



SIEMENS



The Siemens Environmental Portfolio

Examples of sustainable technologies

[siemens.com/environmentalportfolio](https://www.siemens.com/environmentalportfolio)

Table of contents

Introduction	1	Preface
	2	Green light for clean technologies

Products, solutions and customer examples	6	Solutions from a single source – London
	11	Environmental Portfolio overview
	12	Renewable energies
	13	Fossil power generation
	14	Power transmission and distribution
	15	Industry solutions
	16	Mobility
	17	Building automation
	18	Water
	19	Healthcare
	20	Solutions from a single source – Seat Martorell

Further information	26	Unequivocal reporting methodology
	28	Disclaimer
	29	Information resources

Preface



Dear reader,

The transition to a low-carbon economy will be the biggest industrial challenge of this century, requiring changes on every scale – making single components more efficient, developing more energy-efficient solutions, re-inventing entire infrastructures.

While economic volatility may distract us, and the slow pace of climate change negotiations may discourage us, this is a goal we cannot lose sight of. There is a big incentive to address this challenge: investments in energy efficiency often pay off in the short term, and growing green markets such as renewable energies are a promising business case for our customers.

At Siemens, we have implemented many energy-efficient and low-carbon solutions in recent years, and we have seen impressive results. Our technologies helped customers reduce CO₂ emissions and increased their competitiveness with energy savings.

Whatever your arena – public or private sector, industry or the service field – we hope that this brochure will showcase inspiring examples of innovations that help customers work more efficiently while also protecting our environment.

As a global technology and innovation leader, Siemens is helping promote a green transition that will reshape the way we consume resources, use energy, produce goods, move people and promote health. However, collaboration between all stakeholders is essential for further development.

We invite you to join us on this journey,

A handwritten signature in black ink, consisting of a series of loops and curves, representing the name Barbara Kux.

Barbara Kux
Managing Board member of Siemens
and Chief Sustainability Officer

Green light for clean technologies

Siemens is a leading global supplier of environmental technologies. Many of our products help our customers lower their energy costs and protect the environment while helping to fight climate change. This not only benefits the environment and our customers but is also very successful business for Siemens.

The world is changing, and so are the societies in which we do business. Climate change and globalization, rapidly accelerating urbanization, demographic changes and their effects: these are huge trends that shape the world in which people live and work.

One of the key challenges of recent years and the years ahead is how to meet the enormous demand for energy and raw materials while preserving resources and protecting our climate. Siemens embraces a fundamental industrial-technological shift: a change of course toward energy-efficient business management, renewable energy sources, and green technologies. The key impetus for this shift is technological innovation – an area in which Siemens has always been at home.

Challenges for forward-looking innovators

Siemens technological innovations can help stem global warming while encouraging economic growth and prosperity. But for this to happen, energy everywhere in the world must be made as green and climate-friendly as possible. As a reliable technology partner, we see great challenges in the restructuring of our energy systems:

- > Fossil fuels must be used as efficiently as possible, and the costs of regenerative energy production must fall.
- > Despite the growing demand for energy, damage to the atmosphere from greenhouse gases and other pollutants that affect the climate must be reduced.
- > Energy must be transmitted across vast distances at very low loss. The grids must have the flexibility to transmit fluctuating input from wind and solar power at low loss, even across national borders.

- > Energy must be used more efficiently: energy-efficiency programs offer huge potential savings in the business sector while helping to lessen environmental impact.
- > Limited resources such as water must be used sparingly and their quality must be maintained.

Changing the world for the better

For over 160 years, Siemens has stood for outstanding technical capacity, innovation, quality, reliability, and internationality. For many years we have tackled the challenges at the crossroads of energy and the environment with determination and great innovative spirit. In 2008, Siemens presented to employees and the general public its first Environmental Portfolio: selected products and solutions from the fields of energy efficiency, renewable energies, and environmental technologies, all serving as a testament to progress. Since then, we have reported annually on the ecological benefits experienced by our customers and the economic developments at Siemens.

Siemens is a pioneer in green technologies. Our goal now is to ensure that “Made by Siemens” is recognized around the world as a trademark for sustainable, forward-looking technologies that can change the world for the better.

Sustainable energy conversion – from a gust of wind to power distribution

Siemens has always offered products and solutions for environmental and climate protection. Back in 1873, for example, Werner von Siemens developed a technology to block ash emissions from smokestacks. Today we offer the market a wealth of particularly sustainable alternatives covering the entire process from power generation to consumption:

- > Offshore wind farms take advantage of the optimal wind conditions at sea to produce environmentally friendly energy.
- > Siemens high-efficiency combined cycle power plants are an especially effective use of the primary energy source of natural gas with an efficiency of over 60 percent. They also produce less greenhouse gas.
- > Siemens supplies key components for low-loss high-voltage direct-current transmission, and in many metropolitan areas power is distributed using state-of-the-art Siemens gas-insulated switchgear.
- > In industry, solutions from the Siemens Environmental Portfolio provide energy-saving drive technology, environmentally friendly steel production processes, wastewater treatment in the paper industry, etc.
- > State-of-the-art Siemens high-speed trains, energy-efficient locomotives, light rail, subway cars: all of these lower the energy consumed by our mobile society and allow the residents of key cities around the world to enjoy sustainable infrastructure.

- > Individuals benefit from Siemens solutions when they enter energy-efficient buildings, for example, or when as patients they experience low-energy, high-efficiency medical equipment.

Triple win for our customers, the environment, and Siemens

From the beginning, it was not only ecological aspects that inspired us to develop our Environmental Portfolio. Our energy-efficient solutions and environmental technologies create a triple win situation: our customers improve their bottom line through lower energy costs and higher productivity, future generations win through preserved and improved living and environmental conditions, and Siemens itself wins through access to attractive markets and the opportunity for profitable growth.

How Siemens is perceived as a company is increasingly colored by its track record on environmental and climate protection. More and more business customers, consumers, non-governmental organizations, governments, and financial markets demand information on CO₂ emissions. That's why we issue an annual report on how much CO₂ is saved by the products and solutions in our Environmental Portfolio and how much revenue they generate.

- > The windpark London Array will provide renewable electric energy for the mega city.



Clear criteria for the Siemens Environmental Portfolio

Products, systems, solutions, and services from all consolidated Siemens companies may qualify for the Siemens Environmental Portfolio. Strict processes with clearly defined criteria govern which of these are added to the Environmental Portfolio and included in the report.

Products, systems, solutions, and services (“elements”) must meet one of the following criteria to qualify for the Environmental Portfolio:

- > **Energy efficiency:** This applies to elements that offer significantly better energy efficiency than a comparable solution. The criterion is an increase in energy efficiency or decrease in power loss of at least 20 percent in the use phase – or a greenhouse gas reduction of at least 100,000 metric tons of carbon dioxide equivalents in the use phase from all installed elements from a given year combined.
- > **Renewable energies:** This criterion covers renewable energies such as wind turbines, solar power plants, and smart grid installations (such as smart meters or smart control mechanisms for energy distribution networks).
- > **Environmental technologies:** Environmental technologies include water and wastewater treatment, air pollution control, waste reduction, and recycling. This criterion also covers elements for e-mobility infrastructure (such as drivetrains or charging stations for electric vehicles). Solutions from the Healthcare Sector can also qualify if major effects for the patient (noise, x-ray radiation) are reduced by at least 25 percent.

Acceptance process

The entire Siemens portfolio is checked each year for possible classification in the Environmental Portfolio based

on the criteria outlined above. This includes both newly developed elements and existing elements that were not qualified earlier because the evidence was not yet available. For elements in the latter category, we report the revenues they generated and their contribution to the reduction in our customers’ carbon dioxide emissions in the previous years on a comparable basis. Elements that no longer meet the qualification criteria are removed from the Environmental Portfolio.

The proposed elements undergo a multi-phase internal check in the appropriate Siemens Division and in the Corporate Sustainability department before being accepted into the Environmental Portfolio. The Siemens Sustainability Board, chaired by Managing Board member and Chief Sustainability Officer Barbara Kux, looks into changes in the composition of the Environmental Portfolio each year. Part of the Sustainability Board’s mandate is to discuss the interests of stakeholders as they relate to specific technologies.

For more details on the methodology we use for our Environmental Portfolio, see pages 26 f.

Ambitious goals for the environment – and for Siemens

The Siemens Environmental Portfolio presents us with tremendous opportunities for growth. Seizing these opportunities and consistently expanding our Environmental Portfolio are therefore key to our sustainability strategy. Specifically, our target is to generate revenues of at least €40 billion from our Environmental Portfolio by the end of fiscal 2014.

Criteria for the Environmental Portfolio

1 Energy efficient products and solutions	2 Renewable energy	3 Environmental technologies
Products and solutions with outstanding energy efficiency qualify Examples: > Combined cycle power plants > High-voltage direct-current transmission > Intelligent building automation	All renewable technologies qualify Examples: > Offshore wind farms > Photovoltaic inverter > Steam turbines for solar energy	All environmental technologies qualify Examples: > Technologies for water treatment > Air pollution control systems > E-car charging stations



< The manufacturing of the new Audi Q3 is especially energy efficient, thanks to innovative products and solutions from the Siemens Environmental Portfolio.

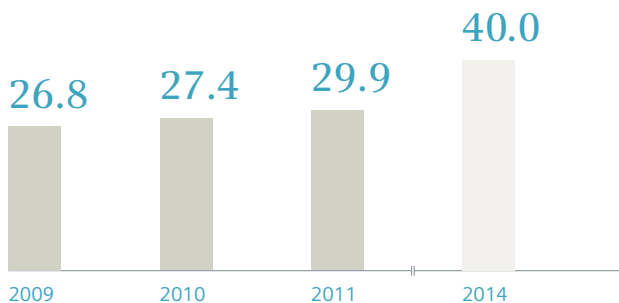
Revenues from the Environmental Portfolio in fiscal 2011 came to €29.9 billion, more than 40 percent of overall revenues at Siemens. Nearly all the Divisions in our Sectors contributed.

Worldwide, our customers also lowered their CO₂ emissions by about another 40 million metric tons with the products and solutions from the Siemens Environmental Portfolio that were newly installed in fiscal 2011. Together with the products and solutions installed in the previous years, which continued to yield CO₂ reductions, the result is CO₂ reductions of 249 million metric tons by our customers. Factoring in the 68 million metric tons of CO₂ reductions attributable to Environmental Portfolio elements from

OSRAM yields 317 million metric tons for fiscal 2011, which meets our target of saving at least 300 million metric tons of CO₂ by our customers.

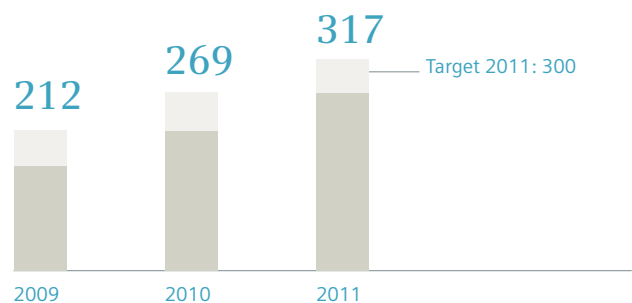
317 million metric tons of CO₂ correspond to the entire annual CO₂ emissions of Tokyo, Hong Kong, Singapore, Delhi, Istanbul, Berlin, London and New York City. To put it another way, the reduction in annual CO₂ emissions corresponds to the emissions of 95 million vehicles comparable to a VW Golf, each driven some 20,000 kilometer annually. At the same time, the technologies of the Siemens Environmental Portfolio are improving the efficiency of our customers and ensuring a long-term reduction in costs.

Revenues from the Environmental Portfolio (in billions of euros)¹



¹ This figure refers to continuing operations and therefore does not include OSRAM revenues. Other changes from the figures reported in the previous year stem from portfolio changes (such as the addition of services for efficient gas turbines).

CO₂ abatement of Siemens customers with products and solutions from the Environmental Portfolio (in million metric tonnes)¹



Legend:
 ■ Annual CO₂ abatement of products/solutions installed in previous years and still in use
 ■ Annual CO₂ reduction from newly installed products/solutions

¹ including OSRAM

Solutions from a single source –
London

London's path to the city of the future

Innovative, state-of-the-art Siemens technologies for infrastructure, transportation, and energy support the economic and financial capital on its path toward a sustainable future.



- > London wants more people to use public transportation, ride bicycles, or walk. That's why since 2003, private vehicles entering the city center have had to pay a congestion charge – collected using Siemens technology.
- < Line 141 features hybrid buses with Siemens ELFA hybrid drive systems. The buses drive very quietly, accelerate without jerk, use much less diesel and emit reduced levels of CO₂.



Ecology drives economy

London has understood the signs of the times. Its government aims to lower the city's CO₂ emissions by up to 60 percent by 2025. Mayor Boris Johnson wants to transform the British capital into one of the most climate-friendly cities in the world. The London of the future should offer its citizens not only opportunities for development, employment, and prosperity but also greater quality of life with clean air, clean drinking water, and low noise pollution. Innovative technologies from Siemens can help London become more livable and environmentally friendly and actually save money in the process.

A history of partnership

For Siemens, sustainability also means treating customers as partners and helping them achieve their goals over the long term. Siemens has had a presence in London for several generations: Carl Wilhelm Siemens, an engineer and brother of company founder Werner von Siemens, settled in the city on the Thames in 1843. In 1850, Siemens opened its first official foreign branch office in

London. Today, more than 700 employees support the city of London with innovative solutions to tackle the challenges of a modern metropolis.

Visionary development

Energy-efficient, easily accessible, and affordable local transportation systems play an important role in making a city an attractive destination with a good quality of life. That's why London is investing in its underground and regional railway system and in electromobility infrastructure. Siemens is contributing the expertise it has honed for decades to help the city manage and integrate its transportation network. The aim is to better harmonize urban transportation developments with the needs of the city's residents, workers, and the environment. The city is taking a similar approach in its energy supply and wastewater treatment, with Siemens at its side as a trusted partner.

- > Siemens will install some 1,300 publicly accessible charging stations for electric vehicles in London by 2013.
- ∨ London's mayor Boris Johnson wants to transform the British capital into one of the most climate-friendly cities in the world.



Mobility made green and easy

A tour of London provides residents and tourists alike with the opportunity to experience many sustainable and highly energy-efficient solutions from Siemens. One highlight is the efficient infrastructures for urban mobility.


Heathrow Express connects London's international airport to Paddington Station in the heart of the city. State-of-the-art Class 322 passenger trains from Siemens shuttle some 17,000 passengers along the route each day, providing a transit option that is both very fast and easy on the environment.

City buses also offer a taste of energy efficiency "made by Siemens." In a trial program, some of London's iconic red double-decker buses are running on hybrid systems using hybrid drive systems from Siemens. This technology achieves a significant reduction in fuel consumption and emissions – and passengers don't even notice the difference. Converting London's entire fleet of buses could reduce annual emissions by 200,000 metric tons of CO₂.



And London's air quality could soon improve even more with more electric vehicles. Transport for London plans to install a network of some 1,300 publicly accessible charging posts for electric vehicles by 2013. Siemens provides the IT infrastructure and control room software for managing the charging posts. As part of London's drive to be the electromobility capital of Europe, electric vehicles do not pay the congestion charge – another incentive for switching to emission-free individual transport.

— Boris Johnson, mayor of London "Through this innovative partnership, Siemens is providing the backbone that will make our city the electric vehicle capital of Europe. With Siemens' help we are delivering the Source London charge point network and enabling Londoners to feel ever more confident that they won't run out of juice when opting for zero-polluting electric driving."



Siemens trains connect London's Heathrow international airport with Paddington railway station in the city center in just 15 minutes. You'd have to allow 50 minutes for the underground, and a taxi usually takes even longer.

15 minutes



Clean energy, efficiently distributed

Anyone who boils water for tea or charges an electric vehicle in London also comes into contact with Siemens innovations. Siemens technologies are used to produce and distribute energy with a special green touch: soon the London Array offshore wind farm will come onto the grid. Siemens is building 175 wind turbines with a total capacity of 630 MW in the outer Thames estuary. London's Canary Wharf business district is already getting its power with the help of Siemens technology. Power here is distributed using more than 50 Siemens NX Plus units – compact, gas-insulated, medium-voltage switchgear that is especially energy-efficient because its space-saving construction reduces transmission losses.

The path to the future: 'The Crystal' – Siemens Centre for Urban Sustainability

Impressive environmental specifications and high energy efficiency at affordable costs are just some of the strengths of the Siemens solutions in London: they reveal their true quality through the added convenience and quality of life they bring to the city's population. The "Siemens Centre for Urban Sustainability" which has been named 'The Crystal' is designed to become the focal point for the city's commitment to energy efficiency and sustainable urban development. Starting in mid 2012, the exhibition and conference center in the heart of London's Green Enterprise District will present visions for the cities of the future.

- √ 175 Siemens offshore wind turbines will generate up to 630 MW of power – enough for around 480,000 UK homes.

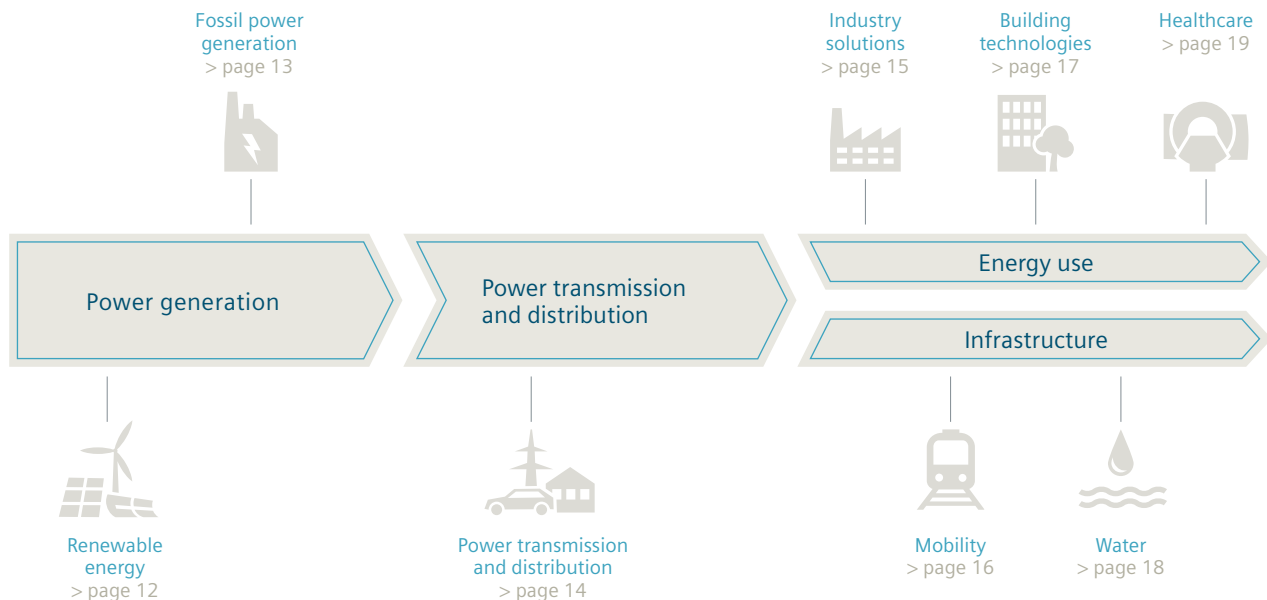


Energy efficiency from production to consumption

The Siemens Environmental Portfolio features products and solutions along the entire energy conversion chain: energy produced with green technologies is transmitted at minimal loss for high-efficiency use. Through systematic innovation, Siemens has achieved an optimal position around the world in the most forward-looking technologies – as evidenced by the following product highlights from the eight categories of the Siemens Environmental Portfolio.

A solar thermal power plant in Spain is one of many innovations in renewable energies. Back in Germany, Siemens holds the world record for efficiency in combined cycle power plants – a prime example of the potential of fossil energy production. In China, Siemens is demonstrating how large amounts of energy can be transmitted more than 1,000 kilometers at low loss through high-voltage direct current lines. Siemens develops efficient industry solutions, winning acclaim for example in steel production for high-efficiency production workflows and highly effective dust filters. In mobility, comfortable and highly reliable inter-

city trains have won over railroads and their passengers in many countries. Siemens succeeded in demonstrating the savings potential of modern building technology in one of the world's tallest skyscrapers in Taiwan, and a major Chinese refinery is investing in state-of-the-art Siemens technology to treat its wastewater. The MAGNETOM Skyra magnetic resonance tomograph is a model of cutting-edge technology – a fast, easy-to-use, energy-saving medical device that provides high-resolution images from inside the human body.



SOLAR THERMAL POWER GENERATION

With the right technology, solar power can be a viable source of energy nearly anywhere in the world. An area of desert just 300 x 300 kilometers – the size of Austria – would be enough to meet the energy needs of the entire world. Solar thermal power plants from Siemens like that in Lebrija, Spain, can play a critical role.

The sun's energy can be converted to electricity in two ways: through photovoltaic, or through solar thermal energy. The basic principle of solar thermal energy production is simple: the sun's rays are bundled using solar collectors and focused on receiver tubes. Depending on the transfer medium – oil or molten salt – temperatures in the receivers climb as high as 600°C, generating steam that is used to drive a steam turbine. A generator converts the motion of the turbine into electricity.

Lebrija lies in Spain's hot and arid region of Andalusia. The Siemens solar power plant here produces green energy for 50,000 households. Over 6,000 collectors, each with 28 mirrors, bundle the sunlight over an area of more than 400,000 square meters. Glass tubes in the focal line – so-called solar receivers – convert the solar radiation into thermal energy. A special oil heated to nearly 400°C functions as a transfer medium, circulating through heat exchangers to produce water vapor. From this, a Siemens SST-700 DRH steam turbine working under optimal conditions can generate 50 megawatts of electricity – with zero CO₂ emissions.

In Lebrija, Siemens is already deploying technology for the Desertec Industrial Initiative, which aims to meet 15 to 20 percent of Europe's energy needs in 2050 through energy from solar thermal power plants and wind farms in Africa and the Middle East. Siemens stands ready with advanced components such as solar fields, solar receivers, steam turbines, generators, complete solar power plants, and low-loss high-voltage direct current technology capable of transmitting across thousands of kilometers.



^ Giant parabolic mirrors in the Lebrija solar power plant collect the sun's energy and use it to generate electricity for up to 50,000 households.

Further Environmental Portfolio examples in the category renewable energy

> Offshore wind power

Offshore wind power supplies green energy for hundreds of thousands of households – reliably and efficiently.

> Photovoltaic

Photovoltaic arrays with Siemens inverters already meet the energy needs of millions of private households.

> Biomass

Siemens delivers highly efficient turbines and generators for producing climate-friendly electricity and heat from biomass.

↳ www.siemens.com/ep/renewable-energy

EFFICIENT COMBINED CYCLE POWER PLANTS

The future of energy production lies in a balanced energy mix. Fossil sources have just as vital a role to play here as renewable energies, because fossil fuels provide a stable basis for a reliable global power supply. Modern gas turbines, high-efficiency combined cycle power plants (CCPP), and combined heat and power plants from Siemens show how climate protection and energy production from fossil fuels can go hand in hand.

An outstanding example from the Siemens Environmental Portfolio is the new generation of CCPPs, which use one-third less natural gas per generated kilowatt hour than the worldwide average among CCPPs in operation today. Since May 2011, Siemens has held the current world record for CCPPs with a (net) efficiency of more than 60 percent. The world's largest gas turbine – the Siemens SGT5-8000H with an output of 375 megawatts – can be found at work in the Ulrich Hartmann CCPP 90 kilometers north of Munich. Combined with the SST5-5000 steam turbine, the Ulrich Hartmann plant delivers 561 megawatts, enough to supply a city the size of Berlin with its population of some 3.3 million.

Improved energy efficiency also brings critical reductions in carbon dioxide and nitrogen oxide emissions. The combination of gas and steam turbines results in a reduction of 43,000 metric tons in annual carbon dioxide emissions compared with earlier CCPPs.

The Ulrich Hartmann plant is also setting new technological standards when it comes to flexibility of operation: fast-responding plants with sophisticated control technology are essential to absorb and offset fluctuations in the feed to the grid and thus accommodate the growing energy needs of tomorrow. During test operations, the Ulrich Hartmann plant was able to make an additional 500 MW available within just half an hour.

Further Environmental Portfolio examples in the category fossil power generation

> Air pollution control systems

Siemens has an extensive portfolio of solutions for reducing airborne pollutants in a wide range of applications.

> Modernizing coal-fired power plants

Siemens equips coal-fired power plants with the latest technology to boost efficiency and cut carbon emissions.

> Removing carbon dioxide from fossil power plants

Post-combustion capture reduces fossil power plants' carbon emissions and environmental footprint.

↳ www.siemens.com/ep/fossil-power-generation



^ The combined cycle power plant boasts an efficiency of over 60 percent. The gas turbine, the generator and the steam turbine are mounted together on a single shaft.

Power transmission and distribution

High-voltage direct-current transmission

> China

> Yunnan



< At the heart of the source of the high-voltage direct current transmission line in Yunnan is the valve hall. It is here that alternating current is converted to direct current. At the destination in Guangdong, it is then converted back to alternating current.

HIGH-VOLTAGE DIRECT-CURRENT TRANSMISSION

How do you provide more than five million households with hydroelectric power if the power source is more than 1,400 kilometers from the households? The answer: with high-voltage direct current transmission (HVDC). A Siemens HVDC transmission line in China connects – with almost no loss – hydroelectric plants in the remote, rainy Yunnan province to the highly industrialized Guangdong region and its megacities Guangzhou and Shenzhen.

The new “electricity superhighway” transmits 5,000 megawatts, the output of five major power plants. The heart of the transmission station in Yunnan is two enormous 800-kilovolt (kV) ultrahigh-voltage converter systems developed and manufactured at Siemens in Nuremberg. The HVDC system works with two poles – one with plus 800 kV and the other with minus 800 kV. This new, ultrahigh voltage level makes it possible to transport huge amounts of electricity across vast distances affordably and with low loss. At 5,000 megawatts, the transmission losses of the 800-kV HVDC line are just 2.7 percent per 1,000 kilometers. Add to this less than 1.5 percent loss for the two converter stations on the transmitting and receiving end of the line. In the case of the new electrical transmission line between Yunnan and Guangdong, the losses are about 50 percent less than for a three-phase AC transmission line with a comparable voltage and line width.

HVDC technology from the Siemens Environmental Portfolio, which pays for itself at outputs of 1,000 megawatts or

more and distances of 600 kilometers and up, will facilitate other groundbreaking projects with the renewable energies of tomorrow. Potential applications include connecting offshore wind farms and transmitting power thousands of kilometers from desert-based wind and solar plants to Europe.

Further Environmental Portfolio examples in the category power transmission and distribution

> Efficient transformers

In operation in more than 100 countries, Siemens’ high-quality transformers are the product of more than 100 years of innovation, expertise and experience.

> Gas-insulated transmission lines and switchgear

In many places, gas-insulated switchgear and transmission lines are replacing conventional air-insulated gear and overhead power lines.

> The basis for smart grids

Smart metering systems like Siemens’ AMIS are paving the way for tomorrow’s smart grids.

↳ www.siemens.com/ep/power-transmission-distribution

EFFICIENT STEEL PRODUCTION

Global steel production grew 6.8 percent from 2010 to 2011 to a record level of more than 1.5 billion tonnes. Today's innovative technologies can ensure that further growth does not come at the expense of the environment. Steel production is extremely energy-intensive and generates high levels of emissions, including huge volumes of greenhouse gases that negatively affect the climate. But the latest products and solutions from the Siemens Environmental Portfolio demonstrate that modern steel production can be efficient and environmentally friendly.

The iron and steel industry is facing the daunting challenges of satisfying a large and fluctuating demand and lowering costs in a competitive global environment while meeting ambitious environmental targets. The latest generation of Siemens scrap-melting electric steel furnaces is the culmination of over 40 years of expertise and innovative spirit. A combined strategy of efficiency and environmentalism has yielded a continuous reduction in energy requirements per ton of produced steel. Process management and process control alike are designed to streamline production processes by using fewer resources and reusing resources, for example. Today's furnaces use less fresh water, and used water is purified for reuse. Modern de-dusting systems meet or exceed relevant environmental regulations, protecting the environment and our quality of life.



Further Environmental Portfolio examples in the category industry solutions:

> Efficient drive systems

As a leading provider of energy-saving motors and frequency converters, Siemens offers solutions that help protect the environment and reduce costs.

> Energy-saving container cranes

The latest generation of Siemens ECO-RTG provides enhanced control features for operating RTG gantry cranes.

> Efficient positioners

Siemens SITRANS VP300 and SIPART PS2 are smart electropneumatic positioners with exceptionally low air requirements.

↳ www.siemens.com/ep/industry-solutions

The optimized SIMETAL EAF Quantum electric arc furnace uses 280 kW/h per metric ton of steel, for example, much less energy than similarly productive conventional electric arc furnaces. Combined with a lower consumption of electrode material and the targeted use of oxygen lances, and without the use of conventional burner technology in the furnace, operators can achieve CO₂ reductions of some 20 percent with an overall cost advantage of about 20 percent as well.

< At Çolakoğlu Metalurji A. S. in Gebze, Turkey, an energy-efficient SIMETAL EAF Ultimate electric arc furnace produces up to 350 metric tons of steel an hour.

HIGHSPEED TRAINS

Trains have the lowest per-passenger CO₂ emissions. They also compare favorably to other modes of transport for their cost-effective energy balance. The Velaro and ICx multiple units from Siemens are especially energy-efficient.

For distances up to 1,200 kilometers, the Velaro high-speed train beats flying: train passengers reach their destination faster while creating less of a burden on the environment. Despite travel speeds of up to 350 kilometers per hour, the Velaro consumes the equivalent of just 0.33 liters of gasoline equivalents per passenger capacity per 100 kilometers. As it travels, it produces only about 14 grams of carbon dioxide per person and kilometer compared to the 140 grams of an airplane. The efficiency and environmental friendliness of the Siemens Velaro are the result of smart energy management and outstanding aerodynamics. Different types of high-speed trains provide reliable service in Russia (Velaro RUS "Sapsan"), China (Velaro CN), Germany (Velaro D "ICE 3"), and Spain (Velaro E).

Deutsche Bahn will debut the Siemens Intercity ICx in December 2016, an ultra-green multiple unit capable of carrying up to 724 passengers and traveling 250 km/h. The newly developed ICx multiple unit platform is unusually light despite its generous seating capacity. Weight is reduced thanks to sophisticated innovations like the combination of lightweight inner-bearing carrying bogies with weight-optimized power bogies. The 200-meter ICx tips the scales some 20 metric tons lighter thanks to its more lightweight construction. This, together with the improved aerodynamic profile of the ICx, yield energy consumption that is up to 30 percent below comparable trains in Deutsche Bahn's current rolling stock. From an environmental standpoint, this gives Siemens an especially powerful argument for the role of trains.



^ The ICx will be the backbone of Deutsche Bahn's future long-distance rail service. The order of 220 trains has a potential volume of some €6 billion – the largest order that Siemens has won in its more than 160-year history.

Further Environmental Portfolio examples in the category mobility

> Metro trains

Inspiro, Siemens' new metro platform, unites low lifecycle costs with excellent passenger comfort and outstanding environmental performance.

> Locomotives

As environmental awareness grows and new logistics strategies gain ground, rail's importance is expanding, and with it the need for new locomotives.

> Intelligent traffic solutions

Siemens offers intelligent solutions for urban traffic management and information systems.

↳ www.siemens.com/ep/mobility

EFFICIENT BUILDING AUTOMATION

Buildings account for 40 percent of global energy consumption and 21 percent of CO₂ emissions, so there is a great potential need for energy-efficient Siemens technologies. Taipei 101 sets new standards for skyscrapers, and Siemens is an advisor and primary supplier of building control systems, building management systems, and security solutions for the world's tallest "green" building.

At 508 meters, the Taipei 101 tower in Taiwan is among the tallest in the world. In 2011 – eight years after its completion – the skyscraper was awarded LEED platinum certification for energy efficiency and environmental design. This is the highest category of LEED (Leadership in Energy and Environmental Design), the world's most important certification system for green buildings. Siemens played a key role in the certification process: between 2009 and 2011, the building automation was optimized and the energy efficiency im-



^ Taipei 101 in Taiwan is a particularly energy-efficient skyscraper. It won LEED Platinum certification following an energy optimization overhaul in which Siemens played a crucial role.

Further Environmental Portfolio examples in the category building automation

> Energy performance contracting

Energy performance contracting offers customers guaranteed improvements in buildings' energy performance without the need to expend capital.

> Energy Health Check

Energy Health Check plus is designed to identify buildings' potential savings and forms the basis for Siemens' comprehensive energy optimization program.

> Home automation

With the Synco living home automation system, occupants and building managers can cut energy consumption and costs.

↳ www.siemens.com/ep/building-technology

proved. A Siemens energy monitoring and control system runs the heating, ventilation, and air conditioning technology. Improved algorithms and modified operating hours have yielded much greater efficiency in the air conditioning system. Taipei 101 uses some 30 percent less energy than average buildings.

Implementing the measures needed to obtain LEED Platinum certification means the tower is saving nearly 3,000 metric tons of CO₂ annually. Water consumption is also down by 28,000 cubic meters. And electrical use is 4.8 million kWh a year lower than before the energy optimization.

Siemens technologies for energy-efficient buildings can make serious contributions to protecting natural resources anywhere in the world. The investments are often amortized within just a few years thanks to costs savings that continue throughout the life cycle of the building.

WASTEWATER TREATMENT

Around the world, rivers are a backbone of industry and transportation infrastructure. And clean rivers are an important element in quality of life. To help preserve clean rivers, Siemens is commissioning a latest-generation industrial wastewater treatment system in the Chinese city of Anqing in 2012.

One drawback of a flourishing refinery is large volumes of oily, saline wastewater, and the plant run by China Petroleum & Chemical Corporation (Sinopec Corp.) in Anqing is no exception. Starting in 2012, state-of-the-art Siemens treatment technologies will clean the wastewater so thoroughly that it will meet China's standards for surface drainage and can be fed into the Yangtze. In so doing, the new Siemens wastewater treatment system will play an important role in protecting the world's third-longest river.

Siemens uses the PACT (powdered activated carbon treatment) system for the Anqing refinery wastewater, a single-step process that combines biological treatment and activated carbon absorption to remove organic impurities. The resulting sludge is treated in a Zimpro WAR (wet air regeneration) system, which regenerates the activated carbon while breaking down organic solids. The sludge would otherwise have to be buried or incinerated, so this also reduces the refinery's operating expenses.

With a capacity of 1,000 cubic meters per hour, the Siemens technology not only offers better treatment of the refinery's wastewater, it also yields about 500 cubic meters of water each hour that can be re-used in the refinery's cooling

towers. A Hydro-Clear sand filter provides high-flow filtration of the contaminated water. The lessened demand for fresh water leads to other cost savings. A compact design means that the Siemens wastewater treatment system also has a relatively small footprint. Thanks to positive results and the customer satisfaction this has brought, the Anqing project is now the seventh of its kind that Sinopec Corp. has realized together with Siemens.

Further Environmental Portfolio examples in the category water

> Industrial reuse and recycling

Siemens helps companies reduce their use of fresh water with innovative reuse and recycling technologies.

> Sustainable wastewater treatment

Siemens' wastewater treatment solutions increase energy efficiency and reduce biosolids output.

> Water infrastructure

Siemens' solutions for improving water and wastewater systems meet today's financial, regulatory and environmental demands.

↳ www.siemens.com/ep/water

> Various state-of-the-art Siemens technologies work together to treat wastewater for reuse at Sinopec Corp.



MAGNETIC RESONANCE IMAGING

Early and confident diagnoses are the first critical step in healing many illnesses. Hospitals and doctor's offices around the world get the support they need to achieve this goal using state-of-the-art medical technology from Siemens. The 3 Tesla magnetic resonance imaging (MRI) system MAGNETOM® Skyra helps increase productivity while providing excellent image quality and superior energy efficiency.

Energy conservation is certainly not one of the first things doctors and hospital administrators look for when selecting an MRI scanner. But Siemens researchers and engineers – in their pursuit of more confident diagnoses and efficient medical processes – are also dedicated to making their products more environment-friendly. MAGNETOM Skyra is more efficient than its predecessor, using on average 20 percent less energy per patient. Thanks to its Zero Helium boil-off technology, this system uses no helium during normal operation. The Green Cooling Package option helps reduce the energy consumed for cooling even more by up to 50 percent.

MAGNETOM Skyra is equipped with Tim® (Total imaging matrix) 4G and Dot® (Day optimizing throughput) technologies for energy and cost-efficient processes. Tim 4G coil technology produces excellent image quality, while Dot helps take the complexity out of MRI scanning. The integration of Tim and Dot can increase productivity by up to 50 percent,¹ while also providing more consistent image quality. MAGNETOM Skyra also features the mobility of the Tim Dockable Table and DirectConnect™ cableless coils for easier exam setup. The 70 centimeter Open Bore design as well as the Illumination Moodlight™ lighting option helps reduce patient anxiety and provide a more comfortable scanning environment.

MAGNETOM Skyra from the Siemens Environmental Portfolio shows that technological innovations can enhance image quality, productivity, and energy efficiency all at the same time.

¹ Data on file, results may vary.

Further Environmental Portfolio examples in the category healthcare

> Computer tomography

The Somatom Definition Flash computer tomograph scans an average heart in about ¼ second and with a very low dose of radiation.

> Biograph mCT

The next-generation dual-modality device, Biograph™mCT, reduces total patient exam time, energy and injection dose at the same time.

> Refurbished Systems

Refurbished Systems guarantee high quality at a fair price: Siemens refurbishes used medical devices in line with nature's cycle principle.

↳ www.siemens.com/ep/healthcare



^ Excellent comfort for patients, enhanced image quality, reduced total cost of ownership, and very green: MAGNETOM Skyra, installed for example in San Luis Obispo, California.

Solutions from a single source –
Seat Martorell

Energy-efficient automotive production

Spanish automaker Seat has set lofty environmental goals for its main factory in Martorell near Barcelona. Production here is particularly energy-efficient thanks to products and solutions from the Siemens Environmental Portfolio.



- > Juan Ramon Rodriguez is director of Seat main plant, one of Spain's largest factories, where some 13,000 employees produced over 300,000 vehicles in 2010.
- < A new car body production facility with 450 robots was built in Martorell for the Audi Q3. Siemens, as a long-time partner to Seat, provided the energy-efficient electrical equipment for the new facility.



The challenge of energy efficiency

“The energy needed to produce one vehicle is as important to Seat today as the number of person-hours per unit was just a few years ago.” Plant director Juan Ramon Rodriguez is proud of the progress made by Seat in Martorell, near Barcelona. Seat’s main factory beat out other sites in the Volkswagen Group to win the production-contract for the Audi Q3.

An important factor when comparing the key indicators of the various plants is their energy efficiency. Over the long term, says Rodriguez, he and his employees will not be measured by their economic success alone: “One of the goals of our environmental strategy is to lower the energy needed to produce one vehicle by two percent annually.”

The director credits much of the progress made in energy efficiency to its long-standing collaboration with Siemens: “Siemens engineers and managers understand our goals and our specific needs. We work together very closely with a long-term perspective.” Another sign of the importance of energy conservation is the implementation of an ISO 50001 energy management system. Seat in Martorell is among the European early adopters of the new standard and in 2011 became the first Spanish company to gain certification.

Common goal: energy-saving production

The new high-tech production facility for the Audi Q3 shows how much Siemens can contribute to energy efficiency. The car bodies are automatically controlled, moving on their own from one position to the next over two floors. Efficient electric motors from the Siemens Environmental Portfolio drive the assembly lines and elevators.

Siemens SIRIUS soft starters are used to bring the motors up to their target frequency with a minimal impact on energy and resources, and Siemens SINAMICS frequency converters are used during braking to recapture part of the energy expended for the conveyance technology and feed it back into the grid. Seat puts its trust in Siemens when it comes to switching and protection technology as well: The devices have low inherent losses. They don’t heat up as much in operation as comparable solutions, so the control cabinets do not require as much cooling – one example of how energy consumption and system investments are reduced.

— Juan Ramon Rodriguez, director of Seat’s Martorell plant **“An important criterion when purchasing electric motors for production facilities is life cycle costs – operating costs alone can account for a relatively high percentage of total costs.”**



- < Siemens SIRIUS soft starters at work in the Seat production facility are used to bring the electric motors up to their target frequency with a minimal impact on energy and resources.
- ∨ Seat uses control cabinets with Siemens SINVERT solar inverter systems to effectively and economically feed the surplus from the solar modules on the roof of the plant back into the energy grid.

From automobile production to energy production


Using less energy is good. Even better is when then energy comes from renewable energy sources or when production is highly efficient. That's why Seat in Martorell generates some of its own electricity – from photovoltaic installations using Siemens inverter systems and with a Siemens gas turbine.

Some 20,000 solar panels across 130,000 square meters cover the roofs of the Seat production and shipping facilities. In its initial phase since early 2011, the "Seat al Sol" project has reached a peak output of 8 MW, thereby reducing emissions by some 5,600 metric tons of CO₂ annually. At the heart of the project to produce clean solar energy are SINVERT solar inverter systems from the Siemens Environmental Portfolio, which convert the generated energy for infeed into the grid at very low cost and a very high efficiency of over 98 percent. More solar panels and SINVERT solar inverter systems are already on order. Seat plans to cover an area of 320,000 square meters with a peak capacity of 10.6 MW by the end of 2012, making it the largest solar energy production facility in the European automotive industry.

On-site power plant

Photovoltaic installations don't generate any power at night, but automotive production continues. A gas turbine has eliminated Seat's dependence on both solar power and the public electrical grid while generating process heat for production. Although its current turbine still worked fine, Seat has upgraded at the end of 2011 to the top model from the Siemens Environmental Portfolio. The latest Siemens gas turbine SGT-400, with improved output and efficiency, uses much less natural gas than the currently installed product while delivering the same output. This means that the upgrade pays for itself and also improves the eco-footprint of the Seat production site.





The photovoltaic project at the Martorell plant has been dubbed "Seat al Sol". An area the size of more than 40 soccer fields will be covered with solar panels by the end of 2012. Siemens SINVERT solar inverter systems provide effective and affordable conversion of the generated electricity for grid infeed.

"Seat al Sol"

This is the potential reduction in the energy consumption of the hoisting drive of a high-bay racking system when conventional frequency converters are replaced by state-of-the-art SINAMICS frequency converters. In Seat's fully automated engine storage facility, Siemens frequency converters feed the energy gained during braking back into the grid.

52 percent



— Juan Ramon Rodriguez, director of Seat's Martorell plant "It always makes sense for us to turn to Siemens for new ideas about optimizing energy efficiency in production."

Brake for energy

Seat is improving its energy efficiency with many Siemens products and solutions. For example in the automated high-rack storage facility for engines: key components of the integrated automation and drive solution come from the Siemens Environmental Portfolio. State-of-the-art SINAMICS frequency converters feed the energy generated from braking the hoisting drives of the high-bay racking systems back into the grid. The result is energy consumption less than half of that required by standard frequency converters.



What is the trend of energy use?

To save energy, you need precise data on your current consumption. The Siemens energy management system B.Data gives Seat's energy controllers the information they need. The software enables seamless source-related monitoring of energy and material flows. Thanks to Siemens B.Data, Seat knows exactly when and where energy is used, so it can develop detailed plans to increase efficiency. Source-related allocation of consumption also makes it possible to set incentives for energy-saving programs within the company.

One area in which B.Data reports declining energy consumption is in the paint shop, where some 45 percent of energy consumption in automobile production typically occurs. To improve efficiency, Seat replaced the electrical drive mechanisms of the large ventilators with SINAMICS systems from the Siemens Environmental Portfolio. The state-of-the-art frequency converters continuously adjust the power consumption of the electrical motors operating at partial load to current needs. This enables energy savings of up to 60 percent and more over mechanical solutions such as throttle valves. Seat is saving so much energy that the frequency converters will pay for themselves after a short time.



- ^ Siemens SINAMICS frequency converters are used to efficiently supply energy to electrical drive units in many areas of the Seat production plant.
- < High-efficiency electrical motors from the Siemens Environmental Portfolio drive the transportation technology for car bodies in Seat's main factory in Martorell.

Unequivocal reporting methodology

Siemens adheres to internationally accepted practices in its financial and sustainability reporting. But currently, there are no international standards that define “green” products or the reporting of the corresponding revenues and greenhouse gas reductions. Siemens has responded by developing its own standard for quantifying and reporting on its Environmental Portfolio. This standard is based on the principles of the official Greenhouse Gas Protocol. Since 2007, the results have been verified annually by an independent auditor.

Our comprehensive internal “Environmental Portfolio Guideline” defines roles and responsibilities as well as the criteria and processes for quantifying elements for the Environmental Portfolio. It also establishes the process for determining revenues and customer CO₂ savings. The Siemens Guideline is based on the principles of relevance, completeness, accuracy, consistency, transparency, and caution as enshrined in the documents “A Corporate Accounting and Reporting Standard – Revised Edition” and “GHG Protocol for Project Accounting” of the Greenhouse Gas Protocol Initiative. Revenues are calculated using the same principles applied to financial reporting.

Selecting a baseline

Energy savings and CO₂ reductions – the “energy efficiency” qualifying criterion for the Environmental Portfolio – are substantiated by comparison to a reference solution (baseline) using one of three methods:

> The before-after comparison is based on the difference between the customer’s situation at the outset and the situation following the installation of an element from the Environmental Portfolio. This comparison is used when upgrading a power plant, for example, or optimizing the energy efficiency of a building (energy performance contracting).

> A direct comparison with a specific, comparable reference technology measures the difference between an element of the Siemens Environmental Portfolio and an appropriate benchmark technology. The benchmark is generally a comparable, readily available product, solution, or legacy product. An example of this is comparing high-voltage direct current transmission with conventional alternating current transmission.

> The comparison with the installed basis measures the difference between an Environmental Portfolio element and the average for the same or comparable function achieved by the existing market technology (installed basis). This comparison is used for example with combined cycle power plants (CCPP) or trains or generally in cases in which average global emission factors for electrical use or generation are relevant.

Focus of Environmental Portfolio and exclusion criteria

Qualification for the Environmental Portfolio relates primarily to the use phase: we look at the positive effects for our customers, but we also rate the Environmental Portfolio elements by so-called adverse effects to rule out mistakenly classifying a product in the Environmental Portfolio that in other life cycle phases is significantly **costlier** than a different solution.

Products and solutions destined for use by the military or for nuclear power cannot qualify for the Environmental Portfolio. What matters is the nature and scope of the actual usage, not the customer group classification.

Services are included in the Environmental Portfolio if they relate to a product in the Environmental Portfolio or the service itself meets the qualifying criteria. Core components also qualify if they are essential for the positive environmental benefit of the overall application and critical to the functionality of the application. Examples include gear units for wind turbines or thyristor valves for high-voltage direct current transmission. Simply being part of an environmentally friendly solution is not enough, however.

To be on the safe side, products and services are not listed in the Environmental Portfolio if there is any ambiguity as to whether they meet the qualifying criteria.

Emission factors for calculating CO₂

The energy production emission factors we use in our calculations are based on data of the International Energy Agency (IEA) on gross energy production and net losses, data of the Intergovernmental Panel on Climate Change (IPCC) on fuel emission factors, and our own analyses of energy production efficiency.

For consistency, we always apply global emission factors when calculating reductions in emissions. We apply an emission factor of 867 g/kWh to calculate the CO₂ reduction of wind turbines, for example.

Category	Emission factor (grams of CO ₂ /kWh)	Basis of comparison for element from Environmental Portfolio
Global energy production, all sources	585	Energy production without renewables
Global energy production, fossil sources	867	Energy production from renewables
Energy use (including 9.3% transmission losses)	640	All types of energy use (except trains)
Energy use by trains (including 6% transmission losses)	620	Trains

Our approach always includes all the greenhouse gases covered by the Kyoto Protocol. In practice, however, carbon dioxide is almost exclusively relevant when it comes to energy production and electrical applications. Our calculations take into account any other greenhouse gases emitted in technical applications (such as switchgear). For the products and solutions installed in a given fiscal year, we calculate the emission reductions for the entire fiscal year.

If the Siemens solutions are used in subsequent years as well, we factor them into the CO₂ reductions of these years. If Siemens provides only core components, the customer's CO₂ savings are reported only proportionally.

With some of our Environmental Portfolio elements, we do not know the exact operating parameters of our customers, so to be on the safe side, we apply conservative estimates by experts.

The CO₂ emissions from the production of the various products, systems, solutions, and services in the Siemens production facilities are included in our own CO₂ footprint, not in the emissions calculated for the Siemens Environmental Portfolio.

Independent limited assurance engagement

For the fiscal year 2011, as in previous years, we engaged an independent auditor to perform a limited assurance engagement of our Environmental Portfolio Report. The results of this engagement are documented in an independent assurance report. This report is available together with significant disclosures on the Environmental Portfolio 2011 in the "Environmental Portfolio Report 2011", which is published in English on the internet at www.siemens.com/epreport.

Disclaimer

There is no standard system that applies across companies for qualifying products, systems, solutions, and services for environmental and climate protection, or for compiling and calculating the respective revenues and the quantity of reduced carbon dioxide emissions attributable to such products and solutions. Accordingly, revenues from our Environmental Portfolio and the reduction of our customers' annual carbon dioxide emissions may not be comparable with similar information reported by other companies. Revenues from our Environmental Portfolio and the reduction of our customers' annual carbon dioxide emissions are derived from various internal reporting systems that are generally different from those applicable to the financial information presented in our Consolidated Financial Statements and are, in particular, subject to less sophisticated internal documentation as well as preparation and review requirements, including the IT systems in use and the general internal control environment. We may change our policies for recognizing revenues from our Environmental Portfolio and the reduction of our customers' annual carbon dioxide emissions in the future without previous notice.

This document contains forward-looking statements and information – that is, statements related to future, not past, events. These statements may be identified by words such as “expects,” “looks forward to,” “anticipates,” “intends,” “plans,” “believes,” “seeks,” “estimates,” “will,” “project” or words of similar meaning. Such statements are based on the current expectations and certain assumptions of Siemens' management, and are, therefore, subject to certain risks and uncertainties. A variety of factors, many of which are beyond Siemens' control, affect Siemens' operations, performance, business strategy and results and could cause the actual results, performance or achievements of Siemens to be materially different from any future results, performance or achievements that may be expressed or implied by such forward-looking statements. More detailed information about certain of the risk factors affecting Siemens is contained in Siemens' filings with the SEC, which are available on the Siemens website, www.siemens.com, and on the SEC's website, www.sec.gov. Should one or more of these risks or uncertainties materialize, or should underlying assumptions prove incorrect, actual results may vary materially from those described in the relevant forward-looking statement as expected, anticipated, intended, planned, believed, sought, estimated or projected. Siemens neither intends to, nor assumes any obligation to, update or revise these forward-looking statements in light of developments which differ from those anticipated.

Address

Siemens AG
Wittelsbacherplatz 2
80333 Munich
Germany

Contact

Project lead: Ralf Pfitzner
Content responsibility: Michael Lakota
Project coordination: Christina Lorenz
Email: sustainability@siemens.com

Further information

This brochure is also available in German.
Both the English and German versions are available online at:
www.siemens.com/ep-brochure
www.siemens.com/up-broschuere

Ordering the brochure

Siemens employees
Intranet <https://c4bs.gss.siemens.com>
Fax + 49 911 654 - 4271
English Order no. L2-Z800-x-7600
German Order no. L2-Z800
When placing your orders, please specify your full delivery address and Org-ID.

Legal note

Designations used in this brochure may be trademarks, the use of which by third parties for their own purposes could violate the rights of their owners.

Text/Design and production

Complan Medien GmbH, Berlin – Bonn – Hamburg
häfelinger + wagner design GmbH, Munich

© 2012 Siemens AG, Berlin and Munich

Ecofriendly production

This brochure has been produced with particular attention to using chlorine-free bleached materials and climate-friendly production processes. In accordance with the Forest Stewardship Council™ (FSC), the paper used was made only from wood from controlled sources such as managed forests. The mill in which the paper was manufactured is certified in accordance with the ISO 9001, 14001 and 18001 standards. It uses only chlorine-free bleached (TCF) cellulose, which in some cases is even elemental chlorine-free (ECF).





Order no. L2.Z800.X.7600