



DEMONSTRATING EFFICIENT WIND INTEGRATION USING DISTRICT HEATING AND COMBINED HEAT AND POWER

A Sino-Danish project in Harbin in north-eastern China is currently researching possible ways of integrating more wind power into the local power and heat system. The project aims to enhance and promote the use of renewable energy in China.

HEAT AND POWER IN NORTH-EASTERN CHINA

Located in the Heilongjiang province in north eastern China, contiguous to Russia, is the principal town of Harbin. The entire province has approximately 38 million inhabitants, whereof approximately 5.3 million live in the city of Harbin. The winters in north-eastern China are long and cold and it is not uncommon for temperatures to drop below minus 30°C. Consequently the province has a long heating season; about six months. The heating and power system in the province is predominantly powered by coal-burning power and heating plants, some of them combined heat and power plants. Also, the province has large deposits of coal making heat and power generated from coal cheap and easy accessible solutions.

Large wind resources are available in the Heilongjiang province and approximately 4,000 MW wind power is already in operation. However, the fluctuating production from wind is increasingly posing a challenge

to the integration of wind power into the power grid. During periods with plenty of wind, the power grid is unable to handle the total amount of generated wind power and consequently the wind turbines are brought to a stop. The production of the combined heat and power plants is lacking flexibility, both due to technical challenges and because coal is still prioritised in the Chinese energy system. Thus the wind turbines are curtailed, when the total energy production is too large. The production of wind power is limited in order to make energy production balance with the consumption. In 2011 the curtailment of Heilongjiang's wind power meant that 15 pct. of the generated wind power was lost.

During the winter months the large coal-based heat production in the Heilongjiang province generates environmental challenges, such as air pollution. Increased use of wind to generate power and heat will benefit inhabitants, through saved fuel costs and improved air quality.

THE HARBIN PILOT PROJECT



PRELIMINARY STUDY OF WIND POWER INTEGRATION IN DISTRICT HEATING/COMBINED HEAT AND POWER SYSTEMS

The project in Harbin, started in February 2013, is a partnership between COWI in Denmark and China, EA Energy Analysis, China Electric Power Research Institute and State Grid Energy Research Institute, in addition to a wider range of stakeholders consisting of among others Aarhus Municipality AffaldVarme Aarhus (WasteHeat in Arhus), Vestas Wind Systems and Chinese partners.

The objective of the Harbin project was to analyse the city's energy system in an aim to study and present possible institutional solutions, concepts and technologies for integrating an increased amount of wind power in Harbin's district heating and combined heat and power grid. As a result the consumption of coal will be reduced to the benefit of the environment, as the curtailment of wind is reduced.

The project was intended to demonstrate the potential use of wind power in heating systems with coal-fired "heat-only boilers" and in combined heat and power systems. In both cases electricity is converted to heat in an electric boiler. Over time heat pumps could also be an option, as well as thermal storage.

BACKGROUND: RENEWABLE ENERGY DEVELOPMENT AND STRONGER MARKET POSITIONS

The project in Harbin was partly financed by the Sino-Danish Renewable Energy Development (RED) Programme, which finalised in 2014. The programme supported the creation of institutional capacity and technological innovation within renewable energy development in China. The programme consisted of two components; the first established a renewable energy centre in Beijing (China National Renewable Energy

Centre) and the second funded projects bringing Danish and Chinese industry actors together in joint projects.

A total of twelve projects were supported under RED Component 2 combining a focus on research, development and demonstration within renewable energy, with the establishment of strong Sino-Danish company and institutional partnerships to develop renewable energy technologies in China.

Danish companies and research institutions have years' of experience developing and handling renewable energy. The twelve projects form a base for Sino-Danish knowledge exchange and bring advanced Danish technology into play in China. The twelve projects are a step towards closer Sino-Danish research and business cooperation creating long term partnerships and possibilities for both Danish and Chinese companies in the market for renewable energy.

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