Challenges and opportunities aplenty

How to meet the challenge of climate change

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It's been called "a disaster in slow-motion." The impacts are already severe but the real threat is probably a couple of generations away. Scientists have been gathering evidence for decades but, until recently, societies have hesitated to take action. Today climate change is on everybody's lips and governments all over the world are taking measures to curb greenhouse gas emissions. However, the challenge is huge: The world is like a super tanker heading toward the rocks and a quick but difficult turnaround is badly needed.

The mitigation of climate change is a long-term issue that calls for significant changes in the way industry and society at large produce and use energy and electricity. For its part, ABB has been and will continue to be committed to helping its customers use energy more efficiently and reduce their environmental impact through a broad array of products, systems and services. It has a two-year rolling target to reduce its use of energy per manufactured unit by 5 percent.

It is well established that the world is getting warmer. Meteorologists have observed an increase in the average global surface temperature of 0.74 ± 0.18 °C (1.33 ± 0.32 °F) during the last century. At the same time the CO_2 concentration in the atmosphere has risen from 280 parts per million (ppm) before the industrial revolution to nearly 390 ppm today. This by far exceeds the natural CO_2 levels in the atmosphere over the last 650,000 years! This increase is entirely the result of human activity caused mainly by the burning of fossil fuels, and the rise continues at a rate of 2 ppm per year.

The Intergovernmental Panel on Climate Change[1] (IPCC) has concluded that most of the observed temperature increases since the middle of the 20th century is very likely due to the rise in greenhouse gas concentrations. This conclusion is based on thousands of studies made by scientists in different disciplines all over the world.

Climate history and predictions

In various ways, nature has kept records of its own climate history and scientists have developed methods to study and interpret these data. For example, historical temperatures can be deduced from tree-ring widths and coral growth, and valuable climate data are hidden in the Arctic and Antarctic ice layers. Also, by studying the composition of air in bubbles deep down in the ice, the CO_2 concentration at a specific time can be determined. The average temperature of the period in question can be determined by measuring the ratio between different isotopes of oxygen in the ice. Mass spectroscopy allows very accurate determination of this ratio and may even resolve seasonal variations. Up to now, ice-core studies have revealed information about several hundred thousand years of climate history.

From the mid-19th century, instrumental temperature records have been used to determine the average global surface temperature. Regular measurements of CO_2 concentration in the atmosphere started in 1958 in Hawaii and accumulated data show an upward trend in CO_2 concentration and characteristic seasonal variations 1.

Over the last century, meteorologists have observed an increase in the average global surface temperature of 0.74 °C while the CO_2 concentration in the atmosphere has risen to nearly 390 ppm.

Advanced computer models are used to project future climate change. The models attempt to cover as many relevant physical processes as possible and combine coupled general circulation models for the atmosphere and oceans with those for ice on land and sea. By applying such models to a number of different emissions scenarios, the IPCC projects an increase in average global surface warming of between 1.1 and 6.4 °C by the end of this century!

The mitigation challenge

To minimize the risk of the dangers of climate change, the European Union (EU) and others have long advocated that any increase in global temperatures should be kept below 2 °C relative to pre-industrial temperatures. This will require a stabilization of greenhouse-gas concentration in the atmosphere at well below 450 ppm CO_2-equivalent.[2]

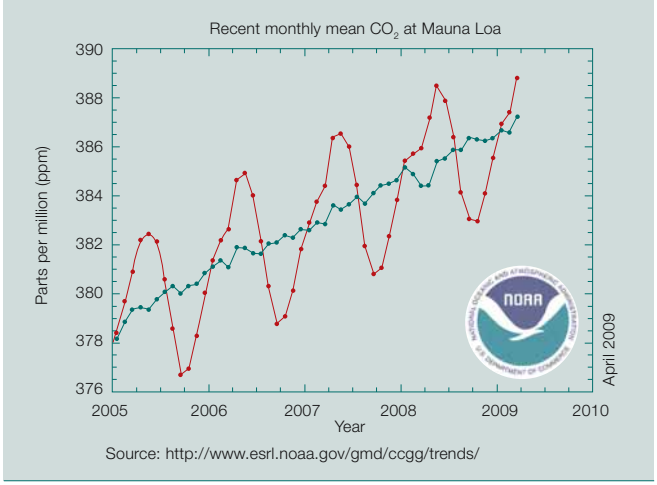
With current global emissions trends, the 450 ppm goal is challenging. In a business-as-usual scenario, the International Energy Agency (IEA) predicts energy-related greenhouse gas emissions to rise strongly in the foreseeable future: By 2030, global primary energy demand will be 45 percent higher than today, with 80 percent of the energy mix still based on fossil fuels. Ninety-seven percent of the increase will take place in non-OECD countries. The IEA has warned that

Footnotes

[1] National science academies in major countries express support for IPCC's results and conclusions.

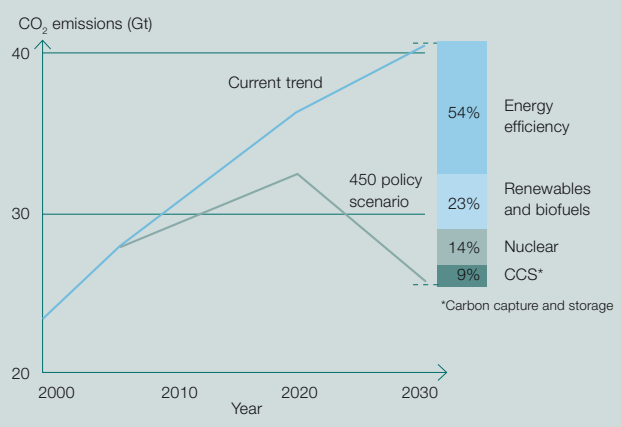
[2] Today's CO_2-equivalent level is already around 445 ppm when five other anthropogenic greenhouse gases are included. However, fine particles in the atmosphere and ozone in the troposphere are believed to largely offset this additional heating contribution, resulting in an effective level of CO_2 concentration of around 387 ppm.

1 CO_2 concentrations continue to increase



Source: http://www.esrl.noaa.gov/gmd/ccgg/trends/

2 IEA emission scenarios



Source: IEA, WEO 2008

this scenario will lead to severe and irreversible damage to the climate.

Securing a global supply of affordable energy to meet ever-increasing demands without generating excessive amounts of greenhouse gases is a huge challenge.

McKinsey & Company has found a potential exists to reduce greenhouse-gas emissions by 70 percent by 2030 and that any increase in temperature can be kept below 2 °C.

The IEA has developed and analyzed a scenario that fulfills the 450 ppm stabilization target. This scenario requires strong and concerted action to curb the growing greenhouse gas emissions. It relies on successful international climate negotiations where all countries, especially major emitters, commit to cutting emissions. According to the IEA, even if the OECD countries were to reduce their emissions to zero, they cannot achieve the 450 ppm target by themselves.

The scenario predicts a 22 percent growth in primary energy demand until 2030, with 67 percent of the energy mix coming from fossil fuels alone.[3)] Energy-related CO_2 emissions are cut by 37 percent compared with the business-as-usual scenario. As much as 54 percent of the savings come from energy-efficiency measures, while renewable energy and biofuels contribute 23 percent. Carbon capture and storage (CCS) and nuclear power are also important instruments in cutting emissions 2.

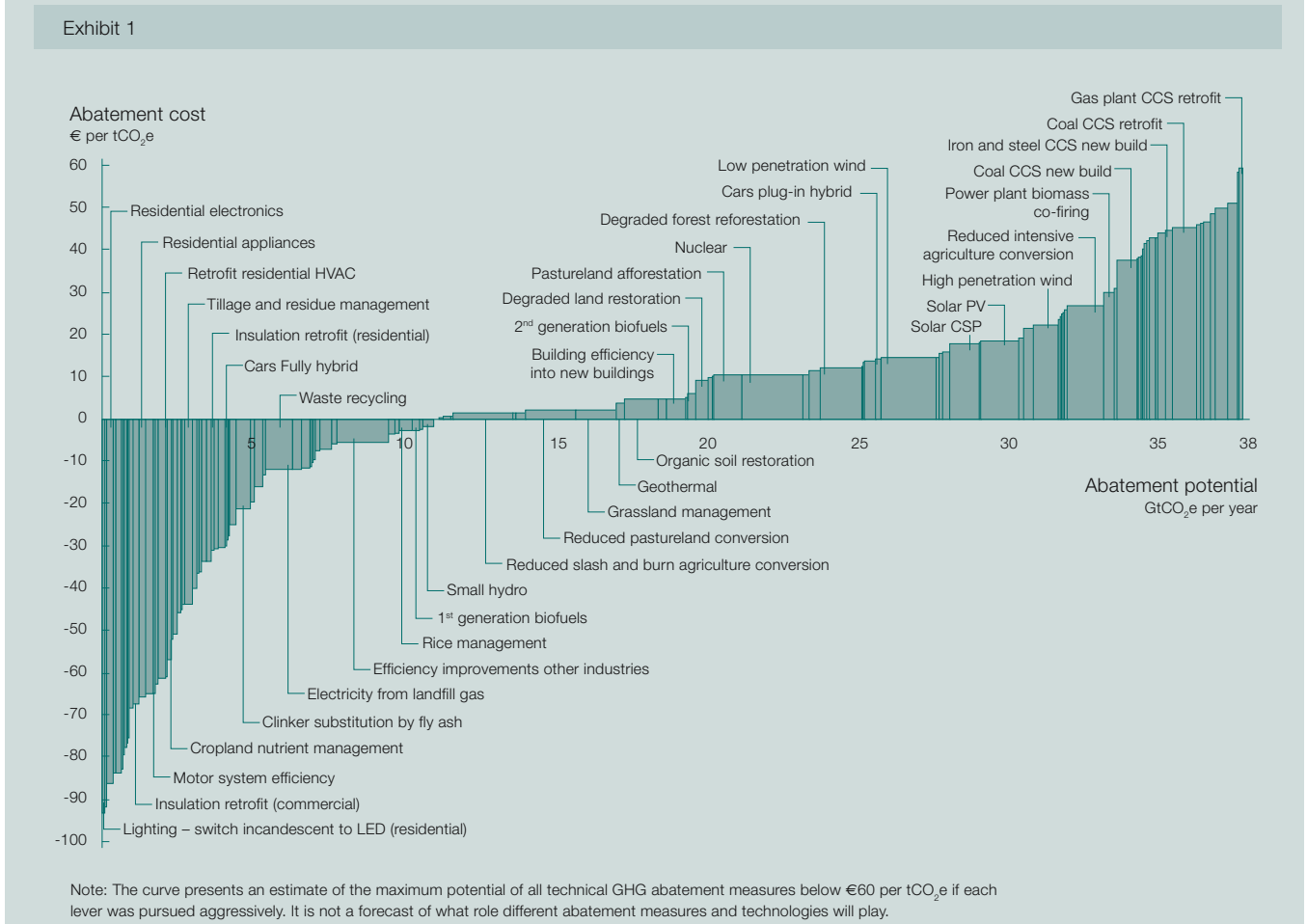
Transforming the energy system will require large investments: The IEA estimates an average cost of 0.55 percent of annual world GDP up to 2030. At the same time, improved efficiency levels will reduce both operational costs and energy bills.

McKinsey & Company has made an in-depth study of emissions reduction potential and cost of more than 200 technologies in 10 different sectors, covering all relevant sources of emissions (not only energy-related) in 21 different regions around the world. The company has found that a potential exists to reduce greenhouse-gas emissions by 70 percent by 2030 as compared to business-as-usual, and that any increase in temperature can

Footnote

3) Even in this scenario, fossil fuels maintain a dominating role for a considerable period of time.

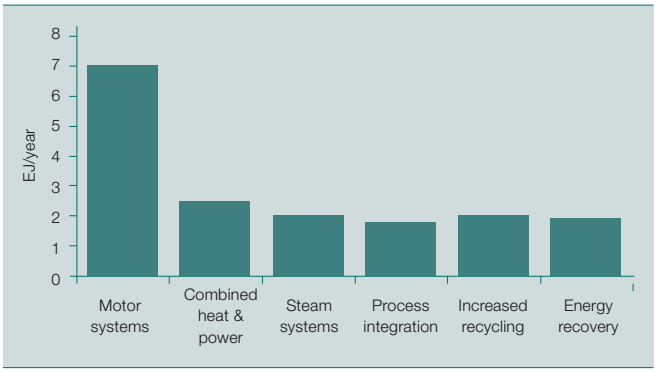
3 McKinsey's global GHG abatement cost curve v2.0



Note: The curve presents an estimate of the maximum potential of all technical GHG abatement measures below €60 per tCO_2e if each lever was pursued aggressively. It is not a forecast of what role different abatement measures and technologies will play.
Source: McKinsey & Company

be kept below 2 °C. However, it is a huge challenge to capture enough of this potential since success relies on the implementation of almost all identified abatement opportunities. McKinsey has found that a 10-year delay in taking action against emissions would make it impossible to limit the temperature rise to 2 °C. The annual mitigation cost by 2030 is estimated at 1 percent of the forecasted global GDP. In agreement with the IEA, it has found that future energy savings compensate for much of the upfront investment 3.

4 Energy-saving potential in the manufacturing industry: Motor systems offer huge opportunities (data from an IEA report).



Energy efficiency

In many countries, energy efficiency increased considerably after the oil crisis in the 1970s. Today, the production of a unit of GDP in developed countries requires 30 percent less energy than it did 1973. This is a result of productivity improvements and products that are more energy efficient and more intelligent.

Energy efficiency improvements decreased during the 1990s because energy prices were low and stable, and considerable reductions in energy intensity had already been achieved. In cases where the cost of energy represents a minor part of a company's overall costs, it is easily forgotten when optimizing manufacturing processes and product performance.

Today energy efficiency is high on many agendas and its key role in the mitigation of climate change is universally recognized.

The potential to save energy is everywhere in society: In the power sector, opportunities exist in the chain that connects generation to consumption. Energy use can be cut in commercial and residential buildings by providing better insulation and by controlling heating and cooling. Improved car fuel efficiency can also make a considerable difference.

Huge savings can also be achieved in industry. According to a report from the IEA, almost a third of the world's energy consumption and 36 percent of CO_2 emissions are due to manufacturing. Industrial energy use has increased strongly over the last 25 years and about 80 percent of the growth has occurred in China. The IEA has identified potential savings of between 25 to 37 EJ[4] (Exajoules) per year in the manufacturing industry if best practices and proven technologies[5] are used. This corresponds to a reduction of 7 to 12 percent of present global CO_2 emissions.

The European Union is a keen supporter of the UN process to manage climate change and has been implementing climate policies and regulations for some time.

Electrical motor systems offer the largest savings opportunity in the manufacturing industry. Optimizing motor systems can achieve yearly savings of between 6 and 8 EJ, which is equivalent a quarter of the world's total nuclear power production 4. The use of high-efficiency motors, variable-speed drives to control motor speed and adequate motor protection to permit downscaling of motor sizes are some of the means of achieving these savings.

Negotiations and climate policies

This year, governments around the world are busy preparing for COP-15, the United Nations (UN) climate conference, which will be held in Copenhagen in December. According to the Bali Action Plan established at COP-13 two years ago, governments are destined to agree on a new and ambitious global treaty to succeed the Kyoto agreement by 2012.

Key points that will be addressed at COP-15 include:

- The amount of emissions reduction that developed countries must commit to and how this is to be financed.
- The reasonable mitigation actions for developing countries, especially China and India.
- The possibility of reaching a credible agreement on the stabilization of greenhouse-gas concentrations in the atmosphere at 450 ppm CO_2-equivalent or less.

The success of COP-15 depends on finding acceptable compromises on these issues and on reaching an agreement. However, even without a new global agreement, countries and regions are already taking action by implementing policies and regulations to curb emissions.

The European Union (EU) is a keen supporter of the UN process to manage climate change and has been implementing climate policies and regulations for some time. Its main tool is the cap-and-trade system, EU ETS, which puts an absolute cap on 50 percent of all emissions in the EU. Twelve thousand industries and power plants within the EU have obligations in the system. The EU's 20/20/20 plan sets out targets for 2020, including:

- Cutting CO_2 emissions by 20 percent compared with levels in the 1990s. This figure will increase to 30 percent if a global agreement can be reached.
- Increasing the share of renewables in the energy mix to 20 percent.
- Cutting primary energy use by 20 percent through efficiency measures.

Footnotes

[4] 1 Exajoule (EJ) = 10^{18} joules

[5] An 18 to 26 percent increase in energy efficiency

The US administration has indicated that it aims for an agreement in Copenhagen, including binding commitments to reduce emissions. The administration's New Energy for America plan aims to:

- Cut emissions to the levels seen in the 1990s by 2020 and by 80 percent by 2050.
- Have a million plug-in hybrid cars on the road by 2015.
- Ensure that by 2012 10 percent of power comes from renewable; this figure will increase to 25 percent by 2025.
- Introduce an economy-wide cap-and-trade program.

China embraces the principle of "common but differentiated responsibilities" established in the Kyoto protocol, which says that developed countries should take the lead in reducing greenhouse-gas emissions as well as providing financial and technical support to developing countries. However, some signs indicate that China may be ready to relax its resistance against controlling its emissions and is interested in reaching an agreement in Copenhagen. China launched its National Climate Change Program two years ago, which includes the challenging target of cutting energy intensity by 20 percent by 2010. China also aims at doubling its share of renewable energy use by 2020. Another ambitious program aims at cutting energy use at China's top 1,000 enterprises.

ABB's contribution

The mitigation of climate change is a long-term issue that will call for significant changes in the way industry and society at large produce and use energy and electricity. Success will require changed consumer patterns as well as the development and deployment of new technologies on a large scale.

ABB has a two-year rolling target to reduce its use of energy per manufactured unit by 5 percent. During 2008, ABB increased its production output by 20 percent while its total use of energy remained relatively unchanged. This was due to energy efficiency programs initiated throughout the group. Typical measures include better climate control, more efficient lighting and the installation of energy efficient manufacturing equipment in factories and offices. This has resulted in impressive results from all over the world: for example, the electricity intensity at ABB China has fallen 55 percent over 5 years.

In 2008 ABB's installed base of low-voltage variable-speed drives saved an estimated 170 terawatt-hours of electric power, enough to meet the annual needs of 42 million households in the EU.

ABB will make energy audits and establish relevant energy-efficiency improvement programs for each of the 23 ABB manufacturing sites that consume more than 1 percent of the total group energy consumption.

In addition, ABB is committed to helping its customers use energy more efficiently and reduce their environmental impact with its broad array of products, systems and services. For example, the company's advanced information technology systems for the control and optimization of integrated industrial processes, electrical power grids and buildings save energy and reduce emissions.

The interconnection and strengthening of power systems with high-voltage direct current (HVDC and HVDC Light®) technology and flexible AC technologies (FACTS) make large savings through a more even distribution of loads, an efficient use of primary energy resources and increased power quality, thereby reducing CO_2 emissions. It also enables large-scale integration of renewable energy into the power grids.

ABB's high-efficiency motors and variable-speed drives for motors also contribute to large emission reductions. In 2008 ABB's installed base of low-voltage drives saved an estimated 170 terawatt-hours of electric power, enough to meet the annual needs of 42 million households in the EU and reduce global carbon dioxide emissions by some 140 million tons a year.

For ABB climate change is a huge opportunity and challenge: ABB must continue to live its slogan "Power and productivity for a better world" and continue to serve its customers with present and new technologies that meet increasing market demands on energy savings and climate efficiency in the long-term.

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