



## SINO-DANISH PILOT PROJECT ON DISTRICT HEATING AND ENERGY EFFICIENCY IMPROVEMENTS IN CHINA

### Programme partners and cooperation

China and Denmark have extended their long term partnership within energy efficiency (EE) by developing a district heating (DH) pilot project in the Chinese city of Tongchuan, representing key challenges in the transition towards a cleaner China.

The pilot project is entered into by a Project Agreement signed in October 2017 in Xi'an between the Danish Energy Agency (DEA), the National Energy Conservation Centre (NECC), Development and Reform Commission of Shaanxi Province, and People's Government of Tongchuan city of Shaanxi Province. The partners are pivotal for the success of the project as they will contribute with the required data, human capital, information and knowledge about political processes and goals. Furthermore the pilot project will establish an expert panel consisting of relevant international, Chinese and Danish stakeholders including knowledge institutions, companies and government authorities in order to ensure high quality results and to improve the knowledge sharing forum within DH.

### Danish regulatory experiences adapted to Chinese circumstances

The pilot project will demonstrate potentials to increase energy efficiency and DH based on Danish regulatory experiences, methodologies, technologies and knowhow tailored to a Chinese context. A District Heating Assessment Tool (DHAT) based on Denmark's 40 years of experiences with planning of DH has been developed as a user friendly tool. The DHAT can demonstrate how much lower the consumer cost for DH can become, compared to individual heating or ineffective DH technologies. The DHAT can also demonstrate how much pollution can be reduced with various heat options. The aim of this tool is to customize it to specific Chinese needs and circumstances in a close collaboration with the partners and build the capacity to use it as a tool for heat planning. The results from DHAT will give the needed information to decide whether to further develop an economically sound DH project.

The District Heating Assessment Tool can be used for:

1. Business cases: Is district heating or individual heat supply the cheapest option?
2. Zones: How small or large shall heat zones be in cities and towns?
3. The selection of fuels and technologies: What technology and fuel should be used in a specific district heating supply? (Natural gas, coal, biomass, solar heating, Heat-Only-Boiler or Combined Heat and Power?)
4. Calculating reduced pollution: CO<sub>2</sub>, PM, NO<sub>x</sub>, SO<sub>2</sub>, etc.

### Scale up lessons learned

An important aim of the pilot project is to demonstrate the opportunities in DH and scale up the implementation by sharing tools, methods and lessons learned in order to support China in reaching their ambitious energy transition targets. Furthermore it is an opportunity to identify potential regulatory, technical and capacity related barriers to harvest the fruits from DH.

### A focus on excess heat

The main challenge addressed in the pilot project will be the use of excess heat from industrial production. Excess heat from industry is widely available in China, especially from power plants, waste incineration and heavy industry. The challenges related to implementing excess heat from industry are tightly connected to the integration of renewable energy from fluctuating sources such as wind and solar.

### Challenges to address

Challenges for the more widespread energy efficiency is due to a number of reasons covering the limited experience within heat planning, excess heat utilization, technical solutions and institutional barriers hindering the expansion and utilisation of excess heat for DH, renewable energy (RE) and higher energy efficiency.

As more fluctuating RE is introduced to the Chinese energy system, the DH systems will play an increasingly important role in providing flexibility and storage at reasonable cost, for the entire energy system.

Energy efficiency in Chinese DH today faces a series of challenges including an estimated 33% energy loss in average distribution, relatively low boiler efficiencies and challenging technical designs for RE integration. Due to the technical design, many systems offer insufficient hydraulics control, connectivity and monitoring for increased use of excess heating and implementation of renewables, as well as the use of the most efficient energy production units.

**Benefiting from the Danish experience**

Denmark is one of the most energy efficient countries in the world. The widespread use of DH and combined heat and power are some of the most important reasons why it has been possible to increase energy efficiency and reduce emissions over several decades.

In Denmark regulatory suggestions have been implemented and continuously made more sophisticated. Nearly all technical solutions have been implemented and Danish DH and Combined Heat and Power (CHP) plants use a variety of fuels on both small and large scale plants. Today 64% of all households are connected to a DH network providing energy not only for space heating but also hot water use. Measured by delivered energy (end use) more than 50% of the DH is derived from renewable sources and more than 78% of DH is generated through CHP with possible combined efficiencies above 90%. Many of the largest DH providers in Denmark have achieved 10% or less energy loss in distribution and virtually all CHP's in Denmark have installed storage capacity. This is in part due to the high connectivity, enabling many production units to a single grid, together with hydraulic controls and remote metering, allowing for smarter energy efficiency efforts.

**Tongchuan**

The industrial city of Tongchuan was built in 1958 in the central part of Shaanxi Province. It had a population of 950,000 in 2015, and it is expected to increase to 1.06 million inhabitants by 2020.

Its weather is characterized by long winters and short summers. The lowest temperatures are between October and April with lowest temperatures going from -6° to -22°.

Tongchuan's main industries are coal, building materials, machinery, textile, chemical and aluminium. Their main energy source is coal.

The government's annual total fiscal revenue in 2016 was 3.144 billion Yuan (2.979 billion Danish Krone).



**Pilot project cooperation and expected results**

The aforementioned challenges and the Sino-Danish efforts to cooperate on improving China's efforts to develop the DH/CHP sector in a sound and cost-effective manner, providing training and tools.

By working on specific Chinese cases in district energy the pilot project in Tongchuan will develop and evaluate implementable energy efficient solutions based on Danish experiences and methods. The pilot project aims to deliver

- Policy recommendation and dissemination
- Specific tools for heat planning, Cost benefit analysis, decision support tools for project evaluation and total cost of ownership
- Technical assistance to energy efficiency
- A showcase to demonstrate Chinese energy efficiency in district heating



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