

Power and Productivity for a better World



ABB is a leader in power and automation technologies that enable utility and industry customers to improve performance while lowering environmental impact. The ABB Group of companies operates in 100 countries and employs about 110,000.

ABB in Denmark is within ABB the corporate global leader within wind power and district heating and employs about 800 people.

How ABB cuts emissions

ABB focuses its climate change efforts on three main areas:

- Supporting efforts by customers – particularly in utilities and industry – to cut greenhouse gas emissions
- Raising energy efficiency within the company and its manufacturing processes
- Strengthening the use of clean energy sources such as wind power

ABB's greatest contribution to the reduction of greenhouse gases is through products, systems and solutions. They

include: High-efficiency motors and variable-speed drives for motors; advanced industrial information technology to control and optimize power grids and industrial processes; and certain types of substation and transformer which have minimal losses.

Not surprisingly, climate change has boosted interest in clean energy technology and renewable power sources.

As a leading supplier of equipment to the global wind power industry, ABB has a strong role to play. Its ability to harness wind power and integrate it into electrical grids is ongoing underlined by major contracts. As an example ABB is going to supply the German utility E.ON Netz GmbH with the power equipment that will connect the world's largest offshore wind farm (Borkum 2) to the German grid.

A group-wide internal energy-savings program, designed to cut consumption by 5 % on production sites over two years is on track to meet its targets. In a country like Denmark, ABB has since 1998 managed over time to double its office square metres at its head office and at the

same time keep the energy consumption level below the 1998 level.

Contributing to a better world

ABB's products, systems and solutions contribute to a better world in a variety of ways – such as saving energy and cutting harmful emissions. Below we highlight some of these contributions:

● Sustainability in motion

High-efficiency motors and variable speed drives from ABB save enough power every year to supply five million people, while cutting nearly 100 million tons of carbon dioxide emissions. Since motor-driven machines consume about 60 % of the power used by industry, even small improvements add up to big electricity and cost savings. ABB's motors convert power to motion efficiently and have a long lifespan.

Using ABB motors and drives, a factory assembly line, escalator, baggage conveyor belt, air conditioner or a ski lift will operate at the exact speed they need to go, rather than at any pre-set speed. Customers, consumers and the environment all benefit.

● Bulk power transmission with low impact

ABB's high-voltage direct current (HVDC) and HVDC Light transmission systems carry bulk power over long distances efficiently and with minimal environmental impact.

The Technology is featured in several European projects; In Denmark an underground and underwater HVDC cable linking the two islands of Funen and Sealand in Denmark to connect grids for the first time and stabilize power supplies. And in Germany a 100 km underground HVDC Light cable is going to connect wind-generated power to the mainland from the world's largest offshore wind farm.

● High-efficiency transformers

Transformers are key to the transmission and distribution of electrical power, acting as "gear boxes" to ensure the right type of voltage reaches the consumer. They account for most of the otherwise low level of energy losses in grids.

ABB has improved their design and use of raw materials to raise overall efficiency. Our technology allows for highly compact transformers, saving copper, electromagnetic steel and insulating oil, and reducing energy losses.

ABB was also the first manufacturer to have environmental product declarations for power and distribution transformers.

The greenest energy is energy saved

Barely a day goes by without talk of climate change. Renewable energy, carbon capture and biofuels are among the main solutions put forward to mitigate climate change. They are valid methods and must be pursued but the truth is that most of the technologies are either not ripe, still too expensive or have unwanted side effects.

There is a quicker, cheaper and more effective way of reducing carbon dioxide emissions that can be applied right now: energy-efficient technologies that are commercially available and proven. Energy efficiency is the low-hanging fruit in the campaign to protect the environment because the technologies exist and we know the savings they will deliver.

In industry, the biggest reductions in emissions in the short term will come from measures to run processes more efficiently. To give one example, about 40 % of electricity is consumed by industry, and two-thirds of that is used by electric motors. Devices to regulate the speed of a motor can reduce their energy consumption by 50 % in many applications. Yet less than 10 % of motors are equipped with such a device.

Fitting them to all the motors shipped last year alone would avoid 200 million tons of carbon dioxide emissions per year, more than three times the annual emissions of Denmark. And there are many more energy saving opportunities like this.

Thus, ABB will focus on energy efficiency in its sponsorship of the upcoming Copenhagen Climate Solutions 2008. This is a great opportunity to raise awareness of the need to use existing resources more carefully. Industry can make a huge positive contribution but political will and support are needed to exploit its full potential.



Energy Control



Photo: ©Jørgen Wolek - www.foto-arkiv.dk

The Danish company AllSun A/S, belonging to the group TopSun A/S, develops and manufactures intelligent and multifunctional energy controllers with interactive communication. The technology of the energy controllers is based on the experience gained through several years of development and application of concepts in the former company PentaCom A/S, which developed and manufactured the first wireless control system for floor heating in the world.

In connection with the sale of PentaCom A/S to Danfoss A/S in 2002, activities concerning solar energy were concentrated in the company AllSun A/S, which was established early 2003.

Domiciled in an energy-saving building

In order to reduce the CO₂ emission of the company we make an effort to reduce *and* make the energy consumption more efficient; compared to a conventional new building, our total energy consumption is reduced by more than 50%.

The premises of AllSun A/S are domiciled in “the Brundtland Center Denmark”, a building which is based upon energy-saving technology and renewable energy.

The Brundtland Center Denmark can be seen as an energy system and such an approach calls for an integrated design process in order to achieve maximum utilization of passive and active solar energy, natural daylight and passive cooling. Thus, the multi-purpose facade is a key element in the building. The upper third is a daylight window with light reflecting blinds, the middle part is a vision window with movable solar shading, and PV panels are integrated in the

lower part. The exposed concrete ceiling helps to redirect daylight deeper into the building, and it is used for passive night cooling. The materials and constructions are chosen for easy maintenance and a clean internal environment, to improve indoor air quality. This in combination with efficient solar control and control of artificial lighting reduces the ventilation load on the building to that created directly by the occupants.

Intelligent energy controllers

AllSun develops and manufactures energy controllers in the Thermius series which are primarily used in smaller and also more complex solar thermal systems. The Thermius series offers a wide range of functions and possibilities which cover almost all needs. The energy controllers are for thermal solar systems in buildings requiring the production of hot domestic water as well as control of heat circuits and boilers. A connection to GSM or the internet allows transfer of the collected data, remote control and monitoring of operation as well as interactive communication.

The Thermius T80 is an individual, customized, and simple intelligent controller. Out of various numbers of applications we can specify e.g. 5 together with the customer fulfilling his requirements due to the types of pumps and valves and the controller itself. Even the connection of the input and output sensors will be specified. As a result the customer gets his T80 version being suitable for the solar packages he sells to installers. Thus, it is easy to install the controller and not necessary to have any kind of technical support.

Our universal multifunctional controllers T300 and T600 are mainly used in connection with complex solar thermal systems in large buildings such as hotels, housing blocks, swimming facilities, hospitals or nursing homes. Their graphical displays make the user interface simple to operate, and furthermore they can display solar energy yield measurements in bar chart. They have a smaller case, a user-friendly button function and can easily be configured via web-interface. Both T300 and T600 have a built-in web server, which can be controlled and configured through the internet and it forwards alarms via e-mail or SMS.

The successor to our universal controller T300 is the T310. T310 has a smaller case with great improvement with regard to connection of cables, a user-friendly button function and moreover T310 is easy to configure via web-inter-

face. The intelligent energy controller Thermius T300/T310 is mainly used in connection with solar thermal systems in large buildings such as hotels, housing blocks, swimming facilities, hospitals or nursing homes. The graphical display makes the use interface simple to operate, and furthermore it can display solar energy yield measurements in bar chart.

Thermius T300/T310 is easily set via the computer. Thermius has a built-in web server, which can be controlled and configured through the internet and it forwards alarms via e-mail or SMS.

Our intelligent Thermius series is also part of a combined heat system - an innovation that might revolutionize the whole field of sun, ground, cooling and ventilation. The system combines solar panels, a ground source heat system, cooling and ventilation, and produces solar and ground heat and is also able to cool and ventilate the house. This "energy saving machine" will affect the entire market, as this system makes it possible to produce a great percentage of the heat and hot water for free, and the combination offers the possibility to produce free cooling and ventilation.

All together it is a great opportunity for all house owners to contribute to the reduction of CO₂ emission by installing an "energy saving machine" like this!

Renewable energy

AllSun A/S is a Danish company aiming at being known as the energy optimizer. Although AllSun started to develop solar controllers for the solar thermal industry, we have gained the experience to close the gap becoming one of the most successful companies in developing controllers for efficient and optimized energy systems.

Adapting all kind of sensor systems to collect data, to effect intelligent control circuits and data acquisition and to activate output handlings are the basic tools to realize energy savings, being one of the key factors to reduce CO₂ emission permanently and - most important - immediately!

ALLSUN
ENERGY CONTROL

Climate Action Plan Aarhus

The city councillors in the Municipality of Aarhus have adopted a very ambitious target for its climate efforts: The entire Municipality of Aarhus as a community must be CO₂-neutral by 2030 – no CO₂ emissions from the Municipality of Aarhus in 22 years' time. At the same time, the municipality is aiming to attract 75,000 more people to the city. This calls for action!

The municipal administration is drawing up a map and an action plan which together will constitute 'Climate Action Plan Aarhus' (Klimaplan Århus).

The map is to identify the areas in which action must be taken to reduce CO₂ emissions. Some of the data for the mapping are already in place in the municipality's environmental action plan, which covers CO₂ emissions from the municipal workplaces. Data must now be gathered for the whole of the municipality as a community. The mapping will be completed in spring 2008.

Concurrently, a large number of new projects and initiatives will be launched aimed at translating the impressive target into action. How can we reduce CO₂ emissions and, in the end, eliminate them entirely?

The municipality itself has a number of possible levers that it can and must activate:

- Houses are already available that are largely energy-neutral – the so-called passive houses. Via its local planning, the municipality can stipulate that low-energy houses must be built.
- The municipality's own buildings constitute a large proportion of the workplaces in the Municipality of Aarhus. In this area, there is also ample opportunity for improving building insulation, replacing windows, reducing electricity consumption etc.
- As everyone knows and can see, transport makes a heavy contribution to CO₂ emissions. Cars pollute. Bicycles don't. In 2007, the municipality adopted a bicycle action plan which aims to improve conditions for cyclists through greater accessibility and improved safety. In addition, the municipality can stipulate that vehicles used by the home

care service as well as vehicles used by the municipality's other employees must run on CO₂-neutral fuels.

- The municipality is about to revise its heating plan. Future energy supplies may be required to be based on wind power, biomass or other CO₂-neutral sources.
- Promoting sustainable energy – e.g. by allowing the erection of wind turbines.
- At the same time, it is crucial to provide information on what the municipality is aiming to do and on what individual consumers can do. The Municipality of Aarhus is participating in the global 'Lights Out' campaign in March 2008 and again in 2009. The Green Guides have been recruited to spearhead the campaign and function as collaboration partners, i.a. by offering half a day of teaching for pupils in years 4-6 at school in the municipality.

Before July 2008, the Municipality of Aarhus's city council must know where CO₂ emissions come from and how they can be reduced. It is then up to the city council to drive the actions which are identified as necessary in Climate Action Plan Aarhus.





Navitas Park – Aarhus

Denmark has grown to become the world's leading Wind Power Hub – a wind energy centre with enormous growth potential. Danish wind turbine manufacturers enjoy a market share of approx. 40% and the market is expected to grow significantly. The Central Denmark Region is home to a significant part of the Danish energy cluster. A broad range of players from industry, education, research and development as well as the public authorities based in Central Denmark has launched a series of new initiatives. Central to this work is a new innovation centre – called Navitas Park – for the energy and utility industries to be located in The Aarhus Docklands. In addition, funds have been allocated to expanding the research and education environment as well as to profiling Denmark more strongly as a Wind Power Hub.

Areas of activity:

Innovation centre for energy and utility industries

An open and active innovation centre is being created, where businessmen, researchers, academics and students collaborate and inspire each other. An environment where the borderlines between private innovation, public research and future-oriented education are broken down in an open, creative and dynamic campus environment. An innovation environment which is a national platform for the development and application of knowledge about energy.

Navitas Park will house companies, education and research as well as a research park, a joint project hotel, a test centre and demonstration facilities, where the companies' development departments can collaborate with researchers and students.

Strengthened education and research

Research will be strengthened through establishing new professorships at the University of Aarhus, boosting the energy-technological subjects at the Engineering College of Aarhus and strengthening specialist post graduate studies by involving researchers and tutors from Danish and foreign knowledge and educational institutions.

Strengthened profiling of Denmark as a Wind Power Hub

Employees with the right knowledge are crucial if Denmark is to retain its leading edge within energy technology. Targeted PR and marketing are therefore needed to attract students, engineers, technicians and companies to Denmark. Already, the industry is recruiting specialist employees from all over the world, and with an extra effort targeted at students, tomorrow's workforce will also discover Denmark as a Wind Power Hub. This effort will be based around the platform "The Talent Factory". www.talentfactory.dk

A coherent and interrelated development plan

Increased investment in education and research will attract companies looking for knowledge and a qualified workforce to the innovation centre. Navitas Park will itself function as a flagship in the marketing of the region - and will attract students and researchers as well as employees and companies.

For more information please visit:

www.navitas-park.dk,
www.businessaarhus.dk and
www.aarhuskommune.dk



City of Aarhus

Copenhagen to become the eco-metropole of the world



Copenhagen City is the capital of Denmark, the largest Danish municipality and the centre of the Danish-Swedish Oresund Region. Home to slightly more than 500,000 people, Copenhagen City covers an area of 91.3 km². The City employs nearly 55,000 staff in its seven administrative units. The environmental initiative dubbed "Eco-Metropole – our vision CPH 2015" embodies Copenhagen City's vision that by 2015, Copenhagen will be justifiably known as the capital in the world that has the best urban environment. The vision encompasses four themes: Copenhagen must become the centre for world climate policy, the world's best city for cycles, a green and blue capital city, and a clean and healthy major city.

Internal efforts in the climate area

Copenhagen wants to be the centre for the world's climate policy as part of its vision of becoming the world's eco-metropole by 2015. Therefore, CO₂ emissions must be reduced by 20 percent by 2015 compared to now (2005 figures). Copenhagen City will lead the way with a number of initiatives to realise the objectives.

Within the energy area, the City has launched a focused initiative to reduce energy consumption in the City's own buildings. The City is working with energy providers to ensure energy savings in renovation work and new constructions, through investments in renewable energy facilities and by means of behavioural campaigns. Energy consumption is also highlighted in the process of implementing environ-

mental management at all the City's institutions. In addition, Copenhagen City has joined the Ministry of the Environment's national "1 tonne less" drive to reduce CO₂ emissions, followed up by a campaign aimed at the City's employees. The City also pursues a green procurement policy observing the requirements for electricity-consuming products set out by the "A Club" of the Danish Electricity Saving Trust.

Copenhagen wants to ensure that experiences gained from its ambitious environmental efforts are shared at national and international level, and Copenhagen will also engage in targeted collaboration with other municipalities, major cities and regions.

Climate solutions

The UN Conference on Climate in Copenhagen in December 2009 will present a unique opportunity to pinpoint Copenhagen as the centre for the world's climate policy and to showcase the city as an eco-metropole. The City is implementing a series of initiatives to serve as demonstration and inspiration for citizens, companies and the city in general.

In the transport area, all of the City's new vehicles that are registered as passenger cars must be classified "A", and Copenhagen City is aiming to implement similar requirements for our other vehicles and work machinery. The City has also earmarked budget funds for pilot projects involving the use of alternative fuels. All administrative units are required to develop plans for environment-friendly transport during work hours, i.e. strengthened use of cycles, buses, energy-saving vehicles and fewer taxis. The City is currently looking into the possibility of enhancing the environmental profile of taxis in Copenhagen.

Despite an outstanding economic development, CO₂ emissions have been reduced by 25 percent since 1990 (compared to 2005 figures). This owes mainly to a fully developed district heating network and a strong focus on wind energy (Middelgrunden Offshore Wind Farm). The goal is to reduce CO₂ emissions by a further 20 percent before 2015.

One of the focus areas is sustainable urban development, and the City is planning demonstration projects in new and existing urban districts. Over the next 10-12 years, up to 36,000 new homes will be built in Copenhagen, potentially resulting in emissions of 100,000 tonnes CO₂. Therefore, the City will promote the establishment of two sustainable, CO₂ neutral urban districts with energy-saving buildings and the use of renewable resources in the energy supply and the transport system. The projects are intended to become models for the future development of sustainable urban areas in Copenhagen, also when it comes to renovating existing districts. Exciting projects are already afoot, for instance a serious solar cell initiative in the Valby area.

As concerns traffic, cycle routes will be continually developed in accordance with Copenhagen's priority plan for cycle paths. Barriers such as curbs and cobblestones will be removed and dangerous intersections will be highlighted. Cycle parking facilities will be improved to make Copenhagen the world's best city for cyclists where at least

half of the citizens cycle to work or school to the benefit of their health, the local environment and the reduction of carbon emissions. In connection with the 2007 Environmental Festival, the City launched a campaign to boost the use of car pooling for work. Intelligent traffic control is also being tested at a pilot stage, and the City has earmarked resources for looking into the possibility of introducing congestion charges, together with the neighbouring municipalities.

Copenhagen City is also implementing an array of initiatives to get citizens and companies on board. The goal is for the climate challenge to become a popular cause, as this will provide far better results than can be achieved by merely raising an admonishing finger. Therefore, in the period leading up to the climate conference in Copenhagen in December 2009, an extra effort will be made to visualise the potential of the individual citizens and companies in Copenhagen to contribute to reducing CO₂ emissions.

The effort serves to raise awareness of the climate issues and render visible the City's initiatives and the possible action of each individual. As an important part of this, special focus will be given to equip children and adolescents in Copenhagen with a technical understanding of climate issues and enhanced competencies for action. The City's environmental network for companies will be expanded with a climate division to inspire companies to enter into voluntary CO₂ agreements.

CONTACT THE CLIMATE TEAM

COPENHAGEN CITY
 Technical and Environmental Administration
 Centre for the Environment
 Kalvebod Brygge 45
 Postboks 259
 DK-1502 Copenhagen V
 Tel. +45 3366 5800
 E-mail: miljoe@tmfkk.dk
 Jane Drejer Nielsen - project manager
 Hanne Christensen
 Maren Madsen
 Thomas A. Christensen



FURTHER INFORMATION

COPENHAGEN AS ECO-METROPOLE
www.miljoemetropolen.kk.dk
 ENVIRONMENTAL WORK IN COPENHAGEN
www.miljoe.kk.dk



Danfoss products save energy for customers

Danfoss A/S is one of Denmark's largest industrial groups with annual net sales of approx. 21 billion DKK and around 22,000 employees, of which 6,500 work in Denmark. We produce approx. 250,000 components every day at 61 factories in 25 countries.

Danfoss is an international group which is among the leading companies within research, development and production for a wide spectrum of different industry sectors.

Activities are based on the company's core values: trust, passion for technology, being a reliable choice, a global perspective, local commitment, and environmental and social responsibility.

A wide range of companies have targets for energy savings and the emission of CO₂ in the future, but often there are clear opportunities to get started right away.

The key words are energy savings, which include existing technologies that generate significant reductions in a company's energy consumption.

Of course, you should choose renewable energy sources for the long term and go for major CO₂ reductions, but there are already lots of profitable energy-saving technologies and solutions that reduce energy consumption by up to 40 per cent or more.

A wide range of Danfoss products reduce the energy used to heat, cool or control the speed of processes. Danfoss fre-



quency converters, which control the speed of electrical motors, save 20-40 per cent of energy compared to traditional solutions; whereas each radiator thermostat saves 80 litres of oil annually. Therefore, the amount of CO₂ saved over one year by using Danfoss frequency converters and radiator thermostats is higher than the amount of CO₂ emitted during one year's production of electricity in Denmark.

Energy-saving solutions from Danfoss Solutions

Danfoss Solutions, which is a business unit in Danfoss A/S, specialises in energy-saving solutions for large industrial consumers, primarily within the food and beverage industry and the manufacturing industry.

In the future, energy, water and heating will be scarce resources – and prices have increased significantly. By implementing Danfoss Solutions' energy control products, companies can, typically, cut an additional 10-15 per cent off their total energy bill, with a pay-back period of less than two years – and thereby reducing the emission of CO₂ significantly.

Danfoss Solutions combines state-of-the-art technology from many suppliers of energy control solutions with Danfoss' wide experience and knowledge about process optimisation within refrigeration, heating, ventilation and speed control. Added to this, is a “no cure – no pay” guarantee.

Danfoss Solutions has carried out turnkey projects on behalf of companies like Carlsberg, Tulip, and Coca-Cola – which are just a few of the Danish projects. All resulted in savings worth millions of Danish Kroner, as well as CO₂ reductions of more than 10,000 tonnes per year, which was advantageous for both the environment and the bottom-line.

Danfoss takes part in ProjectZero: a CO₂-neutral city

A leading international architect is set to prepare a master plan for the city located in the southern part of Denmark.

Thanks to the ProjectZero vision, Sønderborg and the surrounding area – which has 76,000 inhabitants – will be amongst the most progressive areas in the world in just a few years' time. By 2029, ProjectZero aims to have made Sønderborg the first major sustainable and CO₂-neutral area in Europe, based on dedicated energy-saving activities and a shift to modern forms of energy.

As the region's largest global workplace, Danfoss is a natural base for the development. Peter Mads Clausen, the chairman of the Bitten and Mads Clausen Foundation which owns Danfoss, is also chairing the ProjectZero Foundation.

ProjectZero was launched in July 2007. Since then, the ambitious project has been linked to Frank Gehry's plans for the waterfront in Sønderborg. The architect Frank Gehry is well-known for designing the art museum in Bilbao, for example. Currently, he is preparing a master plan for the harbour area in Sønderborg – based on the vision of a sustainable neighbourhood in the centre of the city. The master plan also includes a new hotel which will be at the heart of the project.

“By mixing spectacular, international architecture with the most innovative ideas in sustainable construction and sustainable living, Sønderborg will be one of the world's leading examples of how to make sustainability and business sense go hand in hand,” says Peter Rathje, who is the managing director of ProjectZero and the Sønderborg Harbour Association.

The master plan sets out general guidelines about how to realise sustainability targets in the most effective way. And when the harbour construction is completed in about ten years' time, it will become ProjectZero's live and active showroom for the future – a sustainable neighbourhood and an inspiration to other neighbourhoods, points out Peter Rathje.

At the same time, the harbour construction is expected to attract visitors from outside Sønderborg. This way, ProjectZero will be an important way to brand Sønderborg for both Danish and foreign visitors.



CO₂ Reduction and Climate Solutions

At Danisco, we take Corporate Social Responsibility seriously and we believe that we can contribute to developing more sustainable industrial processes that will lead to the reduction of CO₂ emissions by the private sector. Through our cutting-edge innovation programmes, our enzyme products have enabled reduced usage of energy, water and even chemicals in industries as varied as textiles processing, detergents and grain processing. Particularly in the transportation sector, we foresee tremendous growth and opportunity for CO₂ reduction with the nascent cellulosic ethanol market.



Based on a publication* in "Science" magazine of 27 January 2006, the largest positive impact on CO₂ reduction is the production of bioethanol based on sugar cane and cellulosic (biomass) ethanol. Both would reduce CO₂ by 90%, compared to biodiesel (-80%) and corn ethanol (-20%).

Cellulosic ethanol is an attractive alternative to current gasoline because many different biomass material and plants can potentially be used to produce this biofuel.

However, considerable investments in research and demonstration are still needed to be able to benefit from a full deployment of cellulosic ethanol. Thus partnerships and alliances both between policy makers, industry and technology providers such as Genencor/Danisco are essential to increase the speed to market. In the meantime, our biotechnology division, Genencor, announced the first ever commercially available enzyme for the cellulosic ethanol industry in October of 2007. This important first innovative stepping stone product will facilitate process development and scale up in the emerging biomass hydrolysis industry.

In addition, Genencor entered into a collaboration with Danish DONG Energy on developing second-generation bioethanol.

Together with Statoil and AgBioEnergy and Genencor, DONG Energy intends to receive public funding to establish a demonstration plant near Kalundborg, Denmark. Danisco thereby participates in one of the leading development centres for second-generation bioethanol in Europe. The demonstration plant is

scheduled to come on stream by the time of the climate summit in 2009 and will be handling four tonnes of straw an hour, corresponding to a production of 4,500 tonnes of bioethanol annually.

Catalyst of the biobased economy

Genencor aims to be the catalyst of the biobased economy: An economy that converts renewable raw materials into bio-products, biochemicals and biomaterials – in dedicated biorefineries that are built next to the renewable feedstock. Enzymes are a critical component in such conversion processes, e.g. in the conversion of biomass into sugars, the carbon source for bioproducts, and are thus critical to realising the biobased economy. Danisco envisions a future where biorefineries will develop and take their place alongside oil refineries – and where the world will benefit from this biobased economy.

Danisco's efforts to reduce CO₂ emissions

At Danisco, we have worked towards reducing our carbon emissions for many years. Our efforts have already produced significant results.

In 2005, we set up a Danisco Climate Strategy Network to:

- Identify current CO₂ emissions
- Identify the potential for greenhouse gas (GHG) savings across divisions
- Draw up a Danisco Global Climate Strategy proposal

Combined with the emission data we have recorded since 1999, these objectives form the basis for identifying, prioritising and implementing GHG saving initiatives, such as carbon accounting. The emission data includes both direct (from operations or combustion of fossil fuels) and indirect emissions (from energy purchasing). Supply management and the development of the Danisco Global Climate Strategy are in progress.



DANISCO

First you add knowledge ...

*) Source: Farrell et al. "Ethanol can contribute to energy and environmental goals", Science, 27 January 2006



Interested in attractive CO₂ credits from abroad..?

Danish Energy Management is the most experienced Danish consultancy in the emerging carbon market, providing quality services within a wide range of energy and environmental related activities.

For many years – DEM has developed energy projects with CO₂ reductions to be sold to the Danish State and/or private companies under the Clean Development Mechanism (CDM) under the Kyoto-Protocol. The provided services are covering the whole project cycle from identification to implementation of the CO₂ projects, capacity building and other Kyoto related activities, domestic and abroad.

DEM is expanding its involvement worldwide maintaining its strong position as one of the prime international energy and environment consultants.

The company provides consultancy service in the following areas:

- Project design documentation for CDM and JI project activities
- Baseline setting
- Marketing and contracting of carbon credits for sale
- Capacity building of public and private sector within green house gas emission reduction projects and the flexible mechanisms of the Kyoto Protocol
- Advisory services on contracting, validation and approval process for CDM and JI projects





References

During the last 20 years we have delivered consultancy services within the energy sector to a vast number of national and international industries, cooperation agencies, lenders and recipients and we have implemented energy projects in more than 50 countries. Our clients for CO₂ projects includes both industries and state authorities like DONG Energy, Nordjysk Elhandel A/S, Danish Ministry of Foreign Affairs, Danish Environmental Authority, the European Commission, the World Bank etc.

Thailand

DEM is on basis of a large contract with the Danish Government assisting in developing, managing and implementing GHG emission reductions in Thailand. DEM has had permanent office in Thailand for almost 10 years, providing a long list of services including preparation of CDM contracts between the project proponent and the Danish Ministry of Foreign Affairs. DEM has so far developed about 15 CDM projects in Thailand with possible 2 million tons of Certified Emission Reductions credits to be sold to the Danish State or private companies.

Malaysia

DEM is assisting the Danish Government in developing CO₂ projects in Malaysia for a three-year period and the first international approved CO₂ reduction project in Malaysia was developed by DEM.

Private companies in Denmark and Europe are also engaging DEM to develop CDM Projects in Malaysia. In total

more than 15 CDM projects are being managed by DEM. For almost 10 years the company has been present with an office in Kuala Lumpur, Malaysia and has worked on both energy projects and CDM projects with a potential to generate more than 2 million CO₂ credits.

China

In China, DEM is providing technical assistance to the Chinese Government under the Energy / Environment Program, supported by European Commission. The program targets improved energy efficiency, increased use of renewable energies and a lower GHG emission through the increased use of natural gas.

Other Countries

DEM has registered offices in several countries, such as South Africa, Lithuania, Bangladesh, China, Indonesia, Thailand, Malaysia and Uganda. In these countries we can develop GHG Emission Reduction projects attractive for both authorities and industries in Denmark as well as any where else. The projects developed will be certified and approved by the United Nations.

Of special interest to Danish Industries

On behalf of the Danish Environmental Authority, DEM is engaged in a study on the investigation of professional tools to support the participation of quota companies in the carbon market. This study will among other things enable DEM to assist interested companies navigating this emerging market.



Danish Energy Management

A part of Danish Management Group

Hydrogen and fuel cell technology ensure that 170.000 Danes can surf the internet at breakneck speeds even if the main power supply fails:

Dantherm Power A/S and EnergiMidt have put fuel cell technology to commercial use



Many believe that the future inside energy conversion will be commercially viable solutions based on hydrogen and fuel cell technology. If that is the case then the future began on September 5th 2007 in the central part of Jutland, Denmark. On this date Dantherm Power A/S put the first commercial solution ever based on this clean and safe technology – a UPS-system - into service on the fiber-optic broadband network operated by the electrical power company EnergiMidt.

UPS is short for Uninterruptible Power Supply. It is an emergency power backup system that takes over immediately in case of failure in the main power supply. UPS-systems are crucial in maintaining steady uninterrupted power for the electronic equipment, transmitters and cooling systems inside the radio base stations taking care of the distribution and steady flow of data and information in IT and telecommunications networks.



Hydrogen stored in ordinary Cylinders instead of diesel

The fuel cell based UPS-systems developed by Dantherm Power A/S replaces traditional solutions using batteries or diesel generators to supply emergency power backup. It is powered by hydrogen distributed in ordinary garage type cylinders as safe and reliable as any other industrial gases.

Each fiber network node is equipped with 3 or more hydrogen cylinders supplying about 4 hours of 5 kW emergency power supplying -48VDC and 230VAC. The cylinders can be replaced during operation, and the UPS can run for days or even weeks if necessary.

Dantherm Power A/S and EnergiMidt are both participants in the joint Canadian/Danish fuel cell initiative, CanDan. So when EnergiMidt started rolling out the fiber-optic network offering about 170.000 customers extremely fast internet connections it was only natural to approach

Dantherm Power for a commercially viable and reliable UPS-system based on hydrogen and fuel cell technology.

No harmful emissions or substances

EnergiMidt believed such a system would offer a number of advantages over traditional solutions, and the solution Dantherm Power came up with proved them right.

The environmental benefits are obvious. The only by-product when generating electricity from hydrogen is humid air. The fuel cells contain no harmful substances and the process is virtually noiseless. Quite the opposite of a messy, noisy diesel generator emitting loads of CO₂, and the harmful chemical waste products found in worn out batteries.

The fuel cell based UPS-system has a lifetime of about 10 years performing several thousand startups delivering a constant and reliable power output. Whereas batteries have a limited lifetime degrading a little every time they are recharged or just in standby as well as being sensitive to storage temperatures.

EnergiMidt has calculated a total cost of ownership for the Dantherm Power hydrogen and fuel cell solution which is considerably cheaper than any traditional UPS-system making it a truly commercially viable solution.

Commercial solutions for heat and power in private households is next

When you take the environmental benefits and the socio-economic implications into account Dantherm Power is convinced that it is only a matter of time before hydrogen and fuel cell technology based solutions find their way to other commercial areas. The company plans to continue its role as "first mover". Dantherm Power has already Micro Combined Heat and Power solutions for private households and various transportation solutions based on fuel cell technology are well on the way at Dantherm Power A/S in Skive, Denmark.





As Denmark's largest auditing and consultancy firm, Deloitte performs the role of sparring partner for a large segment of the Danish corporate and public sector. We offer services within Auditing, Tax, Consulting and Corporate Advisory.

About Deloitte

A strong network

Our Danish history dates back to 1901. Today, we have approx 2,000 employees distributed in offices in 21 cities – and we service more than 13,000 clients. We are part of the global organisation, Deloitte Touche Tohmatsu, which has 150,000 employees in offices in approx 140 countries.

Insight and dedication

For us, auditing is not just about figures. It is also about the people involved – our clients' people and ours. Therefore, you will meet professional people that are constantly enhancing their skills by theoretical knowledge and practical experience at Deloitte.

A broad team of specialists

At Deloitte, you are assigned a strong team of specialists. Our expertise covers a wide field. But we enjoy a common enthusiasm, curiosity and sense of quality which is your guarantee of professionalism and added value.

Focus on values

At Deloitte, we want to be recognised as the best auditing and consultancy firm in the world. We base our work on our fundamental values: Trust, Added value, Competencies and Success.

Climate Change Response within Deloitte

Within the scope of global challenges, climate change is certainly among the top concerns. Deloitte participates in the ongoing debate about long-term sustainability and the ways businesses

recognise, create, and measure value. Member firms understand that changing perspectives on sustainability and environmental responsibility will have a profound effect on their people, their clients, and the way business is conducted. For example:

- Businesses, including Deloitte clients, are finding innovative solutions to reduce the consumption of natural resources and to develop and implement sources of renewable energy.
- Supply-chain management is changing in order to maintain sustainable sources of raw materials and produce and dispose of waste in environmentally friendly ways.
- Issues of public policy, including regulatory compliance and taxation, will create incentives to achieve and monitor actions towards achieving a sustainable future.

As a result, Deloitte is:

- Advancing its knowledge of environmental sustainability and climate change issues, responding to market needs, and providing relevant services.
- Raising awareness with the public, its people, and its clients.
- Managing its own environmental footprint.

Supporting your Climate Change Response

Climate change is a global issue which demands a global response. Today, many companies operate on a global basis and are looking for a service provider with a global presence... one that can interpret the various regulations, opportunities and constraints. Climate change creates needs that require multidisciplinary integrated services delivered from across our basic functions.

While climate change and renewable energy are relatively new topics, Deloitte member firm practitioners have amassed a substantial amount of experience. Examples of such are services provided around the world in clean development mechanism (CDM) validation, joint implementation (JI) determination, strategy, emissions verification, assurance, strategic and tax advice for renewable projects, emissions trading risk management, advice to governments on carbon policy development, and more. Member firm professionals have established qualifications, frameworks, and methodologies. If your company needs assistance on a climate change topic, Deloitte member firms can help.

We support clients in the following areas

- Strategy and risk management
 - analysis of the effect of Climate Change response on the viability and profit of the company
 - overview of the company's CO₂ position both in a historic and present perspective
 - forecasting the company's possible future position based on the business strategy
 - Gap analysis and supporting the establishment of a business strategy towards greater efficiency/a CO₂ neutral company
 - mitigation and action strategies (quota on CO₂, CDM and JI possibilities, tax, and excise duties)
 - Implementing CO₂ portfolio planning into the general business planning
- Systems and processes
 - monitoring, registering, and control with CO₂ emissions
 - operational management
 - trading and mitigation operations
 - fulfilling requirements to inventory and bookkeeping etc. from legislation and standards/codes/guidelines
- External reporting
 - fulfilling objectives of external reporting in either the annual report, Corporate Responsibility report or other forms of reporting
- Financing and funding
 - cleantech (from feasibility study to business plan to funding)
 - start-up – assisting and supporting companies with finding the optimal business idea and implementing it
 - Assisting investors in finding relevant objects, evaluating the objects and handling of investment possibilities

Within our independence framework we are able to perform assurance engagements on a range of such areas.

ENERGY IS OUR BUSINESS



DONG
energy

DONG Energy's business is energy. We guarantee a reliable supply of energy and a responsible utilization of our natural resources.

DONG Energy is founded on many years of experience. For more than a century, we have been supplying electricity and heat – and since the early 1980s natural gas – to customers in Denmark and neighbouring countries. Today, we are active in every link of the energy chain – from offshore production platforms in the North Sea, over wind farms and power plants generating electricity and heat to distribution of energy to our customers. This ensures a highly reliable supply of energy and gives us the necessary expertise for developing our company.

Reliability and responsibility

A reliable supply of energy is crucial to modern society. Each day, we all consume energy in multiple ways – when we are at work, at home or on the move. Energy empower modern life. A reliable supply of energy makes a safe and more convenient daily life possible for our customers.

We have more than a million customers, who depend on our energy supply every day. They range from private households to large-scale industrial companies and public-sector customers.

Each year, DONG Energy invests heavily in the development of renewable energy sources like wind power. As a pioneer in establishing and operating offshore wind farms, DONG Energy has amassed powerful expertise in this area, and today our company is a world leader in generation of wind energy. Furthermore, we participate in the development of

cutting-edge technologies such as fuel cells, solar energy and wave power.

We also invest heavily in further improvements of our power plants. In Denmark, as in many other countries, the main part of the energy supply comes from power plants. It is not yet possible to guarantee a reliable supply of energy based on renewable energy sources like wind power alone. The energy supply would then depend on weather conditions, and at days with only light breezes – if any – the supply would not be able to meet the demand for energy.

DONG Energy's power plants are among the most efficient and least polluting power plants in the world, and we constantly strive to further reduce the environmental impact associated with our energy production.

We ambitiously aim at further improving the utilization of the fuel used in our power plants as well as optimising the fuel composition (coal, gas, biomass and waste) and hereby reduce the CO₂ emission. Furthermore, we work hard to develop a post-combustion-carbon-capture proces.

The objective is to separate CO₂ from the power plant flue gases and investigate the possibilities for storing the captured CO₂ in the underground and reusing it to optimise offshore oil production. >>



DONG
energy

Innovation is part of our everyday life

Considerable sums are invested in people and knowledge each year as it is, first and foremost, our talented people who drive DONG Energy forward every day. We currently adjust our products and services, production processes and organisation whenever the changes benefit our customers and/or our surroundings.

New products and services are constantly developed, tested, evaluated and finalised as a result of our research and development efforts. A very promising new project is a new and improved production technology for cellulosic bioethanol.

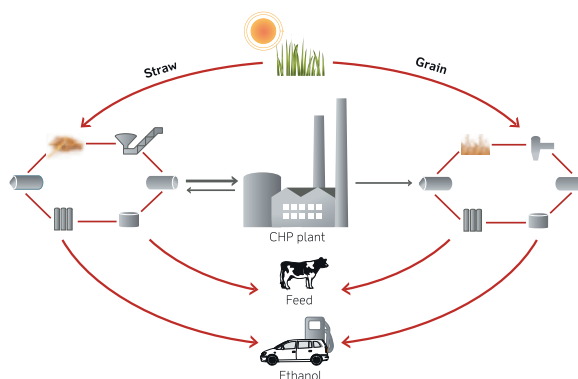
From straw to ethanol

Transportation of goods – and people – is a very decisive factor in the world today, and at the moment, we see no indication of a reduced importance of transportation in the years to come. DONG Energy cannot change this fact, but we can help reduce the environmental impact of transportation through the development of bioethanol. Bioethanol is a CO₂ neutral fuel in the sense that the amount of CO₂ released during combustion corresponds to the amount captured by the plants when growing up.

Bioethanol production facilities already exist around the world today. The production from the existing plants is based on grain, corn, sugar cane or other feedstocks with high contents of sugar and/or starch. DONG Energy's bioethanol production process and technology is different as we are capable of combining the use of the abovementioned feedstocks with lignocellulosic biomass in the production of bioethanol. Our concept even integrates the production of electricity and bioethanol utilising low-value steam from the power plant with the ethanol process.

Low-value steam from the power plant is used in the pre-treatment of the lignocellulosic biomass. The outcome of our process is bioethanol, feed and solid biofuel. The solid biofuel contains more energy than required for processing

the lignocellulosic biomass. The surplus of energy can be used in the bioethanol production based on sugar/starch, which is energy-intensive but results in protein-rich animal feed.



By combining the production process known today based on sugar/starch with our production of bioethanol from straw and other residual products – and integrate the production of electricity and bioethanol – we end up with a more environmentally friendly, less-energy consuming and highly effective production process compared to the bioethanol production we know today.

On the road from idea to industry, we have reached the stage, where we are ready to test our production process on a large-scale pilot plant. The pilot plant is supposed to help us further optimise the technology and to cover all aspects of synergy between the biomass unit and the combined heat and power plant.

This bioethanol production concept is a result of DONG Energy's constant search for new and improved energy solutions. Solutions which meet the needs of our customers and at the same time reduce the environmental impact by reducing the CO₂ emission during production and consumption.

Sustainability through innovation

The Grundfos Group, based in Denmark, is a global market leader within the pump industry. In 2006, turnover reached EUR 2.06 billion, with a profit before tax of EUR 198 million. The Grundfos Group was founded in 1945, and presently employs approximately 14,800 persons in 75 companies in 42 countries worldwide.

Production exceeds 14 million pump units annually. Grundfos solutions are employed in NOx emission reduction, biological wastewater treatment, heating, water supply, wastewater, air conditioning, dosing, pressure boosting, and fire fighting.

CO₂ reduction efforts

Grundfos strives continuously to reduce its effects on the environment. The company works to conform to respective environmental laws, as well as meet its own internal goals for improvements within major environmental fields.

Within transportation, Grundfos has set goals of achieving a load factor of minimum 90% to major production facilities between Denmark – Germany and Denmark – France. Grundfos was awarded the EU Eco-Management and Audit Scheme (EMAS) for good environmental stewardship. Grundfos won the award in the “large organisations” category on 19 November 2007 in recognition of the company’s efforts for waste reduction and handling.

The total amount of waste produced by Grundfos’ Danish factories has been reduced by 1/3 in less than 10 years. Waste recycling percent also rose to an admirably high 84%. Over 100 suggestions for improvements from employees were submitted in 2006 alone. The company is furthermore examining possible usages of excess energy such as utilising cooling energy in manufacturing.

Grundfos NoNOx: clean air for the world

Technological advances in motor technologies have been beneficial to us all. They have also given us air pollution due to emissions from fossil fuel combustion.

Grundfos NoNOx reduces nitrogen oxides (NOx) in diesel motor emissions, helping ensure cleaner air for present and future generations. Using Selective Catalytic Reduction (SCR) technologies, Grundfos NoNOx converts NOx exhaust fumes into harmless water and nitrogen via a reactant (urea) in an exhaust gas stream. These solutions form a natural part of a complete emission control system together with catalysts, particulate filters, and emission piping.

Benefits of Grundfos NoNOx®

Numerous improvements will arise in exhaust after-treatment systems from the integration of Grundfos NoNOx® Urea Dosing Systems:

- Immediately obtainable emission results within city environments
- Prevents unattractive and unhealthy smog
- Engine settings can be optimised for diesel efficiency (up to 10% fuel savings).

Grundfos BioBooster: Bringing clean water to the world

Grundfos BioBooster has gone behind traditional wastewater treatment in selected industries discharging high levels of organics to fully understand the complexities of these industries. And emerged with a groundbreaking solution to industrial wastewater treatment, where modularity, compactness and efficiency combine.

Wastewater treatment is performed inside the revolutionary BioBooster Pressurised Biofilm Reactor (PBR). It combines innovative patented technologies with an aerobic

biofilm process for effective biological removal of high levels of organic content.

The Grundfos BioBooster concept allows industrial process planners and implementers to move from centralisation to decentralisation of wastewater treatment. Wastewater is treated at the source of generation, providing for safe and inexpensive discharge to receiving waters. Depending upon the industry, the wastewater may even be reused for technical purposes, saving money on clean water charges and reducing overall consumption, thus helping to preserve the environment.

As awareness of the problems with global warming grows, so does the public demand for solutions to limit these detrimental effects. More and more people are coming to understand that one way we can all fight global warming is to choose energy efficient products and appliances. Domestic heating is one area where the ordinary homeowner can make a difference, thanks to low-energy circulator pumps.

In 2005, Grundfos pioneered energy-labelling for circulator pumps similar to that known from refrigerators and light bulbs. There are over 120 million circulators in operation in Europe today and the majority of these are simply not efficient enough. Their needless waste of precious energy increases the CO₂ emissions responsible for global warming.

In an effort to accelerate the move towards energy-efficient pump solutions, we have been one of the driving forces behind the European energy labelling scheme and one of the first to launch the A-labelled circulator pump. By choosing energy-efficient Grundfos circulators, customers across Europe managed to provide savings of 916 million kWh in 2005 and 2006. This corresponds to the total annual electricity consumption of more than 200,000 average European households.

Grundfos' ALPHA2 circulator pump uses as little as 5 Watt, easily achieving an A-level rating on the energy scale. It does so by combining the benefits of a frequency converter, compact stator, and permanent-magnet motor. A frequency converter is used to regulate motor speed according to consumption. This means that when demand is lower, the pump motor can be slowed down, using less energy. The alternative is a motor that runs at full-speed, 24 hours a day, wasting energy.



A permanent magnet motor means no electrical power is needed in order to create the rotor's magnetic field. This magnetic field is necessary for the motor to rotate. Furthermore, the unique AutoAdapt function boosts efficiency. The pump automatically adjusts itself to the specific operating characteristics in the system in which it is installed. Low consumption triggers an automatic adjustment of pump settings, so excessive motor speed is eliminated.

GRUNDFOS 

Kamstrup – metering solutions for the energy industry



Kamstrup serves energy and utility companies with long-term stable technology for automatic and cost effective measuring, collecting and management of energy consumption data.

Kamstrup has more than 60 years of experience in this field and holds a strong international position with representatives in more than 40 countries and more than 600 employees world-wide.

The CO₂ reduction effort in our company

Kamstrup not only produces technology that encourages to energy saving behaviour it also acts with environmental awareness and has a CO₂ emission reduction program.

Kamstrup has implemented an environmental management system and is certified according to DS/EN ISO 14001. The energy consumption is constantly monitored and yearly a set of goals for reducing energy consumption are set and carried out. The annual goal for reducing electricity and district heating consumption is a minimum of 5% proportional to the number of produced meters and compared to last years consumption.

Thanks to a committed and focused management and highly engaged employees the result has been exceedingly positive. From 2000 to 2006 Kamstrup has been able to reduce the total electricity consumption per produced meter with 60%.

When measuring leads to saving

The energy industry is facing the challenge of creating energy consumption awareness among consumers and load management is becoming vital to assure an environmentally responsible energy supply.

With automatic meter reading (AMR) the utility gets access to precise and frequent consumption data enabling them to visualise peaks and thus optimising their load management with improved performance as a result. The frequent monitoring of energy consumption also forms basis for household level analysis where consumers can supervise their consumption.

A Kamstrup AMR system is an end-to-end solution from the energy meter, to meter reading and data transmission systems, to the final import into the utility KIS system. The Kamstrup AMR solution offers energy companies improved efficiency in the meter reading and data handling process.

Fjernvarme Fyn A/S – a client case study

AMR has proven to be a meter reading method, which encourages energy saving behaviour in line with actual energy policy tendencies. Apart from introducing AMR the Danish district heating utility, Fjernvarme Fyn A/S is taking energy saving one step further by combining innovative thinking and environmental awareness.

The process of meter reading is carried out by using an existing logistical network – the local municipal sanitation service. Garbage trucks operating in the local area have been equipped with meter reading technology. They now collect both garbage and energy consumption data and thus replace the personnel from the district heating utility who previously drove around in the area collecting the data.

The system is a 100% automated Kamstrup solution and by combining new technology and existing resources the costs for meter reading are substantially minimised. The immediate results and benefits are economic as the utility optimise the costs for the meter reading process. Further benefits can be found in an improved image in the local society as the utility by undertaking this project shows environmentally responsible behaviour.

How does it work?

The "Garbage Truck Model" is designed to collect energy data from Kamstrup heat meters into concentrators placed in garbage trucks and to forward the data to the data collection software via GSM/GPRS.

Energy meters are fitted with radio/radio router modules to achieve optimal transmitting power and reading speed.

Driving around in their local area the garbage trucks automatically read all meters via wireless radio communication. The concentrators read the meters via antennas mounted on the roofs of the garbage trucks.

Data is automatically collected from the concentrators once a day and sent via the GSM network to the utility.



Ramboll – Urban Climate Solutions

Our cities will be able to stop the increase in CO₂ emissions, if we apply the right knowledge and manage to prioritise our efforts. Ramboll provides consulting services to cities on measures to reduce CO₂ emissions and ways to handle the climate impact in a global context.

Today, cities constitute the largest contributor to CO₂ emissions for the world as a whole. In addition, everything indicates that in the future even more people will be living in the cities. Both factors call for strong urban climate solutions, in order to reduce global warming.

The approach has to be two folded, and makes demands on the public sector, citizens, and corporations. On one hand, we must focus on areas that offer the greatest effect. For that purpose we need technological innovation and courage to prioritise. On the other hand, cities will be able to solve the climate problem only if we think holistically. Cities are complex systems in which numerous factors have an impact on the CO₂ emission.

As the largest consultancy in Northern Europe with services within the fields of energy, traffic, construction and planning, Ramboll offers a holistic approach to the climate challenge and possesses key competences within most areas of importance for the urban climate challenges.

Strategy and Urban Planning

If our cities shall succeed in reducing their total CO₂ emission, it requires the existence of a strong strategic outset. It implies the existence of a climate strategy that defines clear objectives, and flexible and long-term planning. At present, Ramboll provides consulting services to several cities on climate strategies, including the identification of main areas of action, planning of processes for implementing actions, and involvement from citizens, and processes to ensure energy efficient urban planning.

With regard to planning, an important element in reducing CO₂ emissions is to limit the need for transport by constructing dense and energy efficient buildings. One way of doing so is to make living and industrial zones integrate with due respect for transport needs and living comfort, and with the purpose of creating as much urban life as possible. Cities should be climate friendly on one hand, and attractive places to stay on the other.

Today, many cities suffer from the close relation between economic growth and increased car traffic. Cars have become global symbols of economic and personal freedom.

In order to reduce the negative consequences of this logic – and at the same time maintain the social and economic dynamic – we need to introduce efficient public transport in



the cities, which will offer people a real alternative to the use of private cars. Public transportation which is based on environmentally justified premises.

As a leading consultancy on infrastructure projects in most parts of the world, Ramboll possesses considerable knowledge of infrastructure solutions that create most value in an urban context and which have the least environmental impact. The Copenhagen Metro is one of the latest and most significant examples of a public transport project for which Ramboll has been assigned as consultant.

Managing the Energy

The need for electricity, heat and cooling is intense all around the world.

Not the least in the cities where prosperity increases demands and expectancies for a higher level of comfort. Changing the energy production from fossil to renewable types of energy and reducing the energy consumption seem to make up the two major efforts of most cities.

As long as our cities base their energy supply on fossil fuels like coal in particular, it is not possible to improve the CO₂ balance remarkably.

Renewable energy sources like solar cells, wind energy, and geothermal energy will have to play a far more important role. Ramboll provides consulting services within a variety of renewable types of energy. Globally, we are the leading provider of services within the waste-to-energy field – a CO₂ neutral type of energy which also solves a major part of the massive urban waste problems. Throughout the last decades, we have been involved in the development of solar heating technology and today, we provide consulting services to some of the largest solar heating plants in the world.

Efficient Systems and Buildings

The introduction of renewable types of energy requires close cooperation between the systems that distribute heat, cooling, and electricity to our cities.

District heating and cooling constitute some of these systems and are among the most essential CO₂ reducing technologies currently available to cities. Throughout the last 25 years, Ramboll have been involved in district heating projects in capitals such as Copenhagen, Beijing, Warsaw, Soul, Bucharest, London, and Moscow. Today, we possess unique knowledge on ways to create a coherent energy

system which allows for the integration of renewable energy sources like waste-to-energy, solar heating, and wind energy in an efficient and relatively cost-efficient manner.

In order to achieve energy savings it is important that houses, offices, and institutions make use of the energy like electricity, cooling, and heating in the best possible way. Energy optimisation within buildings and the design of a building envelope – insulation, density, and ventilation – are some of the key competences in the field of construction which Ramboll has built up over many years. We are also far ahead, when it comes to the development of low-energy houses, integration of alternative energy sources like solar panels in buildings and sustainable lighting design.

Effects of Climate Change: Flooding and Water Shortage

For many cities the main challenge is not only to reduce their own CO₂ emissions. They are already facing severe consequences of global warming which call for prompt action. Problems vary according to geography, but flooding and water shortage are two effects of climate changes which will for certain affect many cities.

If nobody intervenes, many low-lying coastal cities and cities close to rivers will be in danger of disappearing in only few years time as the water level rises. Several cities in Asia are particularly threatened by this development. In other parts of the world, extreme rain causes the drainage systems to break down with heavy impact on the surrounding infrastructure, causing drinking water to be contaminated and diseases to spread. Ramboll is highly competent within the field of coastal protection, simulation of floods, risk assessment, water and waste water, and several other competences that contribute to the urban protection against flooding.

As the opposite extreme, we find water shortage which composes a threat to many cities in Africa. Water resource planning and mapping of groundwater resources will therefore become vital efforts, which also lie within the scope of the year-long experience of Ramboll. www.ramboll.dk



CO₂-neutral housing of the future



SOLTAG, A NEW WAY OF CREATING A SYNTHESIS OF ARCHITECTURE, DAYLIGHT AND ENERGY. PREFABRICATED MODULES CAN BE JOINED TO FORM A CO₂ NEUTRAL BUILDING UNIT.

VELUX is a global company founded on a vision of daylight, fresh air and quality of life. We create better living environments with daylight and fresh air through the roof.

VELUX develops products that help create a sound and healthy indoor climate and low energy consumption. The sharpened focus on climate change and energy supply reli-

ability places more stringent demands on new buildings. In VELUX, we actively support the efforts to reduce energy consumption in buildings. Buildings represent about 40 % of all energy consumption in Europe. Research indicates that improved energy efficiency may reduce CO₂ emissions from buildings by some 20 %.

We believe that a comfortable indoor climate with plenty of daylight, sunsh-ine and fresh air will encourage efforts to increase energy efficiency and promote the building of low-energy houses. With pilot projects such as SOLTAG and Atika, VELUX is demon strating that low-energy buildings with good daylight conditions can be developed and designed for future generations.

The SOLTAG concept house is an example of a sustain-able home of the future with an optimum living environment for people. It is a holistic project living environment for people. It is a holistic project architects, engineers and day-light experts. SOLTAG illustrates the vision that all future buildings could be CO₂-neutral and have a comfortable indoor climate. We can rethink buildings and building automation to support the drive for a better environment. SOLTAG answers the call for zero-energy, CO₂-neutral hous-ing of the future. By using thermal solar energy and promot-ing the use of solar cells, the SOLTAG concept house can achieve an energy consumption of 0 kWh/m² for heating. The 45° saddle roof faces south, so the thermal solar pan-els and solar cells area are generate maximum benefit. The concept of independent heating supply and maintenance is achieved pendent heating supply and maintenance is achieved the thermal solar panels that produce domestic hot water and under-floor heating.

VELUX Atika is a concept house that puts the focus on high-quality dwellings created by an intelligent interplay between contemporary architecture, healthy indoor climate, innovative energy solutions and optimum daylight conditions.

Now that the technology is also mature at single-family household scale, Atika demonstrates that solar thermal energy for cooling is an attractive alternative way of achiev-ing efficient summer indoor comfort in warm regions. Atika also demonstrates the use of passive systems for heating and cooling. Shading that controls passive solar energy combined with natural ventilation that reduces the need for cooling are examples of passive systems that regulate the energy consumption of the building.



WWW.SOLTAG.NET

About VELUX

VELUX, which has manufacturing companies in 10 countries and sales companies in just under 40 countries, is one of the strongest brands in the global building materials sector and its products are sold in most parts of the world. The Group has around 10,000 employees. VELUX factories are certified in accordance with ISO 9001 (quality, 2004), ISO 14001 (environment, 2004) and OHSAS 18001 certifica-tion (health and safety, 2005).

SOLTAG partners

SOLTAG.net is a research consortium project comprising:
 NIELSEN & RUBOW A/S
 CENERGIA A/S
 KUBEN BYFORYELSE DANMARK A/S
 VELUX A/S

CENERGIA



KUBEN
Vi giver dig plads

RUBOW
arkitekter

Contributors and donors to the prototype
 SOLTAG.net apartment:
 THE EU-DEMOHOUSE PROJECT
 THE COPENHAGEN URBAN ECOLOGY FUND
 THE DANISH ENERGY AGENCY
 ELKRAFT-PSO
 RESSOURCEGRUPPEN DANMARK

VELUX®

Modern Energy

Vestas is the world leader in delivering wind power systems. In 25 years, we have installed over 33,500 wind turbines on five continents – and we install a new turbine every 5 hours. In fact, Vestas turbines generate more than 50 million MWh a year or enough power to supply millions of households – thereby saving the environment for 30 million tons of CO₂ every year.

As wind is an inexhaustible, free and clean source of energy, and as a fully operational wind power plant can be established in as little as 18 months, there is every reason to refer to wind power as Modern Energy.

That is why Vestas is No. 1 in Modern Energy.

CO₂ Reduction Effort

Vestas strives to be an industry leader in purchasing the highest available amount of CO₂ neutral renewable electricity that the local market will allow. In 2006 this accounted for 68% of the Vestas group's purchased electricity; a figure Vestas is actively working to increase.

Climate Solutions

In a lifetime perspective, a single V90-3.0 MW offshore wind turbine will generate 257,400 MWh on an average site during its 20 year design life – thus saving the environment the impact of a net volume of approx. 220,000 tons of CO₂ compared to the figures for energy generated by a coal-fired power station.

However, the fact that wind power is being highlighted from several perspectives as a good contribution to CO₂

emission reduction efforts – and, as a result, global warming – is attributable to not one, but as many as eight persuasive arguments:

1. Wind power is increasingly competitive on price
2. Wind power generates no emissions of CO₂, SO_x or NO_x
3. Wind is free
4. Wind is an inexhaustible source of energy
5. Wind is not limited by geographical borders
6. Wind power generates no waste
7. Wind power plants can be established quickly
8. Wind power does not consume water for energy production

More than a drop in the ocean

The climate challenge does not “simply” involve reducing CO₂ emissions, but doing so in a sustainable manner, so that the problem is not just palmed off onto other areas. In this context, it is particularly relevant to focus on global supplies of clean drinking water, which, within a relatively short space of time, may become very scarce¹ – with serious consequences. This focus on water is very important, because a recent Intergovernmental Panel on Climate Change (IPCC) in 2007 concluded that “global warming will hit through water”, and that some of the major challenges to adaptation are related to water resources development and management².

Both nuclear power and conventional energy production (oil, coal and natural-gas) consume gigantic volumes of clean drinking water. For example, a report from The U.S. Geological Survey has established that in 2000, electricity generation in the United States accounted for the second-largest consumption of clean water, exceeded only by agri-

1 The 2nd UN World Water Development Report: 'Water, a shared responsibility', UNESCO, March 2006, http://www.unesco.org/water/wwap/wwdr2/table_contents.shtml

2 Intergovernmental Panel on Climate Change (IPCC), 2007, Summary for policy Makers (In, climate change 2007: The Physical Science Basis, Cambridge University Press, Cambridge, U.K.



culture. In fact, every single day, almost 515 billion litres of clean water were pumped up for thermo-electric cooling at American power plants.

So let us make it absolutely clear: wind turbines do not use any water at all when generating electricity. Not a single drop.

No waste for future generations

In addition to the issue of CO₂ emissions, the problem of waste is another significant consideration that necessarily must be included in the composition of a sustainable energy mix. In this area, too, wind power is a natural choice for the simple reason that wind turbines generate no waste at all when producing electricity. In other words, there are no toxic or otherwise hazardous substances that need to be dealt with.

Energy without borders or limitations

The argument that wind is a limitless natural resource – in two senses of the word – should also carry a lot of weight today among both industrial and political decision-makers. Taking into consideration the geopolitical events of recent years and the fact that the majority of the fossil energy resources are located in unstable regions of the world, it is obvious that greater independence of energy imports is a necessity for many countries, particularly in the western world. In this regard it is, for example, worth noting that the EWEA (European Wind Energy Association) has calculated that wind power has the potential to cover one fifth of Europe's electricity requirements as early as 2030 – and this calculation even takes into account a 50 per cent rise in consumption.

It's also worth noting that the world's electricity demand will rise significantly the next decades. This goes especially for the fast developing countries in Asia³. Economic growth in those regions is essential in order to secure social development and stability. On the global perspective wind power could cover 10 percent of the global energy demand – today wind power globally contributes only with 1 percent of electricity demand.

That this is more than just figures and theory is proved by countries including Denmark, which already covers a fifth of its total energy requirements through wind power. What is more, Denmark does so by using less than 20 per cent of its actual wind resources. (On very windy days, Denmark receives all its electricity from the country's more than 5,000 wind turbines).

In fact, the World Energy Council concluded in its "Survey of Energy Resources" in 2004 that the world's total consumption of electricity could be covered several times over by exploiting just a tenth of the technical potential of the Earth's wind resources.

Vestas®
No. 1 in Modern Energy

3 Source: IEA World Energy Outlook 2006

The environment is Volvo's core value

Quality, safety, and caring for the environment are the core values in all of Volvo's brands, and these values are what have made Volvo one of the most recognized businesses in the world. Volvo wishes to be the world's leading supplier of commercial transportation solutions, and uses its know how to develop transportation related products of exceptional quality, with the best safety and care for the environment.

Focus on the environment since 1972

Volvo decided on making the environment one of their key issues back in 1972. In that year, the United Nations held a

conference on the human environment in Stockholm. In connection with the conference, Volvo's new CEO formulated Volvo's first declaration of intent regarding environmental issues. It says: "Volvo now has a responsibility to ensure not only that their products are a functional form of transportation, but also that the products work properly in a wider perspective: our environment".

Through the years, Volvo's engines have become cleaner measured in emissions, and Volvo has in fact stayed ahead of legislation. Today, emissions from a modern heavy truck are only a fraction of what they were ten years ago.

In 1989, Volvo appointed an internal environmental attendant, who inspects the company's facilities all over the world. The goal is to fulfill and even do better than all environmental rules prescribe.

In 1991, Volvo presented a unique database on chemicals called Motiv. It contains a list of 4000 chemicals, sorted by the degree of danger. The use of several of these chemicals is now illegal and they have therefore been replaced by more environmentally sound alternatives. In many countries, introduction of similar classifications is being discussed.

In 1995, Volvo revealed their environmentally optimized ECT (Environmental Concept Truck), which got great attention all over the world. The truck runs on hybrid power, so that one can drive without emission in vulnerable areas. It is based on a gas turbine with an integrated high speed generator and an electrical engine driven by nickel-cadmium (NiCd) batteries. Other innovative environmental friendly technologies include aerodynamic design and the use of recyclable materials.





Inspiring challenges

A decade later, in the spring of 2006, Volvo presented a new generation of hybrid vehicles, now with an electronic engine which is connected to a diesel engine. Once again Volvo made positive headlines. The Volvo Group invests considerable resources in the development of alternative fuels and drive systems, all with the final goal of securing a development that will hold. Any new type of engine integrates new sophisticated technology that reduces fuel consumption and lowers emissions.

CO₂ neutral production

An important goal in Volvo's efforts to improve the environment is to make the Volvo Truck facilities completely CO₂ neutral. The first CO₂ neutral facilities was the plant in Ghent in Belgium, and this was followed by the Tuve plant in Gothenburg, Sweden. The final goal is to make all production CO₂ neutral and the big plants must fulfill this goal before 2008.

Volvo has the technology to make green fuels

No matter what fuels might enter the market in the future Volvo Trucks is prepared and has the necessary technology in place. The company has proven this by being the first truck manufacturer in the world that can present seven trucks, which have all been built to drive on non fossil fuel. The possibility of having CO₂ neutral transportation is not limited by technology, but rather by the lack of accessibility of alternative fuels.

Second generation of biofuels

Volvo sees a significant potential in the second generation of biofuels. They have been produced by gasification of biomass, which gives a wide range of flexibility in that many kinds of raw fuel can be used to make many different fuels. Furthermore, the accessibility of raw fuels for gasification is far greater than the accessibility of soya-bean oil and rape seed oil, which is used to make biodiesel (FAME) today. For example, synthetic diesel, methanol, biogas and DME (dimethylether) can all be produced by gasification.

Hybrid technology in Volvo's green engines

Volvo has been successful in experimenting with hybrid technology and works with a new driveline that includes the new D7-engine and a whole truck that has been built around the D9 engine. The automatic I-Shift gearbox has proven to be perfect in this context. This system has been set up on the concept truck. Volvo's hybrid technology can reduce the fuel consumption by up to 30% by integrating the best qualities of the diesel engine and the electrical engine with an intelligent operation system. The new tests prepare for future serial production, and Volvo estimates that hybrid trucks will be a part of the company's products within a few years.



Great opportunities for Cleantech innovators

Cleantech is a sector with immense opportunities for innovators

The world faces a number of significant environmental problems. A large segment of the world's population does not have access to clean water; the increasing Asian industrial boom – driven primarily by India and China – is consuming incredible quantities of energy, which is causing extensive pollution challenges. These are big problems, but where there are big problems there are also big opportunities.

The opportunities emphasised by Vækstfonden are especially the potential for the establishment of new visionary companies whose mission it is to solve these problems. This is a classical thought in the realm of innovation: identify a problem and come up with a solution.

In the field of cleantech, an umbrella term for renewable or clean energy technology and environmental technology, there is a great need for innovation. The opportunities are massive, and Denmark holds a number of core competencies that – if put to use correctly – can help create the basis for successful global companies.



The Cleantech Award winning machine from Gypsum Recycling International cleans and crushes plasterboards for recycling as raw plaster for industrial production.



From the left Carsten Steno, editor in chief at Erhvervsbladet, presented the Cleantech Award to Gypsum Recycling International represented by the founder Karsten Rasmussen holding the cheque and CEO Henrik Lund-Nielsen. Representing the nominees are Mikael Sloth from H2 Logic, Per Resen Steenstrup from Wave Star Energy and Jens Husted Kjær and Jan Hoffmann Jørgensen, both CoMeTas, and at the far right Christian Motzfeldt, chairman of the jury.

Danish cleantech is growing

A number of investment analyses show that, although the US is the market leader in cleantech, Denmark is ahead of most other countries in this area. Denmark's success in cleantech is based on, among other things, strongholds the area of research, industrial competencies and forward-thinking environmental policies.

In 2000, one percent of all venture capital investments went to cleantech companies. This was true both in the US, in Denmark and globally. However, in 2006, no less than 14 percent of all venture capital investments in the US went to cleantech, and in Denmark the 7 percent mark has now been passed, with cleantech as the fastest-growing venture-financed business area. The global average is at 4.5 percent.

Global market to grow by 400%

Vækstfonden is working to increase the focus on cleantech in order to bring in more investors to invest in the Danish cleantech sector, which is rich on opportunities.

Vækstfonden expects the global market for cleantech solutions as well as venture capital investments to grow by 400% in the coming years, with these investments comprising 20 percent of the venture market in 2011.

Plaster recycling won the Cleantech Award

Vækstfonden bestowed the Cleantech Award of DKK 500,000 for the first time in 2007 in order to further increase the focus on innovation in the field of cleantech. Small companies with a clear strategy for growth and a solution or product to replace or reduce the use of oil, coal and natural gas, reduce pollution or increase renewability or clean water, air or soil were eligible for the competition.

The winner of the Cleantech Award was the company Gypsum Recycling International. The company has developed a business model by which plasterboards are collected from demolition companies against payment, then the plaster is crushed and sold as raw plaster to building material manufacturers. In other words, Gypsum Recycling International makes money on the entire value chain while solving an environmental problem.

The three other nominated projects out of no fewer than 32 candidates were: filters, bio fuel and wave energy from, respectively, CoMeTas A/S, H2 Logic A/S and Wave Star Energy A/S.