CHINA INTERNATIONAL FORUM ON ENERGY TRANSFORMATION

Suzhou 5-7 November 2015

The Danish Energy Transformation Roadmap

国家可再生能源中心

CHINA NATIONAL RENEWABLE ENERGY CENTRE

DANISH ENERGY AGENCY

The Danish Energy Agency

The Danish Energy Agency is pleased and proud to be invited to the High Level meeting in Suzhou hosted by the National Energy Administration of China and present the Danish experiences with our transformation towards a low carbon society to a global audience.

The Danish Energy Model has shown that through persistent, active and cost effective energy policy with ambitious renewable energy goals, enhanced energy efficiency and support for technical innovation and industrial development, it is possible to sustain significant economic growth, a high standard of living and a high level of security of energy supply, while reducing fossil fuel dependency and mitigating climate change.

In a nutshell: energy savings, optimized manufacturing and investments in green energy technology are good value for money.

Denmark has reduced the adjusted greenhouse gas emissions by more than 30% since 1990. With current measures in place, the Danish Energy Agency estimates that emissions will be 37% lower by 2020.

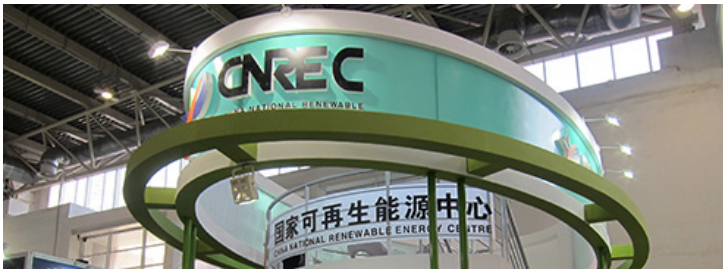
Denmark has the highest contribution of non-hydro renewables in any electricity system worldwide: 46% in 2013. In 2014, almost 40% of the Danish electricity consumption was based on wind power; by 2020 this figure will likely be 50%.

The Danish government has set a number of targets for the further development of the energy sector:

Continuing low-carbon energy sector transition in a cost effective manner. Maintaining Denmark's leading position in a number of low-carbon technologies and systems.

Ultimately, making Denmark self-reliant on renewable energy in 2050 and ensuring that the transition to 21st century energy is doable, affordable and an example for other countries.

Morten Bæk
Director General
Danish Energy Agency



China National Renewable Energy Centre

Denmark is the renewable energy pioneer in the world, including policy and strategy development, technology improvement and green industry growth. As indicated in the report, the Danish government has defined the ambitious goal of a fossil-independent energy system by 2050 with renewable energy as a major contributor. Today, wind energy already account for 37% of the total electric power consumption and it will contribute with more than 50% by 2020. More significantly, Denmark has developed clear roadmap and action plan to reach the long-term goal.

China and Denmark initiated renewable energy cooperation in the1980's in the wind energy sector. And with industry growth, governments of China and Denmark jointly developed the Wind Energy Development Programme (WED) and the Renewable Energy Development Programme (RED), generating significant achievements for industry development and institutional cooperation. Based on such solid cooperation, China and Denmark has formed a long term cooperation partnership in renewable energy field and further strengthen their renewable energy front-runner position the world.

China National Renewable Energy Centre (CNREC) is the national institution for assisting China's energy authorities in renewable energy policy research, and industrial management and coordination. Together with Danish Energy Agency, CNREC is supporting the China National Energy Administration for implementing the partnership with Danish Energy, Utilities and Climate. As well, with experiences from Denmark and other countries, CNREC continues researching China's renewable energy development projection by 2050 and provides a trustworthy picture based on analytic model tools and comprehensive data analysis.

It is a pleasure for CNREC to be able to assist in the dissemination of this report from our Danish partner, providing more information, understanding and inspirations about the successful Danish energy experiences to policy makers, industry and experts. These experiences are very valuable for China, and CNREC is happy to take the role as an interpreter to translate the experiences into the Chinese context.

WANG, Zhongying
Deputy Director General of Energy Research Institute,
Director for CNREC

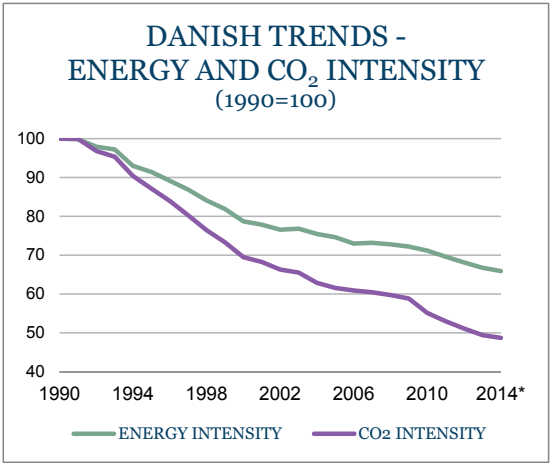
TABLE OF CONTENTS

LOW-CARBON ECONOMIC GROWTH AND JOB CREATION

The results of clear political direction have been significant and convincing: The Danish experience shows that through persistent and active energy policy focused on enhanced energy efficiency and ambitious use of renewables, it is possible to sustain significant economic growth and simultaneously reduce fossil-fuel dependency while protecting the climate and environment.

The Danish economy's energy consumption is among the lowest in the world relative to gross output. Denmark has become one of the world's most energy efficient economies. Since 1990, Danish GDP has increased by nearly 40%. During this period, the domestic energy consumption has declined by 7% and the adjusted carbon emissions by more than 30%. This development has not only benefitted the competitiveness of Danish enterprises through lower energy costs and less exposure to highly volatile fossil fuel prices, but also fostered new products and industries.

Green products and services are defined as products which reduce pressure on the environment, for example energy saving products and the service of installing renewable energy systems. In 2013 Denmark produced green products and services for EUR 22 billion, half of which is related to renewable energy and one sixth to energy efficiency. The green sector employs approximately 58,000 people in Denmark. As an example, the Danish wind energy sector currently employs more than 28,000 workers[1] and the Danish export of wind energy



Source: Danish Energy Agency *preliminary data

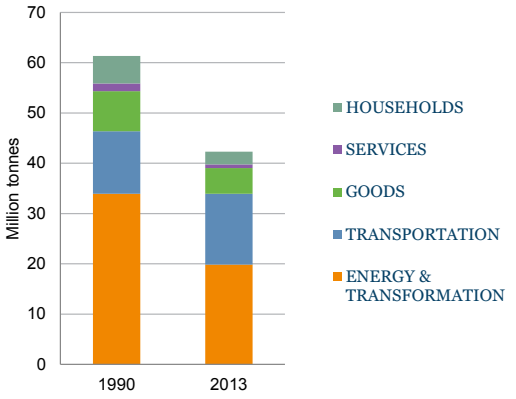
1 The Danish Wind Industry Association (DWIA)

DECLINING ENERGY CONSUMPTION AND CARBON EMISSIONS

Most of the 7% decline in the **gross energy consumption** in Denmark between 1990 and 2013 is due to a 24% drop in fossil fuel consumption relative to the gross energy consumption partly substituted by a 12% increase in contribution from the use of biofuels and 5% from wind energy. In 2013 renewable energy sources accounted for 24% of the gross energy consumption of Denmark. In the same period, energy conversion efficiency has been boosted significantly, reducing conversion losses by 28% or 7% relative to gross energy consumption. The main reason for this improvement has been a massive increase in combined power and heat generation (CHP) and wind energy capacity. These two energy sources have increased their overall contribution by 10% compared to the gross energy consumption in the period. With a 40% increase in real GDP from 1990 to 2013 combined with flat net energy consumption, the end-user energy efficiency has also been improved significantly. As an example, the manufacturing sector has boosted the gross value added by 25% but reduced final energy consumption by 20% in the period. Danish households have increased real consumer spending by 40% in the period but reduced net energy consumption by 1%.

As for **CO_2 emissions** related to energy, the main contributors to the 31% drop in Danish emissions since 1990 is energy conversion (electricity and heat generation) by 46% mainly due to an almost tripling of energy generated from renewable energy sources, plant efficiency and CHP plants. Goods manufacturing and household consumption contributed with 36% and 53% emission reductions, respectively. As for power generation, reduction in fossil fuel based sources and power plant optimization has reduced Danish emissions by 22% compared to 1990 emissions.

TOTAL CO_2 EMISSIONS RELATED TO ENERGY CONSUMPTION IN DENMARK



Source: Danish Energy Agency

technology in 2014 accounted for more than EUR 7.2bn[1]. The total export of energy technology accounted for almost 60 % of that number.

SETTING THE COURSE

Denmark has a long tradition of active energy policy, initiated as a reaction to the first oil crisis in 1973. Over the years, a broad consensus in the Danish Parliament has been utilized to transition Denmark's energy system towards reduced energy consumption, increased decentralized energy production and increased utilization of renewable energy sources. Consistent, determined and long-term political objectives have formed the foundation of the low-carbon transition of the Danish energy sector.

SCENARIOS

In 2007, the Danish Commission on Climate Change Policy was formed to ensure a cost efficient transition of a low carbon energy future for Denmark, . The Danish Energy Agency supported the Commission's work through detailed scenario analyses, to investigate both technical possibilities and related costs for Danish society in reaching the goal of a low carbon energy system by 2050. This analysis shows that it is possible to cost-efficiently design different energy systems which all meet the target of a low carbon energy system by 2050. All scenarios assume vast energy savings as part of the strategy to reach a low carbon energy system. A business as usual based scenario was used as a reference, and the analysis shows that both the wind and biomass scenarios are within 10% of additional costs compared to the fossil fuel based scenario. A low carbon transition of the Danish energy system not only requires further improvement of energy efficiency and new low carbon energy sources, but also further energy cooperation with Denmark's neighboring countries to reduce costs and secure stability and security of energy supply. Denmark fully supports the creation of the EU Energy Union as a way to improve energy security and reduce green transition costs.

To further secure a cost efficient low carbon energy transition, the Danish government will form a new Energy Commission to analyze the next step after reaching the 2020 target for energy efficiency, renewable energy supply and greenhouse gas (GHG) reduction.

INNOVATION AND SYSTEM DEVELOPMENT

Research, development and demonstration of new technologies and systems have been critical elements in establishing a Danish stronghold in the energy sector. Public-private sector

cooperation, coupled with stable political and regulatory frameworks, has fostered important innovation and breakthroughs in energy concepts and -systems. The foundation of the low-carbon transition has been threefold: Energy efficiency, renewable energy and system integration including electrification.

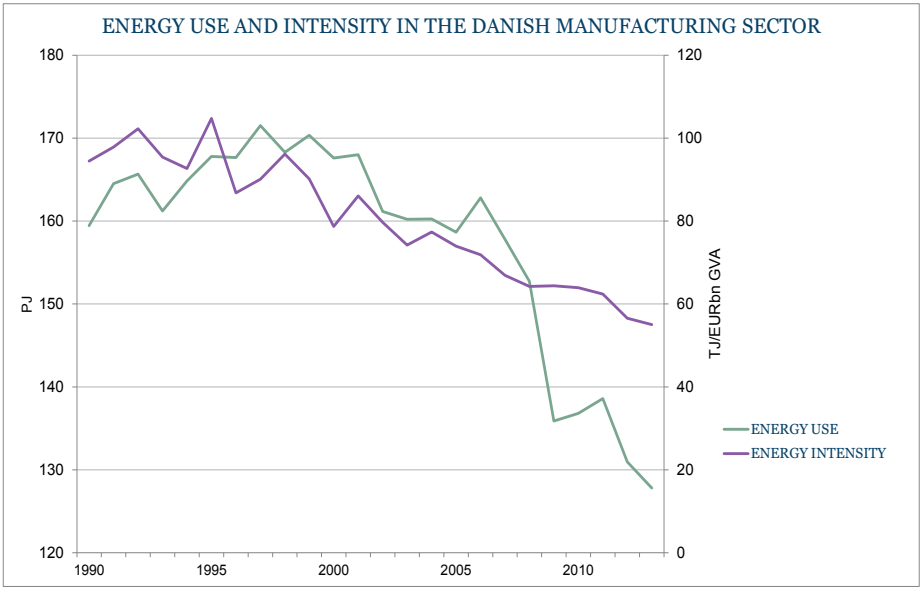
ENERGY EFFICIENCY

Energy efficiency is a vital element in the green transition of the energy sector. Without extensive energy efficiency improvements, it would have been disproportionally expensive to meet energy demands with new and initially more expensive energy sources like renewable energy. Successful energy efficiency deployment enables meeting society's demand for various energy services more efficiently and effectively, so that energy consumption is reduced. Results are achieved in part by transitioning to more energy efficient technologies and solutions, but also highly dependent on increasing energy consciousness and altering consumer behavior.

Denmark has achieved remarkable results in energy efficiency performance for households, manufacturing and energy production. For instance, energy consumption in buildings has been reduced by 45% per square meter since 1975. For the manufacturing sector, the energy intensity has been reduced by more than 2% per annum the last ten years. According to a recent study[2] the

2 Danmarks Nationalbank Monetary Review, 2nd Quarter, 2014, Energy efficiency and competitiveness

Source: Danish Energy Agency



Note: Energy (E) use in PJ and E intensity in TJ / mio EUR gross value added (2010-prices) from 1990 to 2013

gains in energy efficiency has improved cost competitiveness in the Danish manufacturing sector by 9%, due to oil price increases over the last decade.

RENEWABLE ENERGY

Despite almost no hydropower resources, Denmark has managed to become a global leader in renewable energy generation. Renewable energy's share of final energy consumption in Denmark has been steadily increasing since 1980. Today, more than 25% of Denmark's final energy consumption is covered by renewable energy.

Measuring electricity supply alone, renewable energy today accounts for close to 50% of domestic generation, which is mainly due to the incorporation of wind energy in electricity production. Denmark today has 4,893 MW[3] of

SUPPORT FOR ENERGY EFFICIENCY MEASURES

Potential remains for cost effective energy efficiency improvements. These exist in all sectors and areas of use. Significant improvements on national energy efficiency performance can be achieved with products and technologies that are already developed and available as consumer solutions. Often, it will be cost effective for consumers to use existing solutions; however, energy efficiency improvements do not come about automatically. Active efforts are needed to promote additional efficiency improvements and savings. Danish energy policy therefore contains a number of initiatives to increase energy efficiency improvements in order to minimize energy use and energy waste in all sectors.

In addition to more efficient energy production, a number of initiatives have been carried out to increase the efficiency of end-user consumption, that is, consumption by consumers and enterprises. Danish environmental- and energy taxes contribute to a better reflection of the environmental costs of production, use and disposal in consumer prices on energy.

By formulating schemes in close dialogue with industry, knowledge about challenges and possibilities are integrated in the measures.

Initiatives include:

- Energy labelling of buildings
- Building codes focusing on energy consumption
- Electricity saving trusts
- Energy labelling of appliances
- Energy savings in the public sector
- Energy efficiency obligation schemes

installed wind energy capacity, of which 1,271 MW[3] are offshore wind turbines (ultimo 2013). On windy days, wind turbines in Denmark produce more than the domestic demand.

Changes in the Danish overall energy mix have resulted in a substantial reduction of emissions from energy production. CO_2 emissions from electricity production have decreased by over 50%[3] in the period 1990 to 2013. Half the amount of CO_2 is emitted when producing one unit of GDP in 2013 compared to 1990 and per capita emission has been reduced by 37%.

Reaping the full benefits of new renewable energy technologies has caused radical changes to the Danish energy system and networks. Danish experience shows that flexibility in

EFFICIENT AND EFFECTIVE SUPPORT FOR RENEWABLE ENERGY

Promoting renewable energy requires a favorable investment climate, a developed power grid and long-term planning.

High initial investment cost and lack of fuel costs are the main differences between wind or solar energy and most conventional power sources. Stimulating demand through financial and market support has been a central element in promoting the expansion of renewable energy in Denmark. A positive investment climate has been created with priority grid access and resource based feed-in tariffs. Feed-in tariffs for offshore wind are settled by tender and feed-in premiums with a cap regulate the support for onshore wind power.

Central and long-term planning has ensured timely and relevant investments in the power grid and system. Thus the grid and system have been developed incrementally in order to handle the steady increase in fluctuating renewable energy production. Strategic planning of future grid investments follows the current political energy agreement with adopted measures and policies toward the Danish government's long-term goal of fself-reliance on renewable energy.

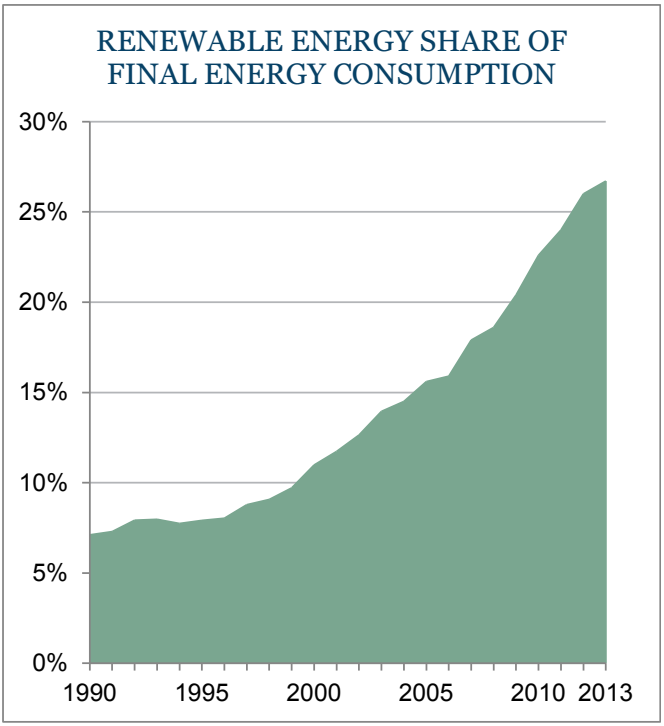
Mapping available resources are fundamental in physical planning to estimate production of potential sites. Ambitious targets, long-term planning and strong and stable political framework conditions have paved the way for significant private investments by creating a positive and secure long-term investment climate. The Danish Energy Agency functions as a "one stop shop" for permits, where all relevant information is gathered. This makes necessary processes more streamlined and effective.

3 Source: Energinet.dk

conventional production in combination with strong transmission and distribution networks, and larger exchange of power with neighboring countries in order to increase balancing areas, are important components in overcoming challenges.

Renewable energy has contributed to a sharp decline in carbon emissions, but also enhanced the security of energy supply by utilizing domestic energy resources like wind, solar and biomass. Going forward, further expansion of renewable energy capacity and sources is an important element in meeting the government's long-term vision to make Denmark able to cover its energy demand by renewable energy generation and sources.

Analyses show that the costs of introducing renewable energy in Denmark have been relatively high initially. However, gradually declining renewable energy costs and gradually increasing prices for fossil fuels have made renewable energy sources increasingly competitive compared with traditional energy sources. Today, onshore wind is the cheapest power generation technology when adding new capacity in Denmark even excluding indirect costs for conventional fossil fuel based generation options. These costs



Source: Danish Energy Agency

HOW IS DENMARK INTEGRATING RENEWABLE ENERGY TODAY AND IN THE FUTURE?

Some days the power production from wind turbines in Denmark exceeds the domestic demand for electricity, and on average the fluctuating wind energy supplied nearly 40% of electricity consumption in 2014. How is Denmark managing to integrate very large shares of fluctuating wind energy nearly without wind power curtailment, as we often see in other countries?

Most would point to the resource endowment of the Nordic countries, i.e. the synergy between hydro-, wind- and thermal power in combination with a strong integration with neighboring grids of Europe, including the well-developed NordPool power exchange, as the primary factors. Denmark can freely buy and sell electricity to balance the fluctuating electricity production from wind. But reality is more complex, and includes a number of innovative features.

- Integrating heat supply with electricity balancing. Half of our electricity is produced by small combined heat- and power plants. This system has been designed with flexibility allowing for varying proportions of heat and electricity production, and also has built-in heating storage that allows for continuing the heat supply, while reducing the electricity production at the CHP plants when there is ample wind power available in the system.

- Innovation in thermal power plant flexibility, which can vary their daily output and quickly adapt to the fluctuating production from wind. In most parts of the world thermal power plants are designed to run constant outputs, and the owners will resist implementing increased flexibility in daily operations. The speed of power production regulation in Denmark is larger than in other countries, and the minimum level of output is unusually low in Danish power plants due to technical retrofits and adjustments.

- Innovation in the incorporation of advanced wind forecasting in the operations of power system control and dispatch. Such advanced forecasting, used by the Danish Transmission System Operator Energinet.dk, has increased the ability to integrate and balance high shares of renewables.

- Advanced functions of the electricity market allowing the CHP plants and the coal power plants to benefit not only from selling to the wholesale market in which their share of trade is decreasing due to increased priority

production from renewables. They can also profit from selling their services to the so called 'ancillary markets', which provides a number of services required for a well-functioning power system.

Further increasing the share of renewable energy will require more flexibility in the power system. Denmark is therefore strengthening international connections, and introducing technical measures that will allow for more flexibility and more rapid response in the demand for power. Furthermore, it is important to note that modern wind-turbines, due to technological improvements, today can provide part of the foundation to ensure power system stability, a role that previously was reserved for thermal power plants.

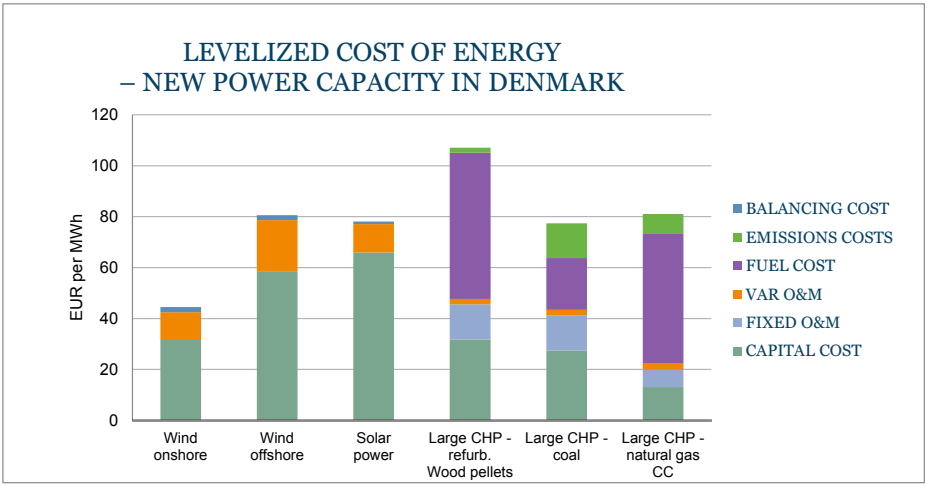
The combination of circumstances in Denmark might be unique, but our experience has attracted huge international attention and has been shared with important Chinese institutions in the ongoing cooperation between the Danish Ministry of Energy, Utilities and Climate and key Chinese authorities in the field of energy, like National Energy Administration (NEA), State Grid and others. The Chinese authorities are using Danish experiences to reduce curtailment of wind power, and working closely with Danish authorities to achieve a general transformation of the Chinese energy sector in a green and sustainable direction.

are mainly related to cost for negative effects of emissions such as CO_2, SO_x and NO_x. These emissions are adding negative health, environment and climate effects and consequently costs for individual citizens and society as a whole.

It is worth mentioning that Danish energy taxation and participation in the European Emission Trading System (ETS) is meant to correct some of these market imperfections making energy market participants and investors aware of indirect generation costs. Also it should be noted that emission levels per produced MWh is very low in Denmark due to strict emissions and efficiency standards (CO_2 per produced MWh). The calculations also includes balancing cost for fluctuating renewable energy sources like wind and solar, which is on a level of EUR 1-2 per MWh for the Danish power system.

SYNERGIES - ENERGY SYSTEM INTEGRATION AND DEVELOPMENT

Focusing on broader interactions and systems, as opposed to individual components and concepts, is an important aspect of the Danish energy



Note: Coal based on supercritical plants.
Source: Danish Energy Agency

model. The Danish energy model is characterized by a holistic view of energy planning, with emphasis on integration of for instance heat and power production, and establishing synergies between taxation schemes and policy support frameworks for renewable energy.

Furthermore, prudent interaction within the power and heating sector, i.e. CHP production, use of heating storage in the district heating system and increased use of electricity for heating accompanied by increased deployment of heating pumps and electrical boilers, will further improve the efficiency in the energy sector and mitigate the challenges of integrating variable renewable energy sources in the power system.

An effective integration and support for renewable energy sources in Denmark combined with a well-functioning open power market in the region (NordPool) has ensured that Danish power prices are not significantly higher than other European countries, even including the cost of supporting generation and integration of large amounts of renewable energy.

CLIMATE CHANGE – SETTING AND ACHIEVING AMBITIOUS TARGETS

The future foundation for Danish energy policy is based on broadly supported political agreements, with the Energy Agreement of 2012 as the most important element for the further transition toward 2020.

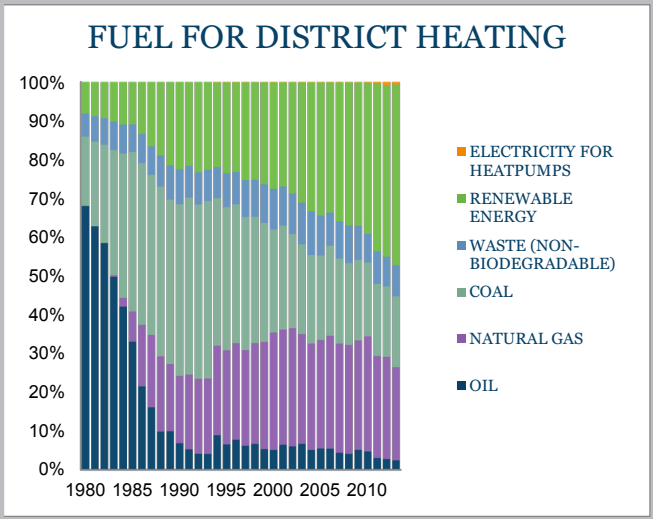
The Danish Government has established the long-term goal of making Denmark self-reliance on renewable energy in 2050, meaning that the entire energy

COMBINING HEAT AND POWER PRODUCTION

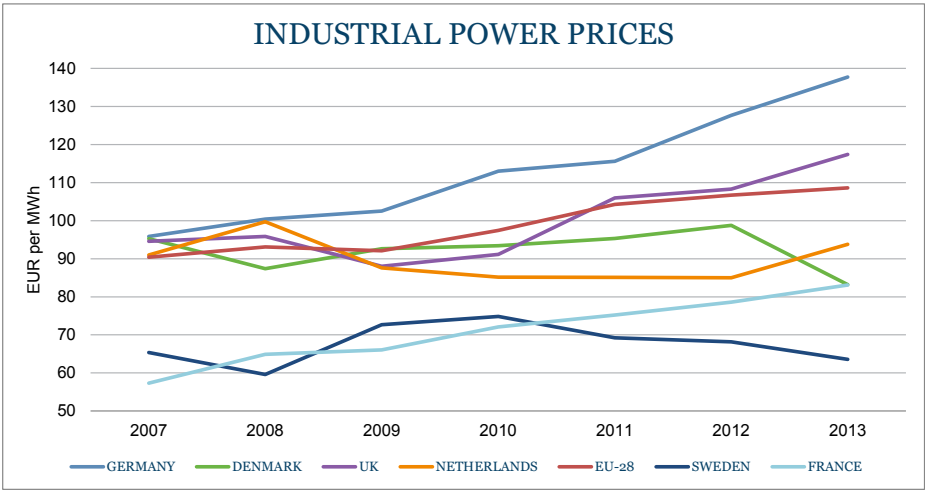
Combining heat and power generation has been a key component in the development of the energy sector in Denmark creating a cost effective heat and power supply. The average cost of receiving heat and hot water from district heating only amounts to 3% of the average household income. The distribution of heat through district heating in Denmark has been one of the key drivers in reductions of gross energy consumption and CO_2 emissions from the energy sector. District heating supplies more than 60% of all households in Denmark with heat and hot water in 2013.

More than 70% of the heat distributed through district heating in Denmark is generated in combined heat and power plants (CHP). CHP's accounted for close to 60% of the thermal power generation in Denmark in 2013. A transformation of CHP from fossil fuel to biomass and new dedicated biomass CHP and heat capacity means that close to 45% of the district heating produced in 2013 was from renewable energy. For Danish society, the gross energy consumption has been reduced by 11% due to combined heat and power.

The implementation of district heating and combined heat and power has throughout the years, apart from the planning procedures, been supported by a variety of different support mechanisms. These vary from tax exemptions, feed-in tariffs to investment grants.



Source: Danish Energy Agency



Note: Electricity prices including tariffs for businesses using 2-20GWh annually. Source: Danish Energy Agency

demand – electricity, heating, industry and transportation – is to be met by renewable energy generation by 2050.

The Energy Agreement is the roadmap for development of energy supply and demand for the period 2012–2020. This agreement contains a wide range of ambitious initiatives, bringing Denmark a good step closer to the target of 100% renewable energy supply. Through expanded offshore wind production and use of biomass, renewables are expected to cover more than 70% of Danish electricity production by 2020. The Energy Agreement and current results and projections shows that Denmark will more than fulfill its obligations toward the EU 2020 targets within energy efficiency, renewable energy and reduction of carbon emissions (20-20-20 targets).

STRONG INTERNATIONAL TIES AND COOPERATION

A significant amount of Danish energy system innovation has been developed in close public and private cooperation with other countries, institutions and corporations. This cooperation includes European and other developed countries, as well as rapidly emerging economies from all continents. Using these lessons and experiences, Denmark is trying to stimulate and inspire low-carbon growth globally.

A tangible example of this is sectorial cooperation with the Government of China on integrating large amounts of renewable energy into their power system and consequently reducing China's rapidly growing GHG emissions. Other partner countries currently include Mexi-

co, South Africa and Vietnam, and the list is expanding. The scope of cooperation is broad, covering energy efficiency, renewable energy and energy system development as well as climate finance.

Through the power of example, Denmark has demonstrated that energy consumption and carbon emissions can be radically improved in a short timeframe while maintaining a sound and resilient economy. An important part of the Danish effort to mitigate climate change will be stepping up international cooperation in coming years.

PUBLIC ENGAGEMENT AND ACCEPTANCE

Energy policy is well rooted in the everyday lives of Danish citizens, with significant public engagement in all aspects of the low-carbon transition. From energy efficiency measures and campaigns for households and residential buildings, ownership in renewable energy assets (roof-mounted solar panels, community owned wind farms, etc.) support for low-carbon transportation (public transportation, bicycle commuting, etc.), energy conservation and transition to low carbon options are a part of everyday life for the citizens of Denmark.

The general public support for the energy sector transition, including costs and other impacts, is an important part of the broad political consensus towards the huge changes taking place in the Danish energy sector these years, to tackle climate change and move towards more sustainable and sound economic growth.

A ROADMAP FOR CHINA

Since 2012 the Sino-Danish cooperation between China National Renewable Energy Centre in Beijing and the Danish Energy Agency has worked with development of renewable energy in China. Danish experts have transferred knowledge and practical experience from the transformation of the Danish energy system to their colleagues in CNREC and other institutions.

The Danish experience with long-term planning and development shows that clean energy production, blue sky, clean water and economic growth can go hand in hand. The transformation of China to a low carbon society should therefore also be a platform for economic growth, job creation and development of new industries in China.

The Danish 2050-vision for a fossil independent energy sector and the consistent roadmap with milestones along the road is essential for planning the energy transformation. CNREC has in 2014 and 2015 developed 2050 scenarios for China as an example for demonstrating the technical possibilities for deployment of renewable energy in China and a sustainable energy

production. In 2016 CNREC will publish the China Renewable Energy Outlook with even more detailed analyses of energy system scenarios and pathways. The holistic system-wide approach in these scenarios comprises conventional energy sectors (coal, nuclear and gas), increased energy efficiency and renewable energy with focus on how the environmental and economic goals can be achieved in an optimal way. Realising the visions of the scenarios requires wide support from the Chinese society, strong engagement and involvement with the stakeholders in the energy sector.

As in Denmark, renewable energy will be the energy source of the future in China. The Chinese energy system can according to CNREC's scenarios integrate 60% renewable energy and up to 90% of the power production can be based on renewable energy in 2050 with current technologies and knowledge. The environmental footprints of the China's energy sector would be lowered to the level of 1980, if this vision is realised. The major part of China's energy consumption will come from wind and solar energy in the future, and China is already a leading producer and manufacturer in these two areas.

The transformation of the traditional power production to the requirements of the future is challenging. The integration of large amounts of variable energy requires integration of the heat and power sectors, implementation of energy storages, increased use of combined heat and power production, stronger transmission systems, roll-out of electrical vehicles and demand side management to create a flexible, reliable and sustainable

Wang presents the Chinese 2050 scenarios at China Wind Power Conference 2015

power system.

Besides these technical challenges there are a number of institutional challenges. A new framework for the energy sectors is needed, including the introduction of a power market that will reflect the real value of power. Priority to renewable energy production, intelligent development of subsidies to renewable energy and gradually removal of incentives for fossil fuels are also parts of the framework for transition.

The transformation of China's energy system will have global impact. Today greenhouse gas emissions represent more than 30% of global emissions and reduction of these emissions will consequently significantly reduce the global carbon footprint and reduce the impacts of global warming. The large transformation to renewable energy technologies in China will also have significantly impact of the future development of these technologies, increasing the efficiency and lowing the cost of energy. This will further stimulate the global demand for renewable energy and the demand for green jobs.

The Danish cooperation with China is one, excellent example on fruitful and mutual rewarding international cooperation. The successful outcome will further spur the two countries to be increasingly active in the international energy cooperation in the coming years.

THE SINO-DANISH COOPERATION IN SHORT

The RED-Program

China National Renewable Energy Centre (CNREC), established in 2009 and officially opened in 2012 is a knowledge Centre in Beijing providing recommendations, analyses and support for the Chinese Ministry of Energy, the National Energy Administration (NEA).

The centre works with the development of strategies, policy research, action plans, industrial management and legislations encouraging the use of renewable energy in the Chinese energy system.

The Danish Energy Agency (DEA) has extensive expertise within renewable energy and in the development of a reliable, cost-efficient and sustainable energy supply. Building on this expertise, Denmark has supported CNREC and the development of renewable energy in China through the Sino-Danish Renewable Energy Development (RED) Programme since the establishment of CNREC in 2009.

The RED programme was a five-year programme and was phased out at the end of 2014. The RED Programme partly funded the work at CNREC, where Chinese experts, supported by DEA , provided scenario analyses, technology catalogues and integration strategies for renewable energy into power supply, as well as into district heating. CNREC has also made roadmaps for solar energy, biomass and biogas.

Additionally, the RED Programme allocated $4,43 million to twelve different renewable energy projects. The projects are concerned with research and technological assistance to establish a closer Sino-Danish research and business cooperation within renewable energy.

Boosting cost-efficient renewable energy in the energy system program

Given that the RED Programme was finalised at the end of 2014, CNREC has reached an agreement with the British Children's Investment Fund Foundation (CIFF) for support from 2015-2019.

The investment from the British fund in CNREC is initiated through the five-year Boosting RE as part of China's Energy Revolution and is technically supported by DEA, Gezellschaft für Internationale Zusammenarbeit (GIZ) and the US National Renewable Energy Laboratory (NREL). The programme aims to promote renewable energy as a vital part of the future Chinese energy system, allowing China to implement international best-practice solutions for the transformation of the energy system.

The programme is funded by CIFF as part of their climate mitigation activities. Additionally, Denmark continues to provide bilateral, technical assistance to CNREC.

The Danish Energy Agency's Centre for Global Cooperation supports emerging economies to combine sustainable future energy supplies with economic growth. The initiative is based on four decades of Danish experience with renewable energy and energy efficiency, transforming the energy sectors to deploy increasingly more low-carbon technologies.

China National Renewable Energy Centre (CNREC) is the national institution for assisting China's energy authorities in renewable energy (RE) policy research, and industrial management and coordination.

Learn more on our websites:
www.ens.dk/global-cooperation
www.cnrec.org.cn

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