percentage point com-

pared with use of a cooling tower. For the second line, a cooling tower with eight cooling cells was built on the opposite bank of the Mur in order to avoid disrupting the temperature balance of the river. In addition, one power plant line will be connected to the 380 kV line for interregional electricity supply, while the second will be connected

to the local 110 kV line of the Steirische Netzgesellschaft SNG. The gas turbines of the gas and steam power plant in Mellach are being produced at Siemens in Berlin and are the heart of the new power plant. Building them requires heavy mechanical engineering that must be handled with the precision of a watchmaker. A total of 7000 parts, from many tons down to ext-

remely tiny, have to be assembled in order to complete an **SGT5-4000F**, which is the official type designation of the gas turbines. Among the most valuable components are the turbine blades, which are coated with ceramic and equipped with integrated air cooling in order to withstand the temperatures of up to 1500 degrees that can arise in the turbines. They each have the output of roughly ten sports cars of the type Porsche 911.

Siemens is handling the entire engineering as well as the complete project and construction management. “So far we have stayed very well on schedule,” confirms Hochfellner. “The main handoff dates for the end of October and end of December next year are still in effect.” ■

### More information

- [www.verbund.at](http://www.verbund.at)
- [siemens.com/energy](http://siemens.com/energy)



**PRODUCTION PLANNING IN THE VIRTUAL WORLD.** Simulating and improving processes before real manufacturing begins.

# Product Biographies Without Gaps

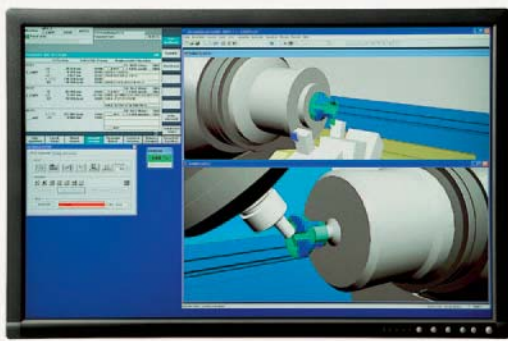
The gaps between the virtual world of planning and the world of real production are closing. Product data can be transferred seamlessly from the digital factory into actual production and the histories of products can be consistently supported by software tools. From the first idea to CAD design, production planning and manufacturing all the way to customer service and maintenance, **product lifecycle management** accompanies the product and ensures that the experience gained will flow into the following generation after the product is retired.

Globally operating companies of the automotive and electronics industries as well as mechanical engineering were the pioneers of PLM. Now the consumer goods as well as the food-stuff industries are starting to deal with the topic. The reason for this is the holistic approach, which opens up new potential thanks to synergies between business ERP software, Microsoft Office and PLM. This gives rise to accessible and homogenous structures across the entire company that lead to cost savings and significantly improved communication between all employees involved.

The technical foundation for the PLM concept is software that holds all information as a central data store and can



**VIRTUAL MACHINE.** Depicting machining processes on the PC with a one-to-one copy of the tool machine.



**A DIGITAL MIRROR IMAGE** of the real plant also allows planning of maintenance work.

work seamlessly with other programs. The most commonly used PLM system around the world is **Teamcenter** from Siemens.

PLM can optimize the production process considerably in a digital factory. In this virtual simulation of a real factory, the processes are simulated and improved long before real manufacturing begins. Using special software, production companies can simulate material flows and virtually test the commissioning process. Possible difficulties, such as collisions between production items and shelving during loading and unloading or plant areas that are not accessible to a robot arm, can be identified and corrected already during planning. "As in the CAD area, we wanted to be one hundred percent certain and error-free already in advance," emphasizes Rainer Aicher, group leader of mechanical design at the mechanical engineering company **Hermle-Leibinger Systemtechnik** in Tuttlingen, which uses Tecnomatix from Siemens for this purpose: "We accomplish that with this program."

After all the simulations, the step into reality requires that production systems to be supplied with PLC (programmable logic controller) programs for the processes at the factory. In addition, software is required to handle the **motion control** for the motors inside the machines. "The typical practice is for such programs to be carried into the factory by the engineers on a laptop, optimized there and manually loaded into the controls," reports Wolfgang Schlögl, Sie-



mens, but this process can result in errors with serious consequences. If data is not copied over cleanly or is copied to the wrong location, schedules and budgets run out of control. In addition, there can be serious consequences for product quality – all the way to expensive recalls that damage a company's reputation.

The current merging of automation technology and PLM avoids such problems. Software from Siemens connects the manufacturing planning directly to the production by combining the PLM software with the motion control. This increases the productivity of the entire plant since the producers also receive complete information about the availability and the location of specific tools.

Another step is connecting the digital factory with the specific automation solution. A majority of the software required for production is generated based on the specific layout of the manufacturing plant, a description of the components used there – such as robots and sensors – and the planned processes. Schlögl: "The **Simatic Automation Designer** generates 70 to 80 percent of the PLC software automatically." In addition, the program can also generate the entire circuit diagram for the future factory: from the switch cabinets to the machine cabling and fuses. "This eliminates up to 50 percent of the engineering work for the electrical systems and automation," estimates Schlögl.

The manufacturer can profit from the virtual representation even during production. He always has access to a digital mirror image of the real plant that can be used for planning maintenance work, simulating changes in production or carrying out optimization. The first user of the Simatic Automation Designer is Daimler AG. The new software tools ensure that product biographies will have no expensive gaps in the future. ■

## Driving fast

An innovative club from the US manufacturer Adams Golf participated in the tournament record of Rickie Fowler in Dublin, Ohio/USA. The aerodynamic properties of the **Speedline Fast 10 Driver** were first optimized with special CAD software following wind tunnel tests. One significant feature of the Speedline product line is the smaller club surface to reduce air resistance. For the current model, the club surface should be increased to increase impact efficiency while at the same time allowing higher speeds. The problem was solved with **NX Flow Software** from Siemens, and a significantly higher level of CAD productivity was achieved. Thanks to the reduction of the manufacturing lead times, testing times and costs, the time-to-market was cut by 50 percent.

■ [www.adamsgolf.com](http://www.adamsgolf.com)

**GOOD FOR RECORDS.** The new club from Adams Golf was optimized with CAD software after wind tunnel tests.



## More information

- [plm.automation.siemens.com](http://plm.automation.siemens.com)
- [automation.siemens.com](http://automation.siemens.com)
- [siemens.com/industryjournal](http://siemens.com/industryjournal)

# We Can Be Greener



**HIGH SPEED WITH VELARO.** Optimized aerodynamics and intelligent energy management ensure high efficiency.

People and goods are increasingly on the go. This will not change in the future, making it a challenge for transportation policy. In order to overcome the difficulties, it will be necessary for rail options – trains, subways and trams – to play a major role. This will require that public transportation providers succeed in at least partially becoming an intelligent, networked system in the sense of “complete mobility,” ensuring smooth transfers between different transportation types and saving

energy and resources for the rail vehicles themselves.

But how can consumption be noticeably lowered when rail vehicles are already very environmentally friendly and are driven by efficient electric motors? Designers are making trains more aerodynamic, developing low-energy, compact drive motors with high torque, intelligent drive systems and technologies for recovering braking energy.

The **Velaro** from Siemens is one example of what optimized aerodynamics can do. Paneling on roof-mounted devices, bogies and transitions, redesigned spoiler, nose and top as well as an elevated roof starting at the middle of the last car, which reduces resistance

and exterior noise when passing through tunnels, are among the most important aspects. An intelligent energy manager also ensures that the train systems operate at optimal efficiency.

On lighter traction units where space is limited, the focus lies on compact design and reduced weight – properties that Siemens achieved in the new Syntegra bogie through an innovative system design. Instead of transmitting the power of the drive motors to the axles via a transmission, a roller-shaped electric motor encloses the drive axes, driving it directly with no actual contact. This shortens the bogie by roughly one meter and makes it about two tons lighter, reducing energy consumption by about



**VECTRON LOCOMOTIVE.** Well equipped for the various requirements of rail transportation within Europe thanks to high flexibility.



**THE VIENNESE ULTRA-LOW-FLOOR TRAM** is being tested within the framework of the subsidized research project EcoTram for ways to reduce the energy demands of public transportation without decreasing comfort. Heating, ventilation and climate control are at the focus. This project won 2<sup>nd</sup> place in the VCÖ Mobility Award 2010. [www.vcoe.at](http://www.vcoe.at)



20 percent. In addition, the design is also less subject to wear.

Using the braking energy also contributes significantly to energy saving. When braking, the electric motors are simply switched to generator operation and convert the energy of motion back into electrical energy.

The ultra-low floor tram currently used in Vienna and Oradea, Romania, was a pioneer in the use of braking energy and also features an extremely low entrance height. The comfort and decreased time required for entering make this vehicle even more attractive.

Appropriate energy storage devices are required for recovering the braking energy. These are located along the rail

route and store the energy in double-layer capacitors of enormously high capacity that can take up and release massive quantities of energy within a few seconds. A new switching concept from Siemens also makes it possible to use such energy storage on the mobile vehicle. "Fast" double-layer capacitors are combined with nickel metal hydride traction batteries that release their energy over longer time periods.

Flexibility and the ability to retrofit and modify the trains are also key for speedy and efficient rail transportation. The Vectron locomotive is equipped for the varying requirements of transportation within Europe.

The environmental impact of rail vehicles should be minimized not only during operation but over their entire life cycles. This involves the following questions: How can steel be welded using the least possible energy while ensuring the same stability? Which parts can be recycled and which are better used for generating energy?

Pursuing these issues consistently

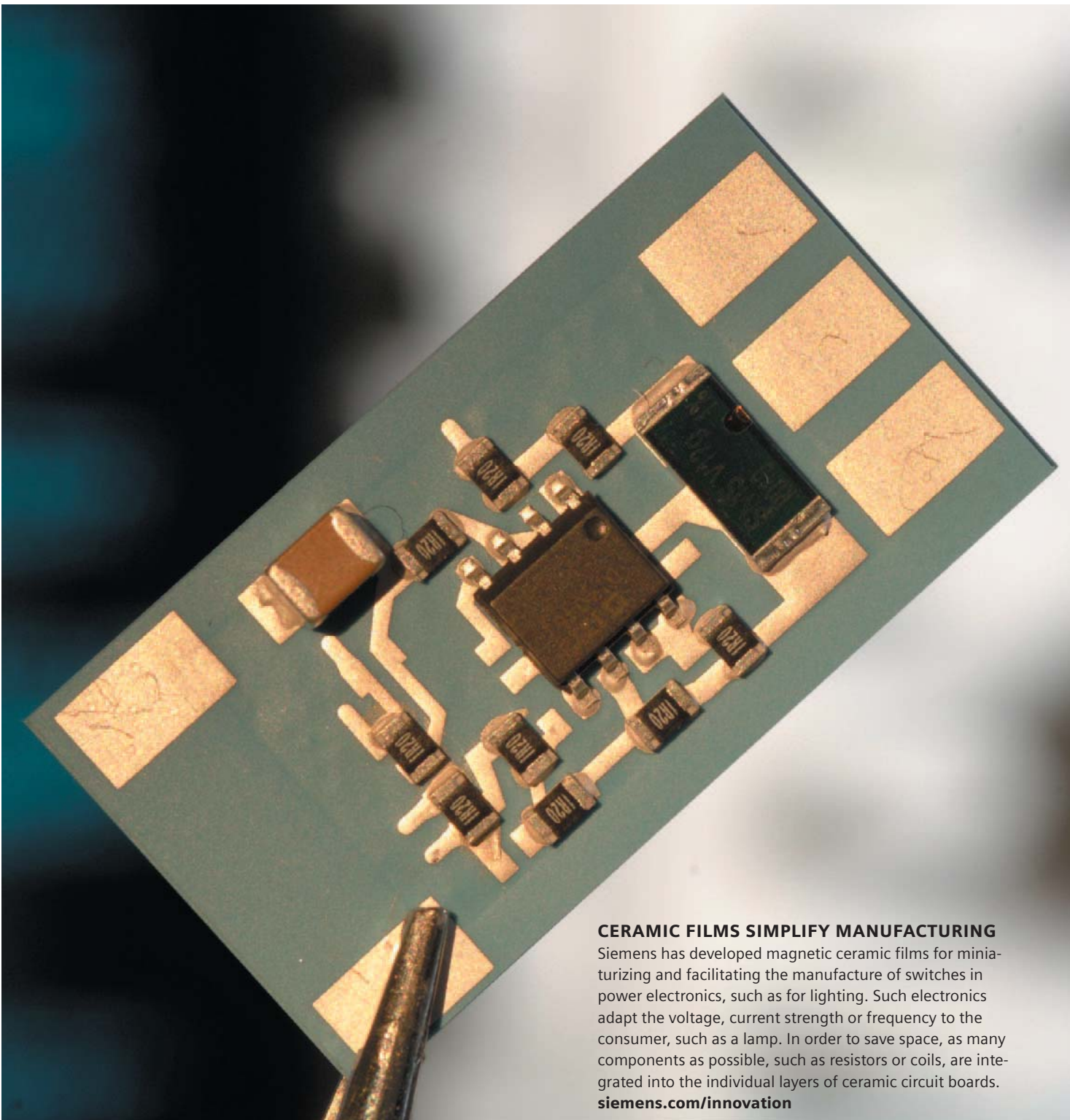


**SUBWAY TRAINS OSLO.** At the end of their lifespan, they will be 94 percent recyclable.

also brings advantages for the operators. For example, the 63 new subway trains developed and built by Siemens for the Norwegian capital of Oslo not only use one third less electricity than their predecessors, they are also free of harmful materials and will be over 94 percent recyclable 30 years from now when they have reached the end of their lifespan.

High availability also increases the environmental friendliness of railways by saving resources for both customers and operators. This requires competent and innovative service, starting with testing and commissioning, followed by preventive and corrective maintenance and supported by comprehensive spare parts management as well as repair and extension of the lifespan through refurbishment activities.

Securing the train and route also makes an important contribution to green mobility. It ensures safety and smooth operations – but that isn't all. Online algorithms in the vehicle computers decrease energy consumption by at least 25 percent while also reducing wear on the vehicle. At the same time, the line capacity – such as in subways – can be increased by up to 50 percent, and punctuality can be improved as well. This is done by calculating an optimal driving speed based on the current position and the schedule in order to avoid unnecessary accelerations. In other words, it can be employed in many areas to make rail vehicles more environmentally friendly. And developments still continue. ■



### CERAMIC FILMS SIMPLIFY MANUFACTURING

Siemens has developed magnetic ceramic films for miniaturizing and facilitating the manufacture of switches in power electronics, such as for lighting. Such electronics adapt the voltage, current strength or frequency to the consumer, such as a lamp. In order to save space, as many components as possible, such as resistors or coils, are integrated into the individual layers of ceramic circuit boards.

[siemens.com/innovation](http://www.siemens.com/innovation)

### News-Snack

#### OUTSTANDING IMAGES



The 3D imaging software Syngo Aortic ValveGuide was awarded the Techno-College Innovation Award.

This software allows doctors to orient themselves within the body of the patient in real-time during a heart operation.

[www.siemens.com/healthcare](http://www.siemens.com/healthcare)

#### FINDING LEAKS

The newly developed measurement instrument Sitrans FUT 1010 allows operators of oil and gas pipelines to continuously check their lines for leaks. It operates using ultrasound waves.



[siemens.com/innovation](http://www.siemens.com/innovation)

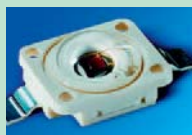
#### OFFLINE SIMULATION

Sittraffic Cosimo is the name of the new offline simulation tool for the autobahn control center Sittraffic Conduct+. It can be used to evaluate the effects of traffic control systems without the need to intervene in actual traffic. The system reacts just as precisely as in live operation.

[www.siemens.com/traffic](http://www.siemens.com/traffic)

#### LEDs ON RECORD-BREAKING COURSE

A performance gain of 30 percent makes the red LED from Osram the most efficient in its wavelength range. The chips used were optimized to allow the new light-emitting diodes to save space and energy.

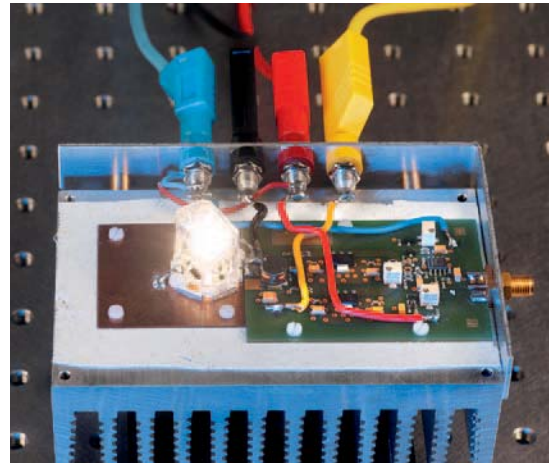


[www.osram.com](http://www.osram.com)





**FAST TRANSMISSION.** Siemens researchers have set a digital data transmission record with white LED light.



## A Digital World

The digitalization of all areas of private and professional life is continuing, particularly since the Internet offers many new applications, functions and services. Plus,

worldwide challenges such as climate change and demographic developments also stimulate innovations in the area of information and communication technology (ICT). These are the conclusions of the Delphi Study 2030, which surveyed roughly 550 ICT experts.

Everyday objects will be networked to create the **Internet of things** and independently exchange information. Embedded systems that can be used as networked processors in systems such as airplanes and machines can independently learn from and communicate with other intelligent systems.

There will also be an “Internet of ener-

gy” with many nodes to link participants in the energy system, such as households, industrial consumers, energy producers and energy storage facilities, electric cars and electronic market places. ICT and the energy system will be united in this system, and the energy will be able to flow in any direction. ICT will contribute to climate protection. In industries like transportation, telematics, energy and intelligent building technology, use of ICT will allow significant reductions in CO<sub>2</sub> emissions.

Particularly in the automotive, industry automation, mechanical engineering, energy and healthcare industries, the dynamic development of information and communication technologies will accelerate growth and drive innovation. A full two-thirds of the surveyed experts consider a growth in value creation of ITC in the car from the current 20 to 30 percent up to 50 percent by the year 2024. This includes, for instance, Internet in the vehicle and car-2-car networking for exchanging data between vehicles or with traffic management systems.

ICT also plays a key role in electromobility, such as for connections to the intelligent electricity distribution networks.

In the future, **cloud computing** will make it unnecessary for us to keep software and large storage and processing capacities on our own computers. Instead, powerful communication networks will be required for a permanent Internet connection in order to access the globally distributed resources of the various service providers. Roughly 70 percent of the surveyed experts expect that accessing the computing capacity of the cloud will be common practice by 2024.

Use of these new possibilities requires communication networks with high transmission capacities. Comprehensive stationary broadband with fiber-optic connections and transmission rates of 100 Mbit/s and faster will be the global standard. ■

### More information

- [muenchner-kreis.de](http://muenchner-kreis.de)
- [siemens.com/pof](http://siemens.com/pof)



**TESLA ROADSTER.** With a 292 kW electric motor that takes the car to 100 km/h in 4.2 seconds.



# Reinvention of the Auto

Everyone is talking about electric cars, but only a few are driving them because there are practically none available yet. But this will change in the coming years. All the

major manufacturers will be putting hybrid and pure electric models on the road. To date, however, the selection of

electric cars actually available for purchase is still small. There is the Californian **Tesla Roadster**, which has been produced in small series since 2008, a trendsetter with a 292 kW electric motor that accelerates the car to 100 km/h in 4.2 seconds, making it a cult car among American celebrities. The drive energy is supplied by over 6,800 typical small batteries, bundled into a powerful package. Toyota and Daimler both found this idea to their liking. Both automobile manufacturers have now purchased shares in Tesla and are buying batteries and con-

trol technology from the electric car pioneer although both are also engaged in their own battery development.

In addition to the electric sports car, there are also electric cars on the market like the **Think City**, which does bring electric mobility to consumers but also makes clear the fundamental challenge of all electric cars. They currently offer noticeably less comfort, space and performance than typical combustion engine vehicles despite considerably higher costs. The Think City takes to the road with 46 HP, a high speed of 100 km/h and



# mobile

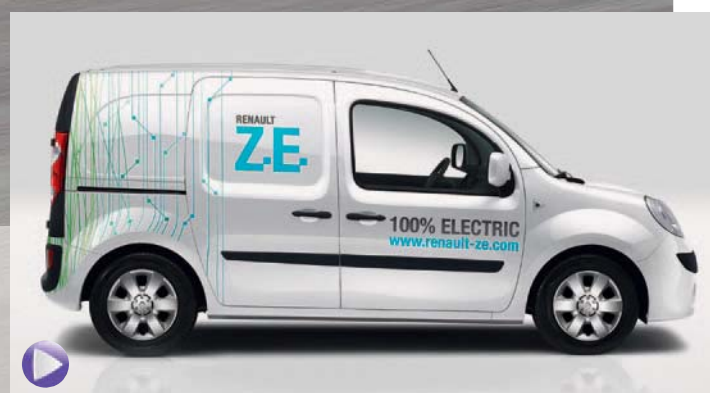
a range of 160 kilometers. It is a two-seater and costs around 40,000 euros. A car for dedicated environmentalists.

Starting in December, the first electric car from a large series manufacturer will also be available in Austria: the **Mitsubishi i-MiEV**. The 1100 kilogram car is about the size of a VW Polo, has a 49 kW electric motor and 16 kWh of lithium-ion batteries, which can be fully charged in seven hours connected to a typical 230 V outlet and should ensure a maximum range of 150 kilometers. But this car definitely doesn't come cheap, either. The

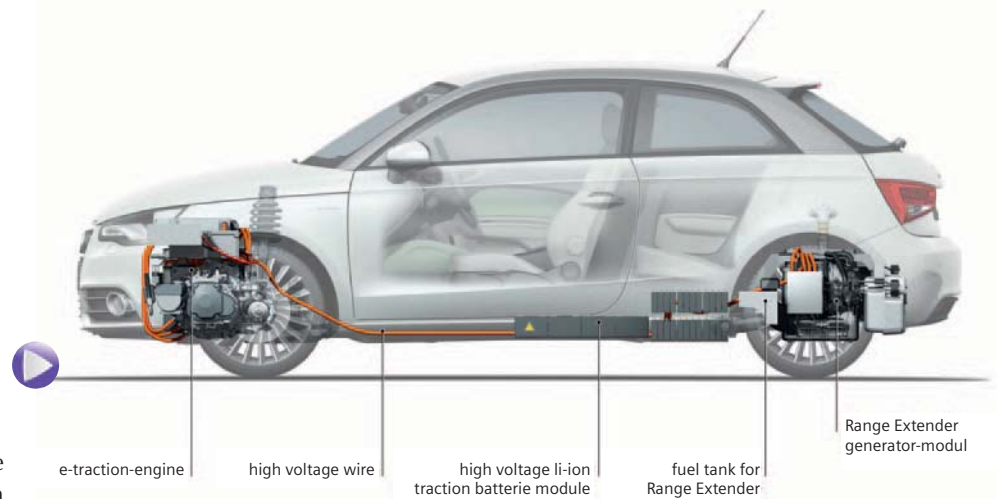
**BY 2020, RENAULT** wants ten percent of the cars sold to have electric drives; they will be available in Austria as of 2012.

i-MiEV will cost around 35,000 euros. The Peugeot iON and Citroën C-Zero will also appear on Austrian roads and share the same basic technology.

Other manufacturers are still holding back and testing the waters with large-scale production trials, BMW with the Mini, Mercedes with the Smart and Audi



with the newest A1. Nevertheless, the starting gun has been fired, and all roads lead to the electric car. **Renault**, for instance, is already positioning itself at the forefront. The French automaker wants electric cars to make up ten percent of its total sales by 2020. The first electric cars, all with the designation Z.E.



at the end of their names, should arrive on the market next year (and in Austria in 2012). The mini van Kangoo Rapid and the sedan Fluence have both been converted for electric drives. The first true electric cars from Renault, the two-seat urban electric model Twizy and the larger Zoe have been announced for 2013.

Renault has developed three different concepts for charging the lithium-ion batteries. Standard charging at a typical power outlet (four to eight hours), fast charging at a 400 Volt three-phase socket (thirty minutes) and a quick drop system that should allow a battery change within three minutes. The first charging stations will be built in Israel in cooperation with the company **Better Place**.

2013 will be the key year for which almost all major manufacturers will announce their first electric cars. Electric cars require new designs, new architectures, new materials and new concepts. The engine is significantly smaller and simpler, and no transmission is required at all. They must be light and have significantly more tailored usage profiles.

This summer, **BMW** demonstrated what an electric car redesigned from the ground up could look like with the Mega City Vehicle. It consists of two clearly separated, independent modules: the "drive module", which integrates the battery, drive, structural and crash functions in a compact chassis, and the "life module", a passenger cell made of carbon fiber. This simple, flexible design will produce a lasting change not only on cars but also on their production process. Both modules could be produced completely independently of each other and assembled quickly and easily practically anywhere in the world.

The competence in matters of carbon fiber was expanded already last autumn when BMW founded a joint venture tog-

**A1 E-TRON FROM AUDI.** Solving the range problem with a small combustion engine for charging the battery.

**MITSUBISHI I-MIEV.** First electric car in Austria from a large series manufacturer.



with the **SGL Group**, one of the world's leading manufacturers of carbon products. "The MCV will be the first large series vehicle with a passenger cell of carbon. In combination with our LifeDrive architecture, we are starting a new chapter in lightweight automobile construction since we are almost completely compensating for the increased weight of 250 to 350 kg typical of electric vehicles," emphasized Klaus Draeger, board member for development at BMW, at the first presentation of the MCV, which should be on the road in 2013.

Lithium-ion batteries have become the first choice for energy storage. Nevertheless, there is still a need for massive development since the batteries are still too heavy and too expensive. At a rough estimate, one should expect to pay about 800 euros per kilowatt-hour and one kilogram of additional load per kilometer of range – at least. In both cases, there should be plenty of potential to lower these figures.

One elegant option for solving the basic range problem of an electric car is the **Range Extender**, as Audi demonstrates in the A1 e-tron, a type of very mild hybrid that inverts the previous model. The A1 always drives on electricity; the

Range Extender, a small, constantly running combustion engine, serves only to recharge the battery via a generator, increasing the range to an additional 200 kilometers. One particularly charming aspect is that the 250 cubic centimeter engine is a Wankel engine, which can finally play to its strengths in this application with a compact size, low weight and silky smooth running.

Without a doubt, the automobile industry is standing at the threshold of one of the greatest transitions in its history with the introduction of the electric car. And this transition will also bring new players onto the market. Once the use of electric motors has taken some of the highly complex mechanical engineering out of automobile manufacturing and new materials have replaced some of the difficult steel engineering, new prospects will open up for small, flexible manufacturers. They can bring new ideas into the traditional automobile market with cars like the Mia, originally a French development that has now been taken over by the German energy company **Conenergy** and the pharmaceuticals entrepreneur Kohl.

The **Mia** is very light, thanks to a bolted plastic body and a simple, streamlin-

ned design, and was designed by one of the stars of the scene, the former lead designer for Peugeot and Volkswagen, Murat Günak, who now wants to realize his vision of the car of the future away from the big name manufacturers. The car weighs just 570 kilograms, and the lightest possible battery pack, which should suffice for a range of 100 kilometers, brings it up to 650 kilograms. What differentiates the design of an electric car from a typical one: “The technology takes up significantly less space: a small electric motor, a converter, the battery; no more than that,” explains Günak. “All of this can be easily housed in the vehicle



Murat Günak offers a large interior with the Mia.

base. This makes it possible for the first time to fully utilize a mono-volume design such as the Mia, a bus shape that requires little area but offers a large amount of space.” Production should begin in the second quarter of 2011. “It is an entirely different kind of production: clean, quiet, simple, with relatively

few components, without a paint shop, no welding, but a clearly defined path.” Also interesting is the price, which should be below 20,000 euros.

In the end, it is more about the reinvention of the car. The electric car can be the catalyst for a reconfiguration of individual mobility, which will be more heavily characterized by seamless networking and use of different modes of transport. ■

## More information

- [www.teslamotors.com](http://www.teslamotors.com)
- [www.thinkev.com](http://www.thinkev.com)
- [www.mitsubishi-motors.com](http://www.mitsubishi-motors.com)
- [www.renault.com](http://www.renault.com)
- [siemens.com/mobility](http://siemens.com/mobility)



**MERCEDES SMART.** Initially, outlets in the garage at home, in parking garages or at supermarkets and company lots will be sufficient.

## Are you charging yet?

Even if the selection is currently very small, a recent study produced by the Federal Environmental Agency for Verbund predicts that 200,000 electric cars will be driving on the roads of Austria by the year 2020. This is twice as many as the goal originally set by the platform Austrian Mobile Power. “It is definitely a realistic scenario,” believes Roman Bartha, head of the electromobility department at Siemens Austria and one of the two general managers of Austrian Mobile Power.

The question is: Where and how will the vehicles be able to charge with electricity? For the first wave of electric cars on the street, however, Bartha sees no problem in supplying them with sufficient electricity. This could take place at company parking lots, in parking garages, in the lots of shopping centers, just to name a few possible docking station locations in addition to the outlet in the garage at home. Public connections on the street will hardly be needed in the initial years. In principle, one should expect two to two-and-a-half outlets per car, believes Bartha: “One at home, one at work and the rest in the public area.” And since these will in many cases be typical 220 V outlets, the costs will be manageable – although this will change over the long term. **Intelligent charging columns** that deliver not only electricity but also information for establishing communication between the car and the grid (buzzwords: smart grid and vehicle to grid) will cost somewhat more, from 2000 euros on up. “Infrastructure always costs money,” confirms Bartha.

A number of questions still have to be



answered in order for this infrastructure to be built. What could an identification process look like that is secure and transparent? How will billing take place? Where is the meter, where is the intelligence housed? In the car? In the charging column? How could useful reservation systems function? What sort of roaming solutions will exist to allow me to purchase electricity from various electricity providers via charging columns of different operators? Final answers to these questions have not yet been found, especially within a larger European context. Only one thing is certain: electromobility will bring together new players with high communication needs and there will be a great need for standardization at the interfaces.

Austrian Mobile Power is working with a **charge everywhere concept** with a uniform access procedure and a simple identification process that identifies every vehicle as a separate consumer. Electricity stations in the classic gas station model will not exist. Instead, there will be high power outlets that have an additional communication component. In addition, Bartha is also convinced that the infrastructure will be developed further and adapted to the wishes of the users.

- [www.austrian-mobile-power.at](http://www.austrian-mobile-power.at)
- [siemens.com/energy](http://siemens.com/energy)



# Water Under Control

Our drinking water is subject to strict testing for contamination. We can drink a glass of water whenever we want without worry. There is only one nightmare for water specialists – a terrorist poison attack or illegal waste dumping in areas from which water is obtained. In 2005, for example, an unknown person sank three canisters of weed killer near the drinking water tapping point in Lake Constance, Germany. It was possible to prevent the citizens from a catastrophe. But that isn't easy. The problem: we only find substances that we are directly looking for. In order to keep the risk as small as possible, fish or water fleas are used as warning systems, but their reactions are not always easy to interpret. In addition, the drinking water is inspected at larger intervals with extensive laboratory testing. It

## Different Limits for Pollutants

Chemical parameters	WHO Guidelines for drinking water quality 2006 [mg/l]	EU Drinking water directive 98/83/EC 1998 [mg/l]	Germany Drinking water ordinance 2001 [mg/l]
Benzene	0.01	0.001	0.0001
Nitrate	50	50	50
Mercury	0.006	0.001	0.001
Arsenic	0.01	0.01	0.01
Lead	0.01	0.01 (prov. value until 12/25/2013: 0.025)	0.01 (prov. value until 11/30/2013: 0.025)
Cadmium	0.003	0.005	0.005
Nickel	0.07	0.02	0.02
Nitrite	0.2	0.5	0.5
Aluminum	0.2 resp. 0.1	0.2	0.2
Iron		0.2	0.2
Tritium		100 Bq/l (radioactive)	100 Bq/l

## Increasing Water Quality

The development of drinking water treatment is pushed above all by Germany, Austria and the USA, all countries with strict regulations that are frequently copied by other European countries. For example, the European limit for nitrate is 50 mg/l, while in the USA it is just 10 mg/l. In many cases, experts cannot agree on permissible concentrations. One controversial topic is lead exposure resulting from old pipes that can impair the nervous system in infants. As part of an amendment to the EU Drinking Water Directive, the current limit of 25 µg/l should be lowered to 10 µg/l.

■ [www.eea.europa.eu](http://www.eea.europa.eu)

Source: Lemtech, WHO, EU, deutsches Gesundheitsamt

should now be possible to monitor air and water more effectively with three new sensor systems developed by Siemens researchers. They use biological components for detection and also complement each other. The enzyme **acetylcholinesterase** (AChE), a protein that is an extremely rapid catalyst, serves as an alarm system for the feared poison attacks. It breaks down a messenger substance that transmits nerve signals to muscles in animals. Substances that impair this enzyme are extremely toxic, such as the chemical warfare agents sarin and tabun or the banned insecticide E605. "When the enzyme is destroyed, something really dangerous is in the water," explains Heike Barlag, specialist in biosensors at Siemens Corporate Technology. This knowledge is enough to provide rapid warning.

The analysis makes use of a type of AChE that produces decomposition products that can be detected electrochemically. The newly developed system is extremely sensitive. It can detect the toxin E605 in quantities of less than one millionth of a gram per liter (one tenth of a gram is fatal to humans). In the future, it will also be possible to detect heavy metals, phenols and blue algae toxins using enzyme disruption tests.

Barlag's team is also working on a wearable lab system that can roughly identify many pollutants and their quantities over the course of a half hour. It detects small molecules such as hormones, antibiotics or pesticides as well as much larger bacteria based on an immunological test in a tiny water sample. The detection is based on the ability of the body's own **antibodies** to identify foreign substances based on characteristic components, called antigens.



**PROTEIN IN USE.** New analysis systems use biological components. One of these is the enzyme acetylcholinesterase. Substances that disrupt this protein are extremely toxic. The reaction takes place quickly, allowing sufficient time for a warning.



The antibodies for up to 25 different substances are located on a chip on a removable card. If the substances being searched for bind to the specific antibodies on the plate, this generates an electric current that is detectable even in the smallest amounts of around several billionths of an ampere. The portable device can also catch bacteria, a central task in monitoring water quality that previously

required time-consuming bacteria cultures. When the new method has matured, it may be able to handle even routine testing in the drinking water test.

**Sensors with animal cells** represent the perfect extension to this system. They cover a broad spectrum of hazardous substances but are not capable of identifying individual substances. Animal cells react to everything that can be dangerous to humans and the environment: heavy metals, pesticides, ozone or nitrous oxide as well as alcohol, nicotine and the remnants of pharmaceuticals. The sensors consist of silicon chips that carry living cell cultures and measure changes to the metabolism of these cultures. External shape, oxygen consumption and the pH value of the cell waste products are monitored. If the parameters change, the residents of the chip are being stressed by toxins.

Biologist Evamaria Stütz has discovered that muscle cells from rats are good for wastewater analyses because they react very sensitively to pollutants, live a long time and are only subject to slow genetic change. But other cells are also being tested. Stütz: "We want to find suitable cell lines for various applications, including for air analyses."

The sensors have wide applications. They can monitor treatment plants or industrial wastewater, measure air and water quality in passive houses or warn of toxin attacks at airports. Most of all, scientists would love to convert whole organisms into sensors. For example, lichen could monitor air quality at busy intersections. However, no one has accomplished this yet. ■

### More information

- [siemens.com/innovation](http://siemens.com/innovation)
- [siemens.com/water](http://siemens.com/water)
- [siemens.com/pof](http://siemens.com/pof)

# Millions of Friends

**Social networks can do much more than just enable private communication** between individuals. An increasing number of companies are discovering Facebook & Co. for direct communication with their customers. A step that offers completely new possibilities – and new risks. The temptation to use **social media** for advertising purposes is great since the required know-how is low and it generates hardly any costs. After a simple registration, it is possible

to present oneself in social networks, blogs and on other platforms, distribute content and interact with people from all over the world. Is this just hype that will vanish as quickly as it came? Naturally, there are also experts who believe this. But the selection of services, which is becoming increasingly broad and more mobile, tends to indicate that **social networks** could lastingly change communication within and between specific peer groups.

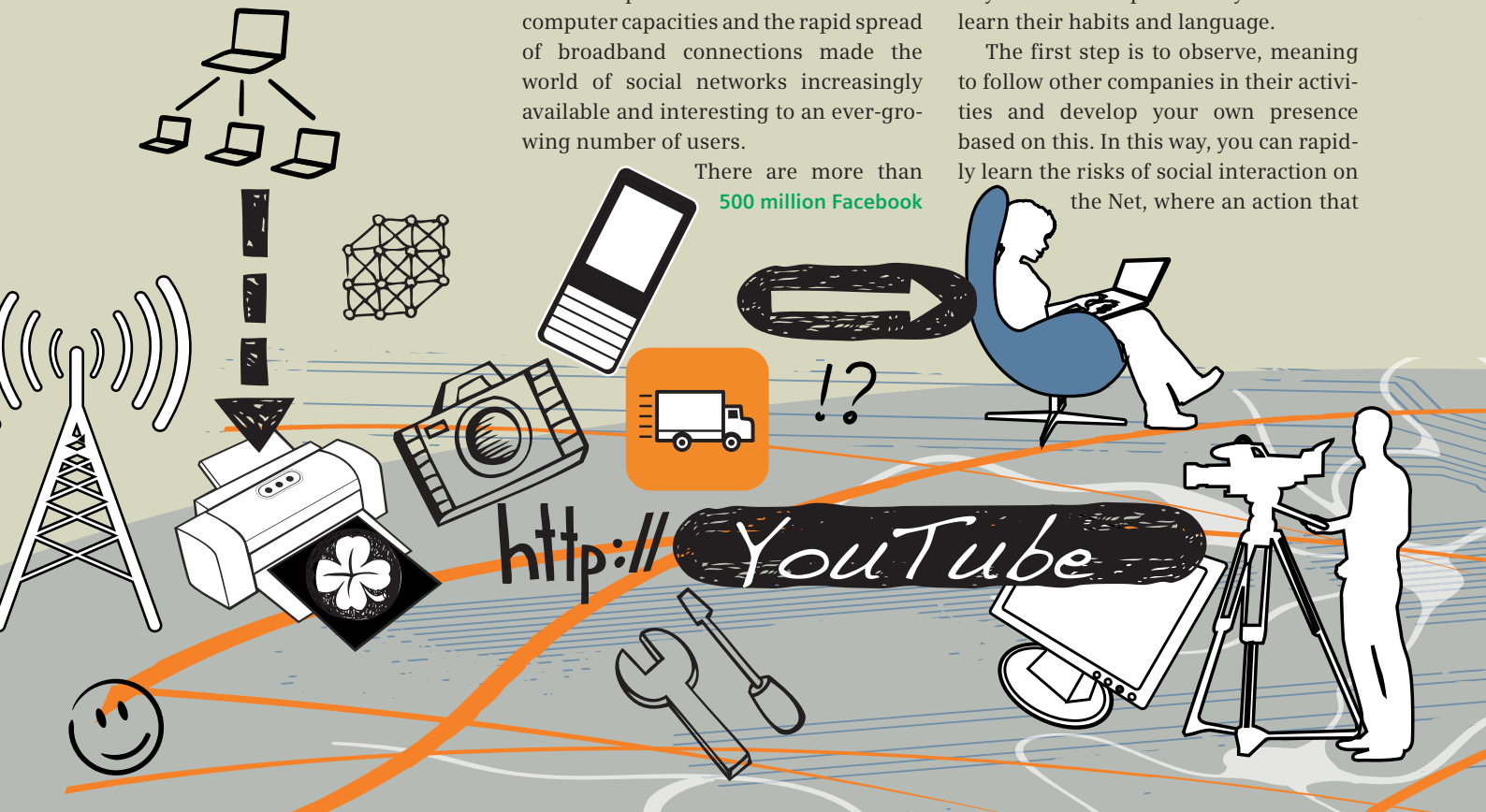
In principle, the idea of communicating, networking and sharing content via Internet platforms is not new. News-groups and mailing lists were the predecessors of social networks. But the dramatic expansion of the available computer capacities and the rapid spread of broadband connections made the world of social networks increasingly available and interesting to an ever-growing number of users.

There are more than **500 million Facebook**

**users** worldwide, who spend over 700 billion minutes there per month. The microblogging service **Twitter** is used less than Facebook and YouTube. Here, each “tweet” may have no more than 140 characters and personal topics of conversation are less common than links to interesting articles or debates about developments in society.

For companies, social networks offer a new opportunity to enter into direct contact with (potential) customers and partners. In order to discover the benefits that presence and personal communication on these channels may have for your own companies, you should study the topic intensively in advance. The best way is to test the platforms yourself and learn their habits and language.

The first step is to observe, meaning to follow other companies in their activities and develop your own presence based on this. In this way, you can rapidly learn the risks of social interaction on the Net, where an action that





would be readily accepted in a classic PR environment can create a critical situation in the social networking world.

Social networks offer above all excellent new possibilities for overcoming crises. This involves key factors that also hold true off the Net. Honest, open and authentic communication will yield friends, regardless of what happens. Messages that rapidly spread to millions of users can therefore be used for issuing warnings and sounding the all-clear – assuming you have succeeded in establishing your credibility – and even act as a counterweight for slanted reporting in other media. **Monitoring** is important for correct responses and good crisis management. There are now dozens of monitoring tools available on the market that cover all social media channels.

Large companies like **HP** and **Intel** have long since jumped on the social media bandwagon and claim to have improved external communication as well as internal communication within the company. The best example for measurable success in networked business is probably **Dell**. The computer manufacturer sells used notebooks via Twitter, utilizes the platform ideastorm to tap

into the wealth of ideas in the Internet community for developing new computers and solely through these actions succeeded in selling 500,000 dollars worth of computers. However, it is more difficult for a company that does not sell consumer products to build up a community. In the area of business-to-business, **voestalpine** is a much-cited leader in social media.

In general, one thing is required above all in order to build up successful communication on the Net: patience. Short-term campaigns make little sense. If a company operates in niche market segments, it won't be possible to accumulate 100,000 "likes" on a Facebook page very quickly. The number of users is also not entirely meaningful. One hundred of the "right" users who are truly interested and active are often worth more than 100,000 passive ones. Siemens is also well represented on various platforms. A **YouTube** account and many other projects invite users to get to the company and participate in discussions. The **Facebook page of hi!tech** in Austria is proud to already have a small fan community.

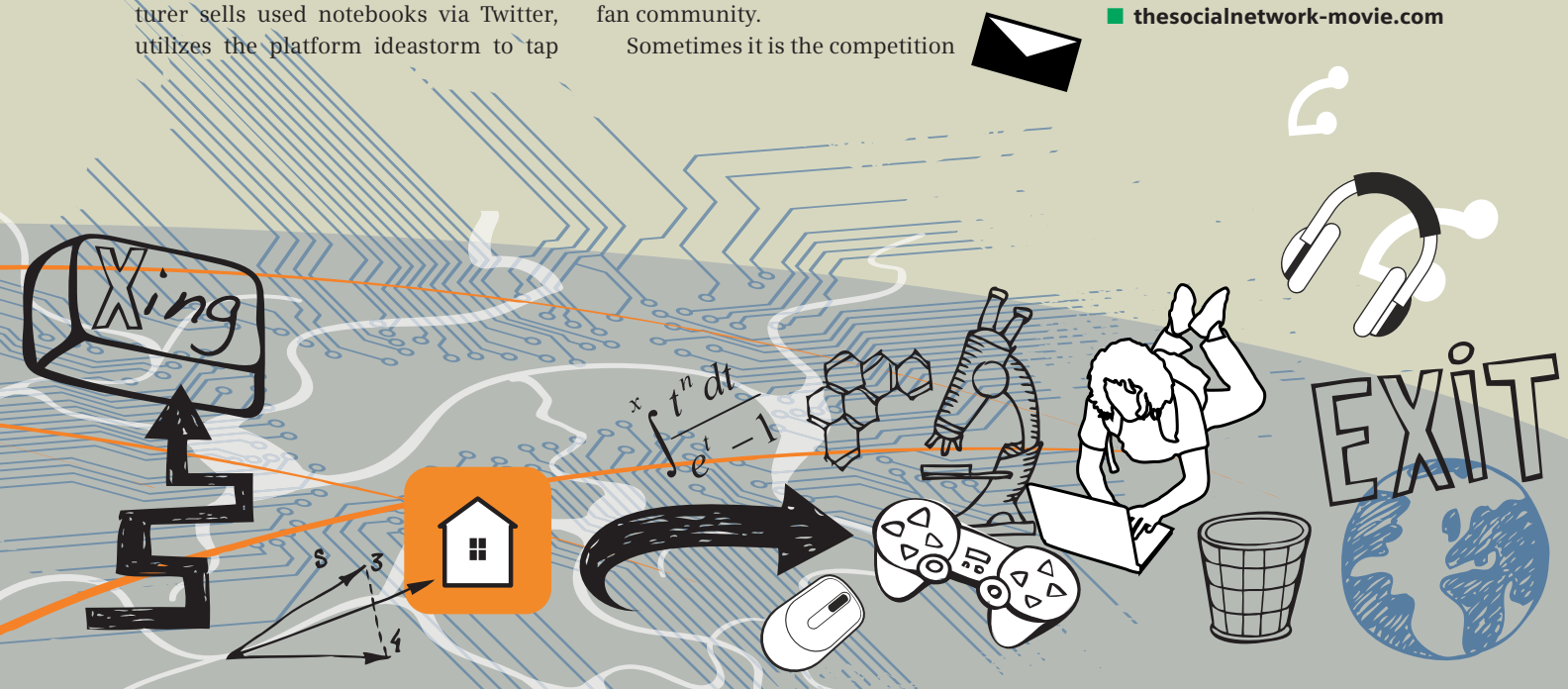
Sometimes it is the competition

for the best talent on the job market that opens up the doors for social media. Presenting your company as open and modern via social media generates an advantages in this case since many young, ambitious people organize their lives around social networks. If you want to be accepted by the leaders of tomorrow, you have to speak their language and maintain a presence in social networks.

If you are still uncertain whether you should engage in interaction via social networking despite all the available options, then you can initially use social media for classic advertising. But definitely do not ignore this trend entirely. Monitoring is mandatory – an agency can also handle this for you. The possibility that you, your customers and partners are already on the Net is very high – in opinions and postings that you may know nothing about. This is a risk you should not take! ■

### Mehr Infos

- [www.ideastorm.com](http://www.ideastorm.com)
- [socialmedia.biz](http://socialmedia.biz)
- [thesocialnetwork-movie.com](http://thesocialnetwork-movie.com)



# Affecting the Global Climate

**Shades in space or reflectors in the oceans – these suggestions for protecting the Earth against a climate collapse sound utopian. But experts no longer dispute the fact that it is possible, in principle, to manipulate the climate.** The further global warming progresses and the less effective the international efforts for CO<sub>2</sub> reduction are, the more demand there will be for scientists working on geo-engineering. In the USA, a new scene of startups is already appearing – the beginnings of a new kind of climate industry.

“Of course we are competing with mother nature. But that doesn’t have to be a bad thing,” emphasizes Nathan Myhrvold, former Chief Technology Officer for Microsoft, who currently runs the company **Intellectual Ventures** with 600 employees. “We will only solve the global climate crises by using innovative ideas and technologies.” Intellectual Ventures holds the rights to a development for preventing hurricanes. This involves a hose-cylinder design that circulates warm surface water on the ocean back down. It is only a matter of time before the countries suffering more frequently from hurricanes become interested in such an idea.

Scientists increasingly agree that geo-engineering must be available as a last alternative. If climate change accelerates drastically, synthetic clouds and screens

made of sulfur particles “might be the only way to quickly lower global temperatures again,” explains the British Royal Society, the most renowned and oldest scientific organization in the world. The fact that **geo-engineering** in principle is possible has been confirmed by volcanic eruptions that eject sulfur dioxide into the atmosphere. The eruption of Pinatubo on the Philippines in June 1991 cooled the Earth between 0.5 and 1 degree Celsius according to estimates. The following ideas are currently considered realistic: a worldwide increase in forestation, depositing CO<sub>2</sub> in the ground, in the oceans and in ice at the poles, fertilizing the ocean to increase its CO<sub>2</sub> absorption capacity and producing synthetic clouds by introducing sulfur dioxide.

## Cleaner electricity

Large quantities of carbon dioxide are released into the air when burning brown coal in particular but also by black coal of poor quality. An economical solution to this problem could contribute much to avoiding the climate collapse. One possibility is gasification. With this process, the carbon is first converted in a gasifier into a combustible gas that consists primarily of hydrogen and carbon monoxide. The carbon monoxide is converted into CO<sub>2</sub> and separated out. What remains is a hydrogen-rich gas, called syngas, that is burned in a turbine to generate electricity. Syngas can also be used to produce urea or fertilizer. Pressing CO<sub>2</sub> into petroleum deposits improves the yield. Siemens is undertaking an engineering study for the US energy company **Summit Texas Clean Energy LLC** regarding a gas and steam power plant with integrated coal gasification that will achieve the world’s highest CO<sub>2</sub> sequestration level of 90 percent.

■ [siemens.com/energy](http://siemens.com/energy)





#### THE LAST HOPE

If climate change accelerates dramatically, synthetic clouds and screens of sulfur particles might be the only way to rapidly lower global temperatures. Volcanic eruptions prove that temperature reductions are possible in this way.

**Klaus Lackner**, geophysicist at Columbia University in New York, believes in synthetic trees that can extract carbon dioxide out of the air one thousand times faster than their natural counterparts. These carbon dioxide extractors follow the principle of ion exchange. Chloride ions bound in liquid synthetic resin bind the CO<sub>2</sub> from the air. The synthetic resin filter is then washed out, leaving compressed, liquid carbon dioxide behind. Lackner has verified that this method works in lab tests at Columbia University.

The Canadian physicist **David Keith** is working on a similar approach that was able to convince Bill Gates to invest 4.5 million dollars in establishing the company Carbon Engineering. Lackner can imagine gigantic synthetic forests with

millions of synthetic trees. There are many possible uses for the CO<sub>2</sub>. Lackner: “You could use it to grow tomatoes in a greenhouse, press oil out of the ground, produce fuels or store it.”

While industrial nations are slowly starting to experiment with geo-engineering, fears are also beginning to rise with regard to negative consequences from the use of climate technologies. China has already used silver iodide on a grand scale to produce **artificial precipitation**. In November 2009, an overdose accidentally created a powerful snowstorm. In Russia, the scientist Juri Israel equipped a car and a helicopter with aerosol generators and used them to spray sulfur-containing particles. He then measured how the incoming sunlight changed. The Californian Plankto Science

also caused a stir by announcing their desire to fertilize a portion of the South Atlantic by enriching it with iron. This should facilitate the growth of algae that take CO<sub>2</sub> out of the air and transport it to deep water levels. **Climos**, a start-up founded by Dan Whaley in San Francisco, acquired 3.5 million dollars in venture capital with the money. Even with these initiatives, geo-engineering is far from breaking out into the mainstream, but it is also no longer pure science fiction. ■

#### More information

- [royalsociety.org](http://royalsociety.org)
- [www.mpimet.mpg.de](http://www.mpimet.mpg.de)
- [geoengineer.org](http://geoengineer.org)
- [unfccc.int](http://unfccc.int)
- [scientificamerican.org](http://scientificamerican.org)

## GREEN, FLEXIBLE AND CONVENIENT

For a train like the Desiro to be environmentally friendly, ecological aspects must be taken into consideration in the selection of materials and the manufacturing process. The train has to be highly efficient and capable of recovering braking energy and using waste heat. And the vehicle's energy management has to be kept in check, even when it is parked. The operator also has to be flexible when it comes to capacities and infrastructure.

[www.siemens.com/mobility](http://www.siemens.com/mobility)



## News-Snack

### LESS IS MORE



The new wind turbine from Siemens runs without gears. The three-megawatt turbine has a rotor

diameter of 101 meters. The new design features fewer components and reduces maintenance requirements, which is particularly advantageous on the high seas. [energy.siemens.com](http://energy.siemens.com)

### PUTTING E-CARS TO THE TEST

Siemens is putting together an electric fleet comprising a total of 100 vehicles that will be put through their paces by employees. The 4 sustain electromobility pilot project focuses on the interplay between infrastructure and electric cars, and involves the very concrete research and development of new business models.

[energy.siemens.com](http://energy.siemens.com)

### INSTRUCTIONS INSTEAD OF SIRENS

Siemens is using explicit warnings and instructions in its E100 fire alarm system. People react to spoken announcements up to four times faster than alarms alone.



[www.siemens.com/buildings](http://www.siemens.com/buildings)

### THE RIGHT DOSE



With i-Dos, Siemens is introducing a precision dosing system to the market that

automatically measures out the exact amount of laundry detergent needed for the load in the washing machine.

[www.bsh.com](http://www.bsh.com)



**CITIES ARE THE FRONTIERS OF THE FUTURE.**

Substantial investments in infrastructure are needed to make them sustainable.

# Expensive Cities

The rapid pace of urbanization is resulting in tremendous challenges. City managers have to substantially expand their infrastructure, because 6.4 billion people are expected to be living in the world's cities by 2050 and using electricity, water and transportation infrastructure, compared to the current 3.3 billion urban residents. At the same time, cities have to reduce their energy needs and carbon dioxide emissions, because they already cause 80 percent of greenhouse gas emissions. So climate protection measures in cities can make a substantial impact, and they open up good market opportunities for green urban infrastructure solutions.

The potential is tremendous: The majority of infrastructure in the developing countries and emerging markets will have to be completely rebuilt because these countries account for 95 percent of the world's population growth. The sys-

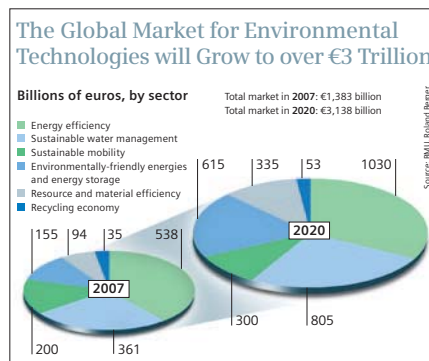
tems in many industrialized nations are also in urgent need of modernization. The consulting firm **Booz Allen Hamilton** estimates that cities will have to invest roughly 27 trillion euros in the modernization and expansion of infrastructure on a global basis over the next 25 years: 15 trillion euros for the water sector, 6 trillion euros for electrical systems and 5 trillion euros for the road and railway network.

Above all, cities need energy-efficient technologies in order to meet their infrastructure needs in a climate-friendly manner. Modern building technologies, traffic management systems, electric

cars and the expansion of public transportation can dramatically reduce carbon dioxide emissions. The growing demand for electricity can also be met in an environmentally friendly manner by using heat-power cogeneration, low-loss power transmission and intelligent power grids.

The economic crisis will provide important stimulus for this process. The London-based investment firm **HSBC** estimates that 15 percent of the funds from the economic stimulus packages that have been implemented across the globe will flow into green infrastructure. And 68 percent of these funds will likely be spent on energy-efficient technologies, because these investments start to pay returns especially quickly. Buildings in particular offer enormous energy savings potential: They account for 40 percent of the world's energy consumption, 30 percent of which could be saved through insulation and controlled air conditioning and heating.

In order to make "green" cities reality, city managers will have to implement complex projects involving huge investments. In many cases, public budgets will not suffice, and collaboration with private investors will be a necessity. Up to 15 percent of the world's annual volume of infrastructure investments is already financed with **public-private partnerships**, in which companies supply products and services, and provide a portion of the long-term financing and project management. The energy savings contracting offered by Siemens is one example of this type of partnership. ■



**More information**

■ [siemens.com/urbanization](http://siemens.com/urbanization)

# Winning the Game



**CONSTRUCTION SITE LONDON 2012.** Three-quarters of the investments are not for the Olympic Games.

The competition between cities has intensified. Regardless of the size and geographic location, population centers around the world strive to attract companies, investors and tourists. Major events such as the Olympics or a soccer World Cup play exactly the right role. This is also shown by the study “Major Events – the right choice for your city?” which was performed by Roland Berger Strategy Consultants in collaboration with Siemens. The goal was to discover whether major events give cities a stronger global profile and secure for them a more competitive position. The summary: If done right, a major event can lastingly improve the future prospects of a

city. London, host to the 2012 Olympic and Paralympic Summer Games, is working on this. The event should be a catalyst of green development of the city. Sustainable London 2012 promises to produce as little waste and CO<sub>2</sub> as possible and seeks to protect the natural areas around the event park. During mega-events, cities are under the watchful eyes of the world’s public. Thousands of journalists report not only on the competitions but also



**MUNICH ALLIANZ ARENA.** Visited by more than five million fans since the opening game.

about the country and its people even years in advance. In a massive national effort, public agencies work with private business to improve the infrastructure.

But can all cities profit? Not necessarily. When considering a bid, it must be clear what the strengths and weaknesses of a city are. For this reason, a ten-point plan for decision-making was developed during the course of the study. Will the bidding/planning process pay off? Which is the right event? Many concentrate too much on the economic growth and underestimate the complexity of such an event and the necessary coordination.

A major event is not an isolated one and must be embedded in the urban planning. The population must be won over for the project. Equally important are innovations since technology has a lasting influence on cities. More than five million soccer fans have visited the innovative Allianz Arena in Munich since the opening game of the 2006 soccer World Cup. But an event site is only the tip of the iceberg. Just 10 to 20 percent of the entire costs of mega-events go to the specific facilities, 80 to 90 percent go to the associated infrastructure. Lord Sebastian Coe, chairman of the 2012 Olympic and Paralympic Summer Games in London, is confident regarding London’s future. The event will indeed be significantly more expensive than originally expected, but three-quarters of the investments have nothing to do with the games. They will benefit Stratford, a district with poor infrastructure, where the games will primarily take place. ■

## More information

- [www.london2012.com](http://www.london2012.com)
- [siemens.com/urbanization](http://siemens.com/urbanization)
- [www.rolandberger.com](http://www.rolandberger.com)



**VATICAN MUSEUMS.** All security systems installed in the museums should be merged.

## Securely Protected

When it comes to protecting the priceless treasures of the Vatican against theft, vandalism and fire, the traditional Swiss Guard is of little help because the number of buildings and artifacts requiring protection is huge. In addition to St. Peter's Basilica, the Papal Palace and the Sistine Chapel, almost all other buildings in the smallest recognized country in the world are considered unique. Already during the 1980s, the Vatican began to protect its treasures with modern fire alarm technology. In the papal guest house, state-of-the-art building services – including modern climate control and power supply – ensure the comfort of bishops and cardinals who travel to Rome for conferences or conclaves. The headquarters of the papal newspaper, *Osservatore Romano*, is also equipped with fire alarm systems.

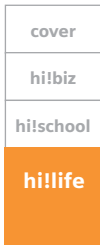
In the year 2001, 90 fire alarm control panels and roughly 2,000 smoke detectors from Siemens were already in operation inside the mini-country. In the meantime, all fire protection systems have been integrated into a single network in cooperation with the Vatican technicians. The network, which is based on fiber-optics, encompasses more than 120 control stations and thousands of fire alarms that are connected to a hazard management system. In order to ensure maximum safety, close coordination with the technical employees of the Vatican is maintained. This has made possible the timely identification of potential dangers that could have led to a fire so they could be integrated into planning of the systems.

The building services systems are also continuously optimized and are networked using the building automation platform *Desigo*. This also applies to the modern lighting solutions for various halls. Starting a few months ago, even the Vatican bank, the *Istituto per le Opere di Religione*, began using systems from Sie-

mens to protect against fire and break-ins. The installed solution guarantees the bank a maximum level of autonomy in control and monitoring. The system is controlled and monitored via the Internet from multiple management stations. Technicians are currently working on a process that will make it possible to merge the systems installed in all museums in order to further improve monitoring. The fire alarms are connected via an interface to a monitoring system of the Vatican fire department. The fire department reacts immediately when the graphical displays on the screens and warning messages indicate that a response is required. Pope Benedict XVI also profits from new solutions in his private chambers that control and monitor the lighting and switchboards. ■

### More information

- [siemens.com/buildings](http://siemens.com/buildings)
- [www.osram.com](http://www.osram.com)
- [siemens.com/industryjournal](http://siemens.com/industryjournal)



# The Waste-Free Economy

The German chemist and process engineer **Michael Braungart** was one of the fathers of the Cradle-to-Cradle vision of the ability of things to be recycled forever. An interview on the possibilities of implementing his ideas.

## **You don't really believe in the idea of sustainability. Why?**

The conventional understanding of sustainability is boring. It's always just about reducing, minimizing and saving. In other words, doing everything as before, just less badly. But less badly isn't nearly enough. My ideas are based on intelligent waste. Instead of doing less damage, we should develop useful things.

## **How does it work?**

It's not that difficult once you get the word "waste" out of your head. Let's take nature as an example. All ants consume as much energy as 30 billion people but produce only biomass and no garbage. We can do that too if we create products for a continuous cycle. The concept behind it is called Cradle-to-Cradle. You can buy a Cradle-to-Cradle carpet that is not only pollutant-free but also removes particulate matter from the air. There are now even compostable t-shirts on the market.

## **What happens to products that can't be composted?**

Anything that can't be turned into humus should be able to be recycled over and over – without losing quality. It works for office chairs and sneakers. Today materials are usually downcycled, in other words, the quality diminishes constantly. They are also often highly polluted.

## **Is there no trash at all in a Cradle-to-Cradle world?**

No. Even car exhaust can provide valuable raw materials. For example, we are currently developing a technology that can be used to produce valuable fertilizers from the nitrogen oxide from exhaust.

## **How are complex products like televisions supposed to be recycled?**

We simply need to re-invent everything. First we always have to ask ourselves a pure market-economy question: What do customers want? And customers want to

not welded. Instead of selling the vehicle itself, the right to use it for 100,000 kilometers, for example, would be sold. Once the body is used, it would be dipped in a bath, and the dissolved bacteria, adhesive and parts could be reused.

## **Isn't it really expensive to manufacture such high-quality products?**

Experience has shown that companies profit very quickly from their Cradle-to-Cradle products. For example, Airbus was able to cut costs by 20 percent through its new seat covers since it no longer had to

**“Anything that can't be turned into humus should be able to be recycled over and over – without losing quality.” MICHAEL BRAUNGART**

watch a movie or television show, not to have a television with over 4,000 different pollutants. Customers want clean laundry but not necessarily their own washing machine. In these cases, it makes sense to sell usage, not the product. A sort of green lease, in other words. When manufacturers retain ownership of products, entirely different materials can be used. Then the best is what counts, not the cheapest. For example, we are currently working with a vehicle manufacturer to build an auto body whose parts are adhered together,

pay for disposing of the old covers as hazardous waste. The occupational health and safety costs are also lower now. What's more, customers gladly pay more for Cradle-to-Cradle products.

## **Why does your EPEA environment institute certify companies as well as products?**

Cradle-to-Cradle is also a part of corporate culture. People who work for a Cradle-to-Cradle company are usually proud of it. The certificate also serves as an advertise-





## Eco-effectiveness

**Cradle-to-Cradle** is the vision of a waste-free economy. The German chemist and process engineer Michael Braungart and the American architect and designer **William McDonough** came up with the idea. The key concept is eco-effectiveness. Products are manufactured intelligently in two closed cycles such that they can be returned to nature without causing any pollution – for example, compostable shoe soles, t-shirts and vacuum cleaner bags – or can be fully recycled.

**Braungart** is a process engineer and professor of chemistry. He established the Chemistry Section of Greenpeace International in the 1980s. Today he teaches at Erasmus University in Rotterdam. He is the founder and director of the international research and consulting institute **EPEA** Internationale Umweltforschung GmbH in Hamburg. He founded an industrial design firm with William McDonough in 1995.

The list of companies that already follow Braungart's Cradle-to-Cradle principle, either entirely or in part, is long and includes the toy manufacturer Lego, the world's largest shipping company **Maersk**, chemical giants **Akzo Nobel** and **DSM** and the waste disposal company **Van Gansewinkel**.

**MAERSK**, the world's largest shipping company, relies on follows the Cradle-to-Cradle principle.



ment for up-and-coming scientists. It also helps us bring together experts, who are essential for intelligent innovation. If you look at it this way, Cradle-to-Cradle is also a communication platform.

**Will the idea of continuous cycles catch on in the next few decades?**

I am optimistic. An increasing number of young, motivated engineers and scientists are making it to top-level management within companies. And the idea is developing faster than we expected in many

countries. The Netherlands is on the fastest track to becoming a Cradle-to-Cradle nation. We have several projects there and are working on new Cradle-to-Cradle ideas with above-ground and underground civil engineering firms, electronics manufacturers and authorities.

**Can laws help, too?**

No. People have to do it voluntarily and develop the feeling that it's not too late, that this is something we can do. Or as the saying goes: Yes, we can. ■

## More information

- [www.epea.com](http://www.epea.com)
- [www.maersk-line.com](http://www.maersk-line.com)
- [www.lego.com](http://www.lego.com)
- [siemens.com/pof](http://siemens.com/pof)



# Grand Prix of Technology

**Formula One cars race here through a hotel. Day and night, they drive around** tight curves that demand everything the driver has. The Yas Marina Circuit on a 2,500 hectare island off the Abu Dhabi coast is

one of the world's most spectacular and technologically advanced motorsports circuits. The first race on the new circuit was held on November 1, 2009, and was the first Formula One race finished under artificial light. Sebastian Vettel from the **Red Bull Racing** team won the first Abu

Dhabi Grand Prix, the first in the United Arab Emirates. Spectators along the 5.5 kilometer course were interested most of all in the track design, architecturally interesting buildings, pit lanes and luxury VIP lounges. The event's success was due in large part to the hidden electrical and communication technology. The size of the facility alone posed specific challenges during planning and installation.

A 22 kV high-voltage network with over 18 substations, 30 transformers and a full battery of switch units and junction boxes supplies electricity to the track. Electricity travels through an almost 5,000 kilometer long labyrinth of wiring and ducts, through 20,000 electrical connections, outlets, light switches, dimmers, motion sensors and other devices in the system.

The heart of the **Yas Marina Circuit** is the race control center, where marshals and officials monitor everything that goes on on the track. Siemens and its partner PKE installed cameras that generate crystal clear images day and night. The images are transmitted to freely scalable rear projection monitors in the race control center, where the marshals can ensure the rules of the race are followed down to a fraction of a second. If the judges want to examine the particularities of a race after it is over, they can check videos, which are saved digitally and in realtime on special servers.

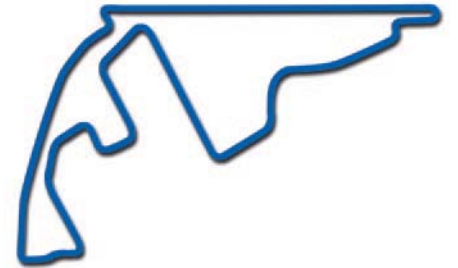
If a race is interrupted, the marshals and race control system can communicate using a marshal intercom system. After consulting with the race director and



**YAS MARINA CIRCUIT.** Modern electrical and communication technology sets the stage for exciting races on one of the world's most spectacular motorsports circuits.



**YAS HOTEL.**  
Solar-powered  
LED lighting system.



cable installed several kilometers beneath the entire circuit.

Fiber optics cables also play an important role in the communication infrastructure. They connect 2,500 telephones and 6,000 data access points together and with the outside world. Unlike the up to 50,000 spectators, most representatives from the media follow the race on a wall-sized rear projection screen – the world's first in racing journalism – which is installed in a media center for over 600 accredited journalists.

In addition, a **satellite master antenna television (SMATV)** system was developed. The system includes a dedicated cable television station that broadcasts various programs, or video feeds, via 7,000 outputs distributed across the venue. In addition, close to 1,000 television receivers were installed in especially important areas, such as garages, team buildings, administrative offices, VIP areas, pit lane areas and the Sun Tower for VIPs.

The lighting technology is also unusual, as might be expected for such a spectacular venue. The solar-powered LED lighting systems are especially impressive. They are used both for the Sun Tower and as effect lighting installed throughout the site. The outdoor LED lighting of the Yas Hotel is already considered an example of unique lighting design. ■

### More information

- [siemens.com/buildings](http://siemens.com/buildings)
- [www.osram.com](http://www.osram.com)
- [siemens.com/energy](http://siemens.com/energy)

## High standards

The investor Aldar Properties selected Cebarco-WCT as the general contractor for building the Yas Marina Circuit and contracted a few additional technical partners, which were able to implement its vision and follow strict standards in a short timeframe. Siemens and its Viennese partner PKE were chosen due to their expertise from similarly highly specialized projects. The consortium was hired as a subcontractor responsible for the security technology, access controls at the circuit, high and low voltage systems, lighting and for wiring the entire site. Siemens and PKE had already worked together to build the first motorsports facility in the Middle East, the Bahrain International Circuit, and the even more complex first permanent motorsports circuit in Turkey, the spectacular Istanbul Park.

■ [www.pke.at](http://www.pke.at)

other officials, the race control center starts the traditional flag procedure with yellow, red or green. This all happens at the touch of a button at the Yas Marina Circuit. The “flags” are DigiFlag signal lights, which are installed along the entire circuit at specified intervals and in accordance with the FIA guidelines. They are clearly visible in bright sun and at night.

But in the end, it all comes down to time. Modern timing equipment clocks and saves times and speeds. The two tracks combined into a circuit for the Formula One race are equipped with wireless local loop (WLL) systems. Laser technology is used on the straightaway to track the vehicles, which are equipped with transmitters, down to the ten-thousandth of a second. The information is transmitted to the race control center via a fiber optics

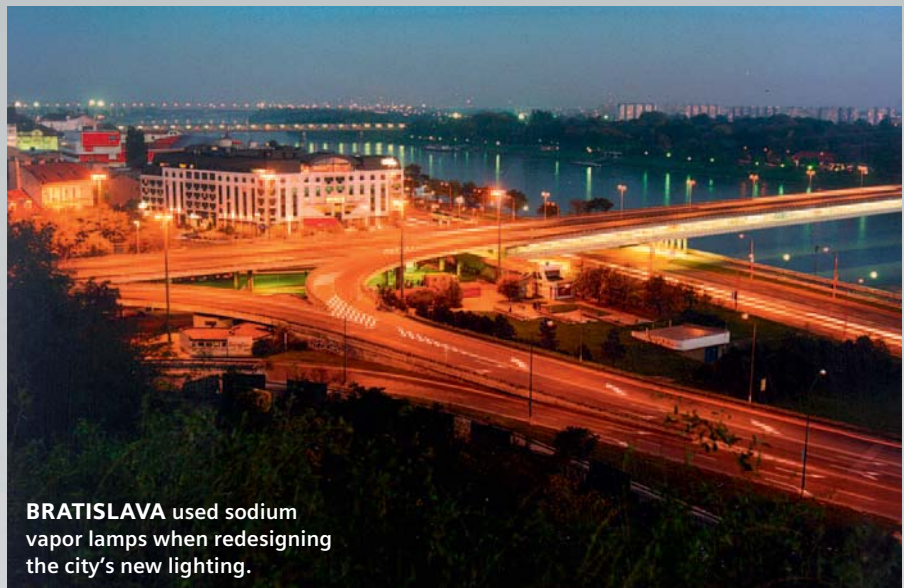
# Cities in a New Light

Using energy-saving light sources is one of the most effective ways to protect the climate.

Artificial lighting accounts for just under twenty percent of global electricity consumption. Over 33 percent of this electricity could be saved through more **efficient lighting technology**, 900 billion kilowatt-hours per year or an equivalent of 450 million metric tons of carbon dioxide.

Streets are a special case when it comes to efficient lighting. On one hand, street lights, which illuminate all nooks and crannies of a city, are essential for safety and comfort residents. On the other hand, street lighting also ensures that historic city centers, for example, look just as picturesque at night as they do during the day. And it shouldn't be too bright either – not only because of energy consumption. Global light pollution is a growing problem, especially in highly industrialized regions, where the lights never go out. It has a negative impact on people, animals and the environment.

These reasons alone are enough to make cities consider new street lighting. But what's more, after banning the incandescent bulb, the **EU** will phase out **less efficient bulbs** for street lights, such as the popular mercury vapor lamps, which deliver only 50 lumens of cool, white light per watt, by 2015. One alternative for use in public spaces is the **sodium vapor lamp**, which is a much more



**BRATISLAVA** used sodium vapor lamps when redesigning the city's new lighting.

efficient light source with 120 lumens of light per watt. Sodium vapor lamps have replaced light sources in five cities in Slovakia: Bratislava, Trnava, Trenčín, Poprad and Žilina. The project in Bratislava cut energy by 40 percent. "The high energy efficiency of the sodium vapor lamps comes with a small disadvantage: the yellowish light produced makes it a bit harder for people to distinguish colors and contrasts", explains Matthias Fiegler, Osram.

Ceramic metal halide lamps are the front-runners among the conventional technologies. The bright lights emit brilliant, white light, render colors well and are generally used where an enormous amount of light is needed, such as stadiums. **Light-emitting diodes (LEDs)** are capable of the same, but advances in the technology can still be made. Overall, LEDs offer the greatest savings potential. LEDs can cut electricity consumption by

up to 80 percent compared to the oldest systems with mercury vapor lamps.

LED lights can also be combined with control systems that take advantage of their ideal dimming properties. LEDs can direct light precisely where it is needed. They largely prevent unwanted scattered light, reducing **light pollution**. Another advantage of LEDs is their ability reproduce colors and their potential to be used in effect lighting for individual hotspots. With a life of 50,000 hours, they last twice as long as conventional bulbs and need to be replaced only every ten years. LED bulbs are still around two to three times as expensive as traditional technology. If, however, you count on consuming 50 percent less electricity on average – depending on the existing light technology – switching to LED bulbs pays off within ten to twenty years. It's worth the investment regardless of the immediate effect on the environ-



ment. **Contracting models**, which finance the investment from energy savings, are available. Osram also wants to cut the cost in half, making LED systems only 50 percent more expensive than competitors' systems.

**Regensburg**, Germany, uses LEDs. Following test runs on two lanes in the city, all 250 street lights in the medieval old town will be converted to LEDs in 2011. LED bulbs consist of up to 54 individual LEDs. They can be screwed into existing sockets and provide warm, natural light, which shows off the historic facades even at night. The new bulbs are expected to cut electricity consumption by 50 percent.

A city like **Sydney**, Australia, could save several million dollars in electricity costs by switching to LED street lighting. The city council is starting out small. Martin Place pedestrian mall was equipped with 18 LED street lights, which increase the average light by around 50 percent and cut energy consumption by 56 percent. ■



**REGENSBURG** is converting all 250 street lights in the old town to LEDs in 2011.



**A NEW FORM OF LED LIGHTS.**  
The color of the light produced by the bulb can be adjusted to the environment.

## LEDs used in public spaces



**In Russia, Kemerovo**, a city of 520,000 on the Trans-Siberian Railway, installed 200 LED street lights, which have to demonstrate their durability and radiant flux in Siberian temperatures and weather conditions.



Around 1,800 meters of LED modules light up the **Domovinski Most** bridge, which was built in **Zagreb, Croatia**, in 2006. The public and media were so impressed that the bridge had to be opened twice by the mayor.

## More information

- [siemens.com](http://siemens.com)
- [siemens.com/osram](http://siemens.com/osram)
- [siemens.com/pof](http://siemens.com/pof)

# Tapping the Sun's Energy

Solar thermal is the most efficient way of generating electricity from the sun and is currently experiencing a boom. It promises environmentally friendly electricity genera-

tion on a grand scale, especially in the earth's sun belt, which includes the southern United States, southern Europe and parts of Africa. **Solar thermal power plants** that will generate up to 250 megawatts of power are already being planned. Building this type of solar power plant is simple in principle. Mirrors concentrate sunlight on receivers, where it is collected and heats a heat medium. The medium flows through heat exchangers, which generate steam to power a turbine. Different technologies are available for collecting the sunlight. One method is parabolic troughs that trap the sun's energy using mirrors. The solar energy is concentrated on an absorber tube, where it heats fluid.

A **parabolic trough power plant**, which will generate 50 megawatts (MW) of power, is currently under construction in Lebrija, Andalusia. The just under 170,000 mirrors needed for the plant are being manufactured in Nazareth, in



**PARABOLIC TROUGH POWER PLANT.** Mirrors collect the solar energy, which heats a liquid in an absorber tube.

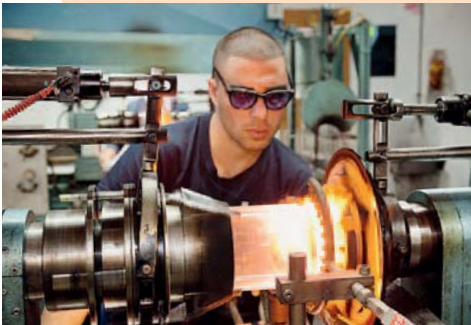
northern Israel. The mirrors are made using glass that contains little iron, which means that they absorb very little but reflect a lot of solar energy. The hot, liquid glass flows out of the furnace through steel pipes and cools slowly. Plates measuring 1.6 x 1.7 meters are broken off, the edges are ground down and the plates are reheated. The glass plates travel on stainless steel mats through another furnace, where they are slowly shaped into the required rounded form over a period of 1.5 hours. No stresses can be left in the material that could later cause cracks or fractures since the solar

arrays have a 25-year warranty.

A parabolic trough consists of 28 individual mirrors. Their bent shape must be accurate down to a fraction of a degree to ensure that the sunlight hits the receiver tube as accurately as possible, causing as little scattering loss as possible. Great care is taken with the film to further reduce the amount of energy absorbed by the mirrors. As is the case with the receiver tubes, the film is the key to high efficiency. The bent glass plates pass through several showers. A silver solution is sprayed on the back, followed by a layer of copper and several layers of anti-

## Solar collector production

A parabolic trough consists of 28 individual mirrors. Their bent shape must be accurate down to a fraction of a degree to ensure that the sunlight hits the receiver tube as accurately as possible, causing as little scattering loss as possible. The receiver tubes (bottom) have the greatest impact on the overall efficiency of a system. Special film coatings on the mirrors and receiver pipes are the key to high efficiency.



corrosion paint. The individual components for the new power plant in southern Spain will be assembled on site in Lebrija. Concrete pillars, on which the 6,048 parabolic troughs will be mounted, extend down 40 meters into the ground. The power plant may be finished in time to connect to the grid by the end of 2010, supplying over 50,000 Spanish households with electricity via a Siemens steam turbine.

“Solar thermal can be expected to make a real breakthrough once it can be used to produce electricity at competitive prices, in other words, without subsidies,” stresses Eli Lipman, Vice President of Research and Development at **Siemens Concentrated Solar Power** (CSP). For now, the aim is to keep the cost of generating electricity at or below the market price of electricity. Receiver tubes have a greater impact on the total efficiency of a plant than any other component. Siemens launched the most efficient receiver yet in late 2009. This was achieved by increasing the heat absorption while decreasing the thermal loss that occurs when the solar energy is re-radiated. Special

film coatings play an important role.

The economic efficiency of a power plant can also be diminished when large parabolic mirrors are used since fixed costs are lower per square meter of mirror. Further improvements in the mirrors themselves will help reducing the **levelized costs of energy**, a measure of the cost of generating electricity that takes into account investment and operating costs as well as capital costs.

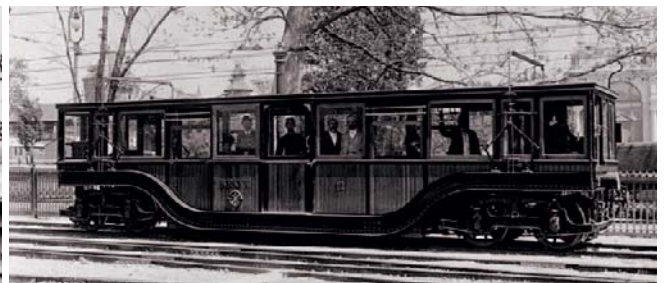
While some solar thermal plants are already in operation in Spain and the US state of Arizona, plans are only now being made for the first facilities in Israel. “The irradiance data for Israel are perfect. The whole Negev Desert is an ideal area for CSP plants,” says CEO of CSP Avi Brenmiller. “And if the plants were also equipped with gas turbines, you could generate power competitively right now in Israel, even without any subsidies.” The downstream steam turbine in such gas-solar hybrid power plants can be powered by solar heat and by the waste heat produced by the gas turbine. This means that the power plant can also generate electricity at night. Solar and fossil fuels could play to each other’s strengths.

Israel is an ideal location not only for solar thermal power plants. It also promises big yields for **photovoltaic plants**. The market leader in developing photovoltaic plants is **Arava Power**, in which Siemens has a stake. The first desert power plants are being built in the Kibbutz Ketura in southern Israel. “My big hope is that this will mark the beginning of a lucrative future for renewable energy in Israel,” says Mike Green, Chief Electrical Engineer at Arava Power. ■

### More information

- [siemens.com/energy](http://siemens.com/energy)
- [www.aravapower.com](http://www.aravapower.com)
- [siemens.com/pof](http://siemens.com/pof)

# 120 Years of Electric Subways

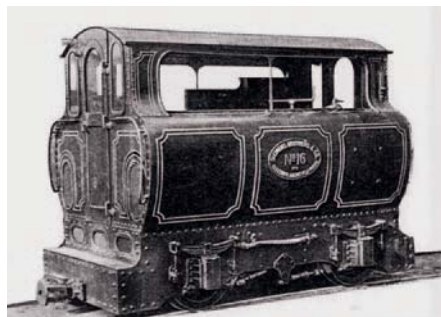


**THE FIRST** underground railway on the European continent when into operation in 1896 in Budapest, the Franz Joseph Railway.

The first electrically driven subway in the world was opened in London in December 1890. Plans for connecting two long-distance train stations within the city of Vienna already existed in 1844. The very first underground railway started operations in London in 1863. However, it was operated with steam trains and initially found no imitators. In the year 1869, **Henry Greathead** developed a tunnel drilling machine for the Tower subway under the Thames. However, the breakthrough for underground urban transportation came only with the use of electric motors. The basic idea of the electric railway was presented by Werner von Siemens in 1879 at the Berlin Industrial Exhibition. In 1888, Frank Julian Sprague developed the **nose-suspension drive** for

the streetcar system in Richmond, Virginia. This drive allowed secure transmission of the motor torque to the wheel sets.

The first electrically operated subway in London ran between Stockwell and William Street. The subway had three cars that were pulled by an electric locomotive. Siemens supplied 52 electrical components, axle motors, later nose-suspension drives. They remained in use until the end of 1923. Today, the City and South Railway is



**LONDON:** The world's first electrically driven subway travelled between Stockwell and William Street starting in 1890.

part of the Northern Line. As general contractor, Siemens built the first underground railway on the European continent in 1896 in Budapest, the Franz Joseph Railway, today **Fälderlatti**. In 1896, Frank Julian Sprague developed the first multiple-unit control in Chicago, with which a single conductor could control an entire train with motor-driven wagons on his own.

On the basis of these technical developments, roughly 140 subway systems have been opened around the world since 1900. The largest networks are found in London, New York, Tokyo and Moscow. And new developments are constantly underway. In 1967, for instance, the first subway with aluminum car bodies and air-cushioned bogies was introduced in Munich. In 1975, an inverter-fed three-phase asynchronous drive for subways was tested in Nuremberg. In 1983, the first fully automatic, driver-less, rubber-tired subway system VAL went into operation in Lille. In 2004, the first driver-less subway went into operation in Nuremberg. In 2008, the extremely energy-efficient Syntegra drive was used for the first time in Munich. At the Vienna plant, Siemens has produced subway cars for the Wiener Linien since 1972 – a total of over 500 silver arrows – and also the V-car since the year 2000. Vienna is the worldwide headquarters for subway cars and coaches. ■

■ [www.siemens.com/mobility](http://www.siemens.com/mobility)