

# Environmental concerns speed growth in wind, rail and water industries

Our world is searching for ways to reduce carbon dioxide emissions and preserve natural resources without stifling economic growth or social progress.

This is no simple task. The challenges before us are enormous and complex.

- The world's energy needs could be almost 50 percent higher in 2030 than they are today, according to the International Energy Agency. Since fossil fuels dominate the fuel mix today, no change in energy use inevitably means large increases in CO<sub>2</sub> emissions and even greater reliance on imported oil and gas.<sup>1</sup>

Energy is the engine of our economy and, while we will remain dependent on fossil fuels for many years, the good news is that sustainable technologies such as wind are becoming true alternatives.

- By 2025, the U.N. predicts 1.8 billion people will live in conditions of absolute water scarcity, and fully two-thirds of the world will endure water stress, just barely able to meet their water requirements for agriculture, industry, domestic purposes, energy and the environment.<sup>2</sup>

Our planet is blue, but only 3 percent of its water is fresh and drinkable. Technology exists to effectively manage the unprecedented surge in demand for our freshwater resources.

- The price of crude oil jumped nine-fold in eight years, from about \$16 per barrel in 1999 to a peak of \$147 pb in July 2008. It has since fallen by more than half, but this kind of volatility raises deep concerns about the long-term affordability of energy supplies and predictability of energy costs.

The days of cheap fuel and worrying about emissions “later” are behind us. The world is eager for alternatives to fossil-fuel, and rail transport is an old idea whose time has come again.

Demand for new solutions is growing rapidly in a variety of industries that are helping reduce carbon dioxide emissions, improve congestion in our cities, conserve natural resources and preserve our way of life.

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<sup>1</sup> International Energy Agency World Energy Outlook 2008

<sup>2</sup> UNEP Global Environmental Outlook 4, 2007

ABB is committed to delivering sustainable technology solutions for each one of these challenges. With that in mind, we have identified three fast-growing industrial areas where a broad offering of our products and services portfolio is particularly relevant to our customers. These areas include wind energy, water and rail transportation.

This press kit outlines the prospects within each of these industries, describes the opportunities for ABB, and presents examples in each area of our technology in action.

# Background information

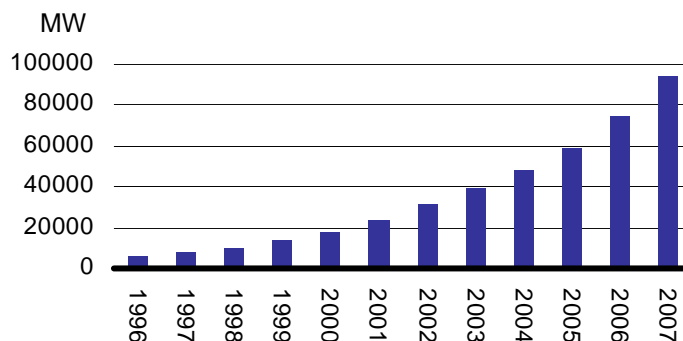
## Wind, water and rail

### Industry prospects: Wind

The International Energy Agency predicts the world's energy needs will be almost 50 percent higher by 2030 than they are today. Global demand for electricity grew 24 percent between 2000 and 2006, and is expected to nearly double by 2030.<sup>3</sup>

The IEA also predicts that CO<sub>2</sub> emissions will rise by the same amount by 2030, unless steps are taken immediately to accelerate the deployment of emission-free power generation and improve current levels of energy efficiency.

Global cumulative installed wind power capacity, 1996-2007



Source: Global Wind 2007 Report, Global Wind Council

The wind power industry has developed into a powerful alternative to the grim scenario of energy consumption and carbon emissions endlessly rising together. As a result, the sector has expanded exponentially, fueled by increasing energy demand and a focus on renewable alternatives, as well as technical improvements and wind power's new found competitiveness versus traditional methods of power generation.

Also at play is a desire by many countries to reduce their dependency on fossil-fuel imports from politically unstable markets. By the end of 2007, accumulated global wind power capacity was about 94,000 megawatts (MW), an increase of 25 percent compared to the end of 2006.<sup>4</sup>

<sup>3</sup> International Energy Agency, World Energy Outlook, 2008

<sup>4</sup> The Wind Forecast, MAKE consulting, October 2008

## Increasingly competitive technology

In terms of technology, the industry has grown by leaps and bounds. Since the early 1980s, wind turbines have increased their power generating capacity by a factor of more than 200, according to the European Wind Energy Association (EWEA).

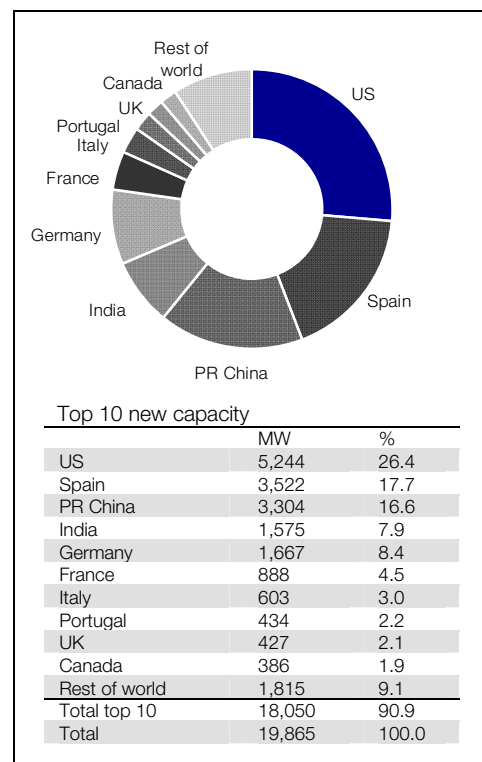
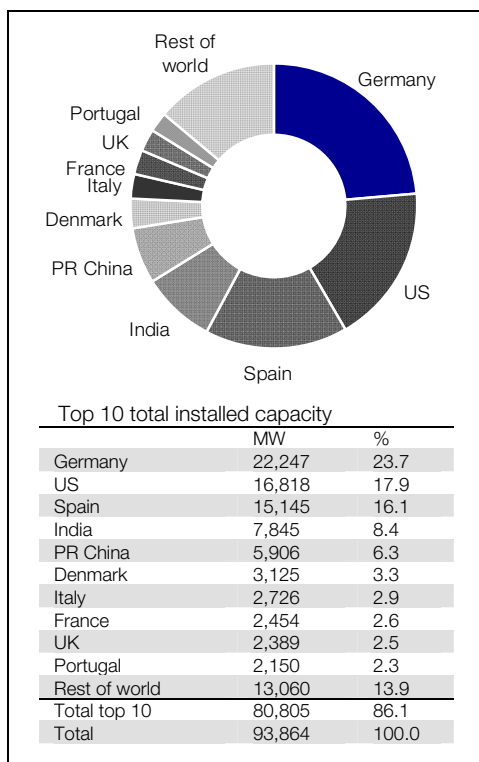
In the beginning, turbines were a few stories high and could generate about 50 kilowatts of power. A single machine installed today can have blades longer than a football field, and is capable of generating 7 MW of power - enough to meet the yearly power needs of 4,250 average European homes.<sup>5</sup>

Encouraging renewable technologies such as wind power is one of the ways the European Union plans by 2020 to cut greenhouse gas emissions by 20 percent from their 1990 levels, and ensure that 20 percent of energy use comes from renewable sources, such as wind and solar power.

EWEA estimates that the wind-power capacity installed in Europe by the end of 2007 – a total of 56,500 MW – will avoid the emission of about 90 million tonnes of CO<sub>2</sub> per year.<sup>6</sup> This is equivalent to taking 37.5 million cars off the roads of Europe, or 17 percent of all the registered passenger cars in the region.<sup>7</sup>

## Growth in all regions

While Germany retains the largest wind generation capacity, the industry has strong growth rates in China and India, and is growing fastest in the United States.



Source: Global Wind 2007 Report, Global Wind Energy Council

<sup>5</sup> European Wind Energy Association, Wind Benefits, 2008

<sup>6</sup> European Wind Energy Association, Wind Benefits, 2008

<sup>7</sup> The European Automobile Manufacturers' Association says average annual emissions are 2.4 tonnes for each of the 225 million passenger cars in the region

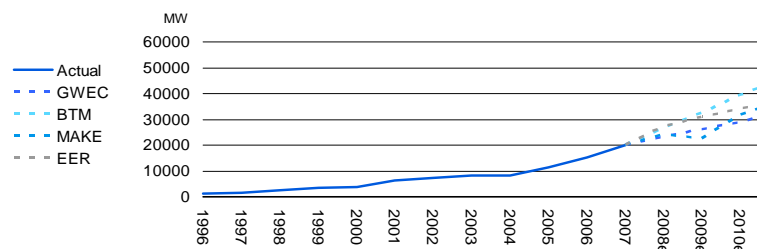
In 2007, new installed wind capacity in the U.S. was more than double the 2006 figure, accounting for about 30 percent of the country's new power production capacity in 2007. Of nearly 5,700 MW of wind power capacity installed in the Americas in 2007, the U.S. accounted for most of it - 5,250 MW.<sup>8</sup>

The Global Wind Energy Council says 2008 was another record year for the U.S. wind industry, with an estimated 7,500 MW of additional capacity installed. Despite the turmoil on capital markets, ABB believes the long-term future for renewables is very promising.

The wind sector is a vital and effective new means of power generation, with tremendous growth potential as governments continue to make renewable energy policy and targets part of their mandate. A widespread awareness of environmental damage and the growing desire for energy security also favors wind, which has zero emissions and is an energy source available to all.

Globally, the sector is expected to achieve compound annual growth of 13 to 16 percent between 2008 and 2013, according to recent forecasts.<sup>9</sup> Total global investment in wind generation could total more than \$350 billion for the period.<sup>10</sup>

**Actual and estimated number of MW added per year, global wind power capacity, 1996-2012**



Source: Actual – Global Wind 2007 Report, Global Wind Energy Council; Estimates – GWEC, May 2008; The Wind Forecast, BTM consultant, March 2008, MAKE Consulting, Oct. 2008; EER, Emerging Energy Research, Nov. 2008

Total accumulated installed capacity (onshore and offshore) globally in the sector is expected to exceed 300,000 MW by 2013, compared with 94,000 MW in place at the end of 2007.<sup>11</sup>

About 20,000 MW of capacity was added globally in 2007, and that means about 13,000 turbines were installed around the world. (Current average turbine size is 1.5 MW, although in the U.S. and European Union, turbine capacity is now moving closer to 3 MW).

## ABB: a leading industry supplier

ABB booked revenues of \$900 million in the wind sector in 2008, where our main customers are turbine manufacturers, engineering contractors, independent power producers and utilities.

Growth areas include the Americas, where the industry has expanded aggressively, as well as mature markets like Europe and developing markets in Asia. The business is centered mainly in Europe (67 percent) and Asia (15 percent), followed by the Americas (18 percent).

Onshore generation remains the largest area of activity, where the trend is towards larger turbines generating more power. Offshore wind projects are in the early stages of development, and so far

<sup>8</sup> Global Wind Energy Council, Global Wind Report, 2007

<sup>9</sup> Emerging Energy Research (13 percent CAGR forecast), November 2008, and MAKE Consulting, Market Report (16 percent CAGR forecast), October 2008

<sup>10</sup> MAKE Consulting, Market Report, October 2008

<sup>11</sup> Ibid.

account for just 1 percent of installed capacity. Offshore turbines are usually above 3 MW, and even larger machines for offshore use are under development.

ABB is a leading supplier of electrical products and systems to the wind power industry, including the generators that convert the mechanical power of the turning blades into electricity, and the connections that ensure irregular wind power enters the network at a steady voltage.

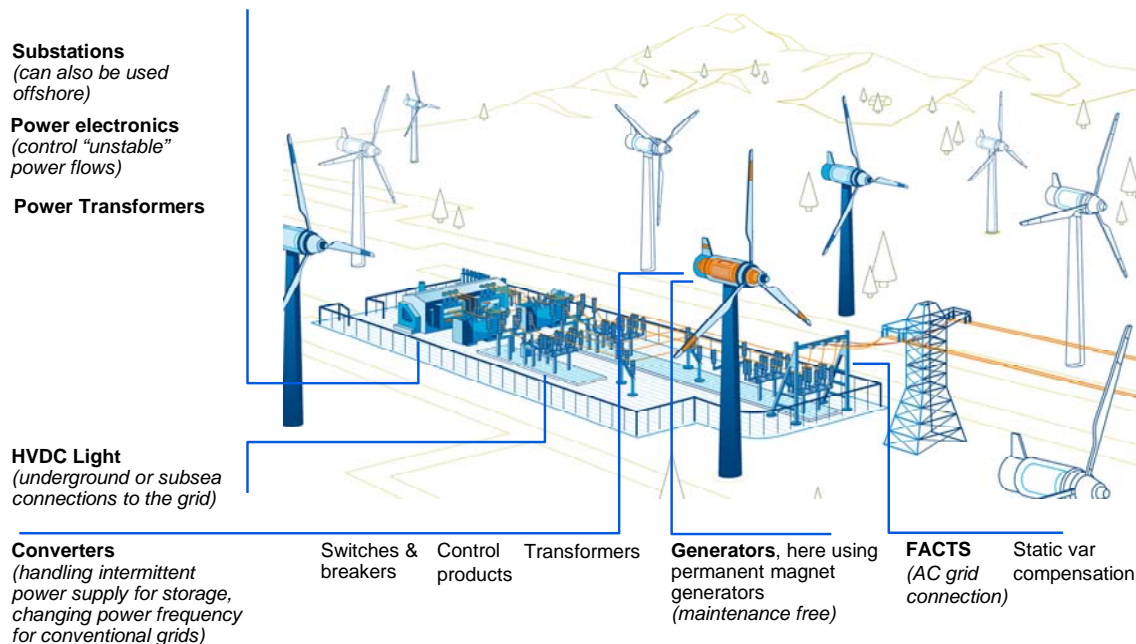


ABB can provide offshore customers with the latest low- and medium-voltage technology, simpler turbine designs and high-voltage direct current (HVDC) transmission links to stabilize and connect offshore power generation to the onshore grid. ABB is the world leader in this type of transmission technology as well as AC interconnections and links, with decades of experience and dozens of project references.

ABB is one of the world's largest independent suppliers of internal electrical components, controls, grid connections, service and maintenance plans for wind power projects. Since the 1980s, we have delivered more than 20,000 wind turbine generators, which are the beating heart of wind power systems.

If generators are the heart of wind power systems, grid connections are the arteries that correct electrical voltages and move wind-generated electricity into the power distribution grid, where it can be used by all. As the wind industry grows, however, it is often bumping up against the reality of an electrical distribution network that in mature markets was conceived 100 years ago.

Many transmission lines and interconnections are too small to accommodate the amount of electricity that power companies would like to push through them. That impacts wind-generated power in the sense that the best sites are as yet barely tapped, because there is no way to move the electricity from where it is generated to the load centers that need it.

Weak power networks tend to be those with transmission lines in lower voltage ranges, which are most common in rural or isolated areas where wind power projects are usually found.

Unpredictable wind-generated power fed into a weak transmission network causes problems such as voltage fluctuations, or 'flicker' (also known as harmonic voltage disturbances), which can cause some equipment to overheat or malfunction.

As wind farms increase in size, ABB is designing products to extract the most power from turbines without destabilizing their grid connections, so that wind parks can operate as other power plants do. ABB has a portfolio of technologies (flexible AC transmission systems, or FACTS) that can increase the amount of power a transmission system can handle by 10 to 50 percent, while at the same time improving the system's stability and flexibility.

Even ABB robotics plays a role in the industry - paint robots are being used to spray the giant windmill rotor blades.

## **ABB references**

We are involved in some of the biggest wind power projects in the world. For example:

- ABB is delivering the power transmission link for the 400-MW Borkum 2 wind farm being built 120 kilometers off the coast of Germany in the North Sea. ABB power equipment will connect the world's largest offshore wind farm to the German grid, and the project is expected to save 1.5 million tons of CO<sub>2</sub> emissions per year by removing the need for additional fossil-fuel generation. Most of the transmission system provided by ABB will be laid underwater and underground, thus minimizing environmental impact.
- ABB fast-tracked an order for 156 transformers to expedite the expansion of one of the biggest wind parks in the U.S., at Buffalo Gap in Texas. Transformers are essential technology for turning turbine-generated energy into usable electric power. Buffalo Gap 2 went live in June 2007, and the park produces 354 MW of emissions-free power, enough for 100,000 Texas homes.
- In China ABB is involved in large-scale projects such as the country's largest wind farm, Jiangsu Rudong on the Yellow Sea coast, and the Huitengshile wind farm in Inner Mongolia. A compact ABB substation, distribution transformers and ring main unit help Rudong feed about 230,000 megawatt-hours (MWh) of electricity each year into the local transmission network, avoiding 200,000 tons of CO<sub>2</sub> emissions annually.

## Background information

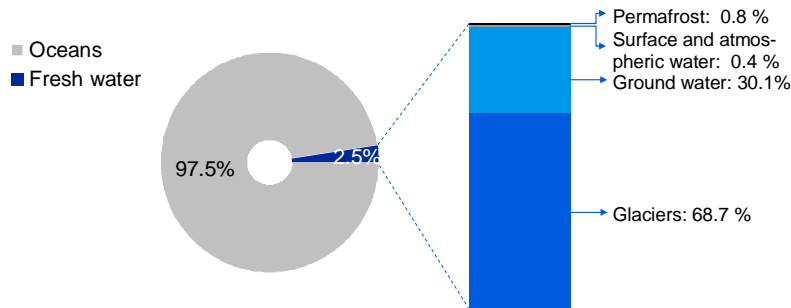
### Wind, water and rail

## Industry prospects: Water

Less than 3 percent of the world's water is fresh, and about 70 percent of that is locked away as snow and ice, or in deep groundwater aquifers, which are underground channels and basins.<sup>12</sup>

We mostly rely on water from lakes and rivers and shallow groundwater aquifers, which originates in underground channels and basins. In addition to these aquifers, other freshwater sources available to us include lakes and rivers, reservoirs and rainfall, which we share with the world's ecosystems.

World water resources, by type



Source: U.N. World Water Assessment Program 2006

Fresh water keeps us alive, so you would expect this resource to be very carefully managed.

Yet in many parts of the world a staggering 30 to 40 percent of the water supply is simply lost due to leaky pipes, breached canals and illegal tapping.<sup>13</sup>

Pollution of our water from runoff and industrial discharge is also threatening this essential resource, while melting glaciers threaten to remove a system of natural water storage for millions of people, according to Achim Steiner, head of the United Nations Environment Programme.

<sup>12</sup> UNEP Global Environmental Outlook 4, 2007

<sup>13</sup> Ibid.



## Demand vs supply

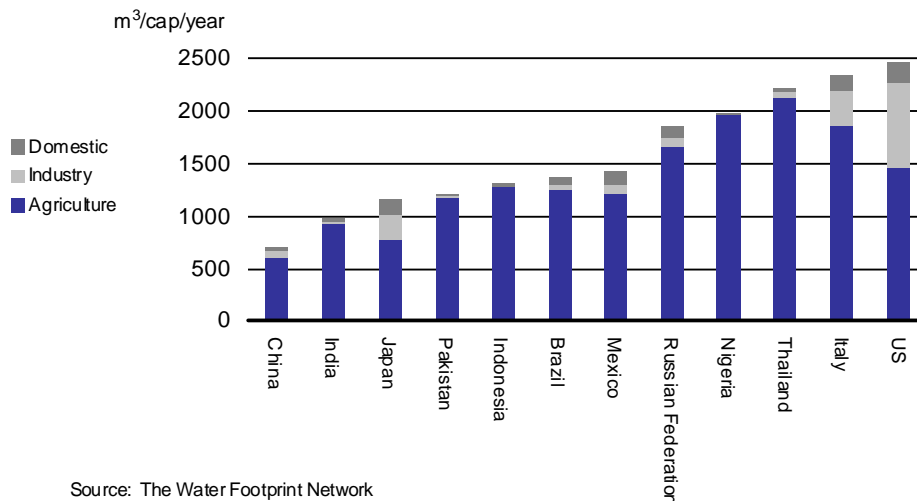
Global exploitation of our groundwater resources has intensified dramatically since 1950. Aquifers now supply half our drinking water, 40 percent of industrial water and more than 20 percent of irrigation water.<sup>14</sup>

A combination of factors including population increases, industrialization, climate change and increasing food production is expected to increase water use by 40 percent by 2020.<sup>15</sup> Demand for freshwater is expected to increase by 50 percent by 2025 in developing countries, and 18 percent in developed countries.<sup>16</sup>

According to a new report from UNICEF and the World Health Organization, more than half the world now has clean piped water in their homes, and use of unimproved water is steadily declining.<sup>17</sup>

Water use now exceeds annual average replenishment in parts of West and South Asia, North China and North America. More than half of the regions studied in the U.N.'s world water assessment program currently suffer moderate or severe water shortages.

**National water footprint per capita and the contribution of different consumption categories, selected countries**



Following current demand trends, the U.N. predicts that by 2025 nearly 2 billion people will suffer absolute water scarcity, and two-thirds of the world's population will experience water stress as they try to balance the competing demands of agriculture, industry, domestic use, energy and the environment.<sup>18</sup>

<sup>14</sup> World Business Council for Sustainable Development, Facts and Trends, Water, 2005

<sup>15</sup> World Water Council, 2006

<sup>16</sup> UNEP Global Environmental Outlook 4, 2007

<sup>17</sup> Progress on Drinking Water and Sanitation - UNICEF and WHO, 2008

<sup>18</sup> UNEP Global Environmental Outlook 4, 2007

That use is increasing. The U.N. Food and Agriculture Organization says that from 1962–98, irrigated farmland expanded by nearly 2 percent a year, increasing by almost 130 million hectares. The FAO says it takes from 2,000 to 5,000 liters of water to produce one person's daily food.

### **A multi-billion dollar market**

The world may not be running out of water, but it is not always available when and where we need it. Water needs to be managed carefully, and ABB products, system and expertise can help preserve and protect this essential resource.

The global water market was worth about \$365 billion in 2008, and the water equipment and services market is expected to grow at about 5 percent annually.

Total capital expenditure in the sector is expected to be around \$150 billion a year, and ABB could potentially capture 3 to 5 percent of this market. In 2008, ABB booked orders worth \$640 million in the water sector.

ABB's business is centered mainly in Europe and the Mediterranean (45 percent), the Middle East and Asia (40 percent), followed by the Americas (15 percent). Market drivers include increasing demand for quality fresh water, the need for new and upgraded infrastructure, and the need to improve water delivery systems and make them energy efficient.

ABB currently provides products and systems for water transmission, distribution and irrigation networks, desalination plants, water and wastewater treatment plants. Our customers include utilities, engineering, procurement and construction (EPC) companies and civil contractors, system integrators and pump builders.

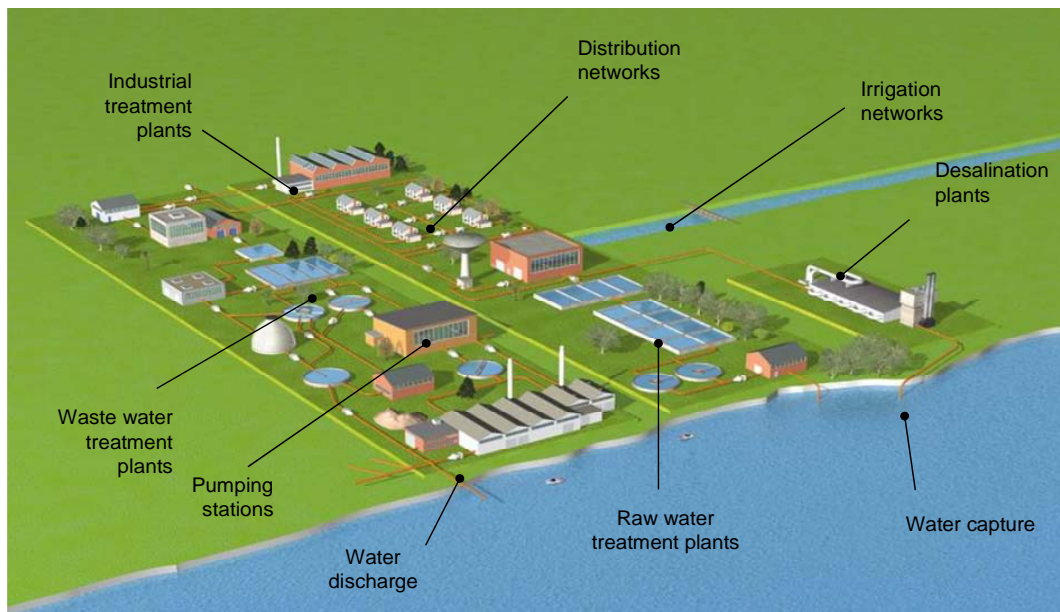
### **ABB: technology for critical processes, from leakage control to desalination**

A key area where radical improvement is needed is water quality. In many populated areas, exploitation and contamination have transformed potable water into a chemical cocktail unsuitable for human consumption or use. Inefficient transportation and distribution systems also contribute to poor water access and increased water loss.

Using new and improved technology, ABB is helping water utilities improve water quality and distribution in the areas that need it most, as well as re-using treated wastewater.

ABB has identified growth areas in Asia and the Middle East, where there have been large investments in new water infrastructure, while in Europe and North America the focus is on energy-efficient water distribution and leakage management.

The "water footprint" measures the amount of water that a country, company or individual uses each year. This includes the water needed to produce goods: the water withdrawn from surface as well as ground water and soil water. For a cup of coffee, for example, an average of 140 liters of water is needed, 2,700 liters for a cotton shirt, 16,000 for a kilo of beef. On a global scale, each individual has an average water footprint of 1,250 cubic meters a year. Americans use twice that amount, Chinese or Indian citizens much less. Source: The Water Footprint Network



ABB's product and systems portfolio includes solutions for the key water applications, such as desalination plants, long-distance water transport networks, water re-use plants.

ABB systems can reliably automate a water supply network and contain costs for water utilities by minimizing energy consumption and automating process operations that were previously dependent on operator expertise and carried out manually.

We can draw on our complete power and automation portfolio to service this sector, including expertise in energy- and water-efficiency solutions. This includes motors and drives, control systems for water plants and SCADA (supervisory control and data acquisition) systems for distribution and irrigation networks, instrumentation, switchgears and transformers.

Our SCADA systems add specific functions such as leakage management and irrigation management, our plant control systems add performance monitoring and energy management. ABB drives and motor control create massive energy savings as well as peak levels of reliability and availability, particularly in pumping applications.

Our electrical systems, controls and software keep water flowing from giant desalinization systems through pipelines hundreds of kilometers long to the consumer taps.

ABB helps customers identify where water is leaking away in broken pipes, and helps customers save and reuse their water, minimizing the need for new sources. ABB electromechanical systems power and control some of the world's most ambitious irrigation networks.

## ABB references

Hundreds of ABB projects and installations are currently in service, especially in Europe, the Middle East and Asia. For example:

- ABB supplied the complete electromechanical solution for a number of lift irrigation\* projects in Andhra Pradesh state in southern India. These projects are designed to water nearly 800,000 acres of parched land and benefit thousands of farmers in the Krishna River and Godavari River

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\* Lift irrigation pumps water from a river or lake to a main delivery chamber situated at the highest elevation in the area to be irrigated. Users are connected to the chamber and draw water from it.

basins. ABB equipment includes substations and power transformers, drives, instruments and SCADA network control systems.

- ABB water-cooled motors and drives will power eastern Australia's first large-scale desalination plant, located on the Gold Coast of Queensland at Tugun. The plant will deliver 125 million liters of potable water a day to an area severely affected by drought. ABB equipment will power and control the reverse osmosis pumps and energy-recovery and booster pumps.
- ABB designed and engineered a master control station and remote leak-monitoring system for the Bangkok Metropolitan Waterworks Authority to control water leaks and pressure drops in 19,000 kilometers of pipes. The network delivers 5 million liters of tap water each day to customers in the region of the Thai capital.

# Background information

## Wind, water and rail

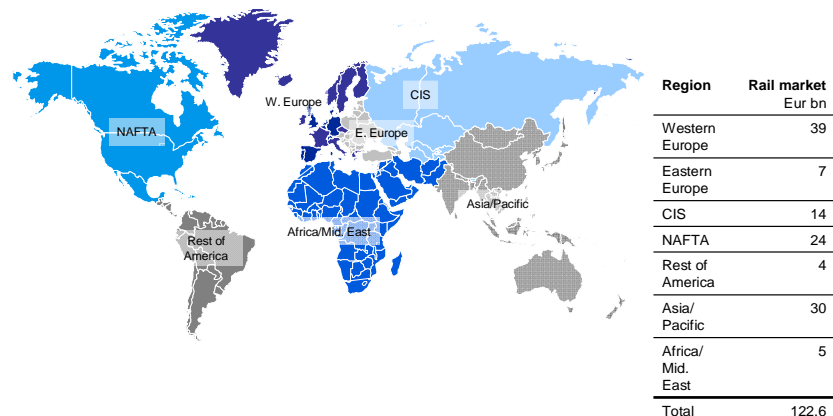
## Industry prospects: Rail

The rail industry is benefiting from environmental concerns, rapid urbanization, the need for greater and faster mobility of people and freight, especially in emerging economies, and volatility in fuel prices.

That's because railways perform best in studies on the impact of different modes of transport according to wide range of measures; including CO<sub>2</sub> emissions, energy consumption, noise pollution, capacity in urban and intercity transport, footprint and security.

Rail, a 200 year-old technology, is being rediscovered as a sustainable means of transport capable of reducing congestion in our cities, and this is triggering investment in infrastructure, rolling stock, control systems and services. The world market for the rail supply industry was about 120 billion euros (\$165 billion) in 2007 and is expected to reach 154 billion euros by 2016.<sup>19</sup>

World rail markets  
Accessible annual market volume, overall rail market  
(average order intake, 2005-2007)



Source: Roland Berger Worldwide Rail Market Study, 2008 – status quo and outlook 2016

<sup>19</sup> Based on an analysis conducted by Roland Berger Strategy Consultants on behalf of the Association of the European Rail Industry (UNIFE)

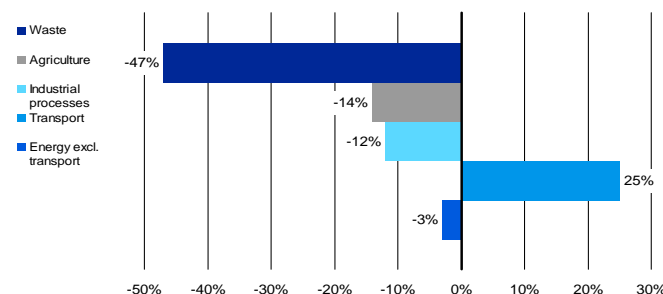
Europe, the North American Free Trade Area (NAFTA) and the Asia/Pacific regions are the biggest markets (see figure above).<sup>20</sup> Emerging economies are developing state-of-the-art rail and metro-rail systems, while the developed world is reinforcing, modernizing and expanding existing rail infrastructure

Demand from Asia is set to overtake second-place North America in the near future. The sector also has high growth rates in Africa, the Middle East and other parts of the Americas, although these regions will remain comparably small in terms of absolute market volumes.

## A compelling environmental case

One U.S. study identified cars and light trucks as the largest single mobile source of greenhouse gas emissions in the country, together representing more than 60 percent of emissions from mobile sources.<sup>21</sup>

Projected changes in EU15\* greenhouse gas emissions from 1990 to 2010 with existing policy measures

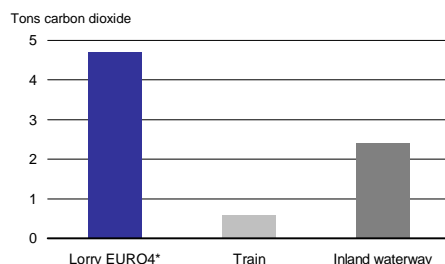


\* Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom. Source: EEA 2007

In the European Union, transport is responsible for about one quarter of all CO<sub>2</sub> emissions, and more than 90 percent of total domestic transport emissions are due to road traffic.<sup>22</sup> Transport is the only sector in the EU in which greenhouse gas emissions have risen since 1990 (see graphic).

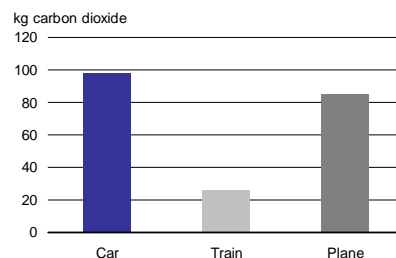
Studies have also shown that rail is by far the most energy-efficient form of transport. In a recent study of freight and passenger transport on two European routes, CO<sub>2</sub> emissions generated by passenger rail travel were found to be at least three times lower than those of either road or air transport, and the savings were even greater on freight transport (see graphic below).

CO<sub>2</sub> (100 tons cargo, Basel – Rotterdam, 700 km)



\* EURO4: EU emissions standard for light commercial vehicles, defined in 2006  
Source: [www.ecotransit.com](http://www.ecotransit.com)

CO<sub>2</sub> (1 person Berlin – Frankfurt, 545 km)



Note: Plane emissions include travel to and from the airport; they are not increased to take account of the effect of emissions at high altitude  
Source: [www.econpassenger.org](http://www.econpassenger.org) 2008

<sup>20</sup> Roland Berger Worldwide Rail Market Study – status quo and outlook 2016

<sup>21</sup> Todd Davis, Monica Hale, Public Transportation's Contribution to U.S. Greenhouse Gas Reduction, Science Applications International Corporation (SAIC), Virginia, September 2007

<sup>22</sup> EC 2007 and UIC Energy / CO<sub>2</sub> database (Domestic transport is defined as transport within national boundaries.)

## **Rail facilitates urbanization and efforts to eliminate urban pollution**

Between 2005 and 2030, the world's urban population is expected to grow by an average of 1.78 percent annually, nearly twice the rate of the world's total population.<sup>23</sup> One hundred cities now have populations exceeding 3 million people; by 2015, an estimated 560 cities will have more than one million people, and 300 of these cities will be in Asia.

In Europe, there has been a very strong growth in mobility over the last 30 years, and the increase in distance traveled has been mainly by road. Every European citizen now travels an average of 35 km per day, compared with 17 km per day in 1970. Yet road traffic is worsening air quality, especially in urban areas, with emissions that are harmful to health as well as the environment, such as nitrogen oxides (NO<sub>x</sub>) and particulate matter less than 10 microns in size (PM10).

The big advantage of electric train systems is that they generate no local emissions and can meet mass transportation needs in a variety of urban situations, from local tram networks, to commuter systems and high-speed rail links.

New combustion technologies, efficient transmission systems and exhaust after-treatment also ensure that rail diesel traction will remain more environmentally friendly than transport by road or inland waterway.

## **ABB: a long and successful history in the rail supply industry**

ABB has a long history of providing reliable, innovative and energy-efficient technologies to rail suppliers that manufacture and service all the systems, subsystems and components used in modern urban, conventional and high-speed rail systems. This includes rail infrastructure and rolling stock, as well as signaling and telecommunication systems.

The segment of the rail supply market in which ABB operates is worth around \$14 billion. ABB's rail sector orders in 2008 were in the range of \$800 million, with a compound annual growth rate of about 40 percent between 2004 and the end of 2008.

Regionally, our biggest market is Europe, where more than 60 percent of orders originated in 2008. Growth drivers here include new investments in high-speed passenger lines, and new freight capacity.

Mirroring global trends, Asia has in recent years shown the fastest growth for ABB (accounting for more than 30 percent of rail sector orders in 2008), spurred on by new investments in mass transit, high-speed passenger networks and added freight capacity.

Among many other contributions, ABB products and systems are in the London Underground and Delhi's new Metro, in the sophisticated high-speed trains of Europe and China, as well as the expanding rail networks of the Americas.

ABB offerings encompass equipment for rolling stock as well as fixed installations, and main and auxiliary converters, traction transformers, traction motors, semiconductors, low-voltage products, traction substations and components.

Globally, ABB is number one in rail traction transformers with a 50 percent market share. Traction transformers step down electrical voltage from the grid so it can be used on-board the train to power motors and auxiliary systems such as heating and lighting. ABB's comprehensive offering of on-board electrical components also includes main and auxiliary converters, and low-voltage products.

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<sup>23</sup> UN Habitat, State of the World's Cities, 2006/2007

The combination and design of traction chain components (generators, circuit breakers, transformers, traction converters and motors) are the main determinants of a train's efficiency. ABB supplies both individual components and complete traction packages to rolling stock manufacturers.

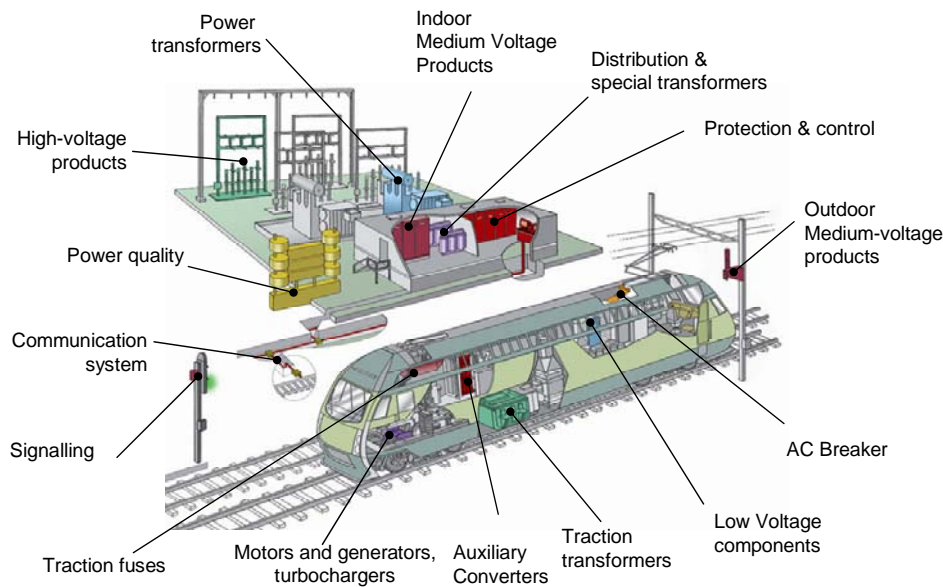


ABB is also the largest independent supplier of modern turbochargers for diesel-electric locomotives. Turbochargers boost the performance of diesel engines up to four-fold, which reduces the size of the engines needed to power the trains and leaves more space for passengers and freight. Turbochargers also help the engines to burn fuel more effectively, producing “cleaner” exhaust emissions: Today’s turbocharged diesel engines produce significantly less NO<sub>x</sub> and CO<sub>2</sub> than naturally aspirated (non-turbocharged) equivalents.<sup>24</sup>

ABB power supply infrastructure enables rail networks to run on electricity from the main grid, which helps lower rail's carbon footprint.

Power electronics monitor and maintain power quality between grid and rail network. Sophisticated controls such as our supervisory control and data acquisition (SCADA) systems monitor rail power networks to ensure they are running as effectively as possible.

ABB communications networks transmit vital data about the network between substations, control rooms and train stations to control rooms and stations throughout the system. ABB’s signaling solutions ensure safe train movements and help optimize capacity and punctuality.

## ABB references

- ABB installed a SCADA system in the newest extension of the Delhi Metro to monitor, manage and control power to the city's mass transit system, which will carry more than one million passengers daily when it is completed in 2010
- When a very high-speed train built by Alstom set a new world speed record for rail in 2007 (574.8 kilometers per hour), a specially designed ABB traction transformer was aboard. ABB is a key partner for Alstom in the development of distributed power technology for the next generation of very high-speed trains.

<sup>24</sup> ABB sources



- ABB traction motors can recoup energy through regenerative braking, converting it into electricity, which is fed back into the power supply system. The technique can contribute annual energy savings of 15 and 30 percent of total energy consumed, depending on the number of stops made.<sup>25</sup> ABB will deliver traction motors for 190 of London Underground's newest trains, due to go into service in 2009.
- ABB RailManager (Centralized Traffic Control Center) helps the Norwegian Railway Administration to efficiently control one-third of the Norwegian Rail Network.

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<sup>25</sup> ABB sources

# Background information

## Wind, water and rail

### For more information:

#### Wind

International Energy Agency, World Energy Outlook, [www.iea.org](http://www.iea.org)  
European Wind Energy Association, [www.ewea.org](http://www.ewea.org)  
Global Wind Energy Council, [www.gwec.net](http://www.gwec.net)  
American Wind Energy Association, [www.awea.org](http://www.awea.org)  
MAKE consulting, [www.make-consulting.com](http://www.make-consulting.com)  
BTM Consult ApS, [www.btm.dk](http://www.btm.dk)  
ABB wind power solutions, [www.abb.com/ProductGuide/Alphabetical](http://www.abb.com/ProductGuide/Alphabetical)  
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