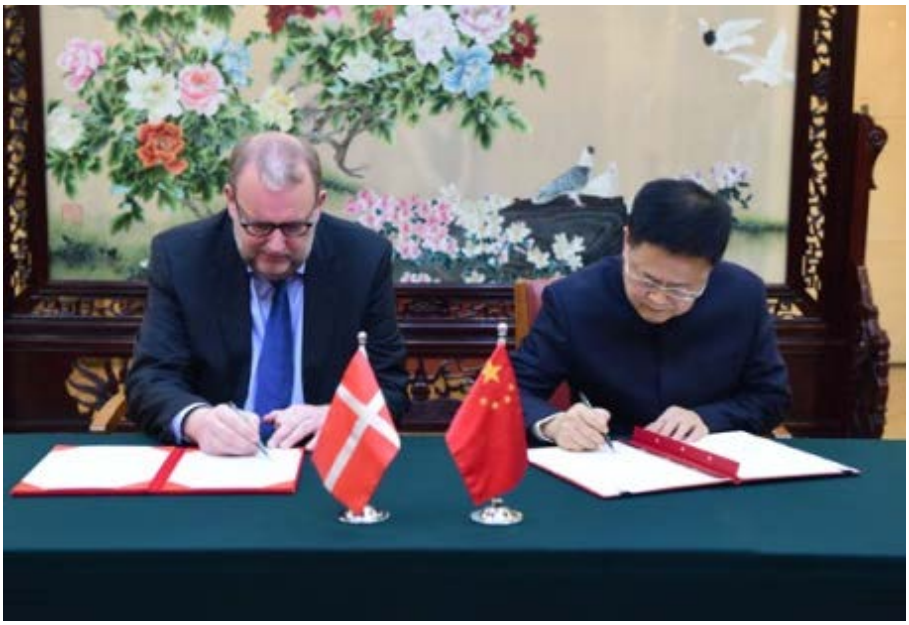


DANISH-CHINESE COOPERATION ON THERMAL POWER PLANT FLEXIBILITY

Denmark and China have extended their intergovernmental cooperation with a new program - the 'China Thermal Power Transition' - aiming at assisting China in the transformation of the thermal power sector towards a low carbon future. The program was officially approved by the Chinese National Energy Administration (NEA) in January 2016, and the Danish Minister of Energy, Utilities and Climate signed a new MoU with NEA late January.

THE PROGRAM PARTNERS

The program is developed within the close cooperation between the Danish Energy Agency (DEA) and the Chinese Institute of Electric Power Planning & Engineering Institute (EPPEI) who are mandated by NEA to serve as the secretariat and lead partner in the program. The program is set out by NEA to be a cornerstone in their effort to enhance the power system's flexibility and regulation capability.

CHALLENGES OF INTEGRATION VARIABLE RENEWABLE ENERGY

Due to the fluctuating and non-controllable nature of variable renewable energy (VRE) the integration of the production into the existing power system is already proven to be a big challenge. A clear sign of the integration challenges is the large curtailment (abandonment) of wind and solar power that takes place in order to handle the variability of the VRE production. In 2015 respectively 15 % and 12 % of the total wind and solar production (in total 38 TWh) in China was curtailed.

CONSEQUENCE OF CURTAILMENT IN 2015 IN CHINA

- Coal usage in the level of 15-20 million tons per year could have been avoided
- CO2-emission in the level of 30-40 million tons per year could have been avoided
- Fuel costs of around 1,000 million USD per year could have been avoided

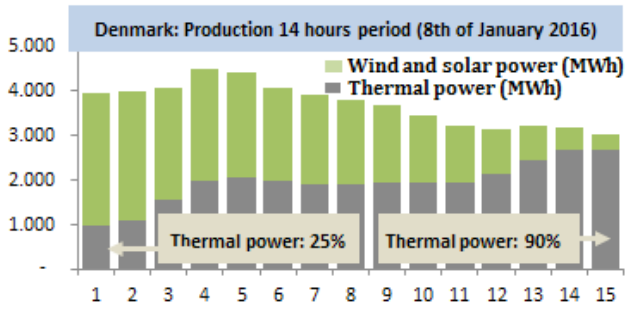
With China's intention to respectively double and triple the installed wind and solar power capacity in 2020 and similar ambitious targets for 2030 the challenge with integration will only increase. Tackling the challenge with curtailment is now a top priority in China's power market reforms. To succeed in integrating an ever increasing share of VRE it is necessary to have a highly flexible power system where the flexibility has to be provided by already proven measures, as well as development of new solutions.

THE CHINA THERMAL POWER TRANSITION PROGRAM

VALUABLE DANISH EXPERIENCE

In 2015 wind production covered around 42% of all power consumption in Denmark - and in many days more than 100%. Despite such a high share Denmark has very limited curtailment and a very high security of supply. Besides the extensive use of interconnectors for export/import of power - Denmark's success with integrating high shares of VRE rest on two interrelated pillars. The first, is the Danish world-class experiences on highly flexible thermal power plants capable of changing their production very fast to accommodate the variable RE production. The second is the design of the power market with clear economic incentives motivating the thermal power plants to invest in and operate very flexible.

THE 'CHINA THERMAL POWER TRANSITION' PROGRAM



In order to contribute with concrete and proven solutions to the challenges with integration of VRE in China, the 'China Thermal Power Transition' program has been developed as part of their intergovernmental cooperation between China and Denmark.

The program aims exclusively on the short and long term transformation of the thermal power sector to pave the way for integration of rapidly increasing share of wind and solar power using international expertise and experience.

The 'China Thermal Power Transition' is program consisting broadly of three components: (i) to technical demonstrate flexibility enhancement initiatives on Chinese thermal power plants through a series of on-site demonstration projects; (ii) the development of power market reforms focusing on developing economic incentives driving investment in thermal flexibility and outlining possible long-term paths for the thermal sector in the context of a future dominated by RE assets; and (iii) finally a dissemination and network platform to share the experiences and not least to engage the relevant stakeholders – particular the thermal power plants - to be proactive instead of resisting power market reforms.

The program will thus impact through facilitating the integration of increasing shares of VRE through power plant flexibility and by engaging the sector itself in contributing to the longer term transformation of the thermal power sector to a low carbon future.

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