
Comparison of district heating systems used in China and Denmark

The 2nd International Research Conference

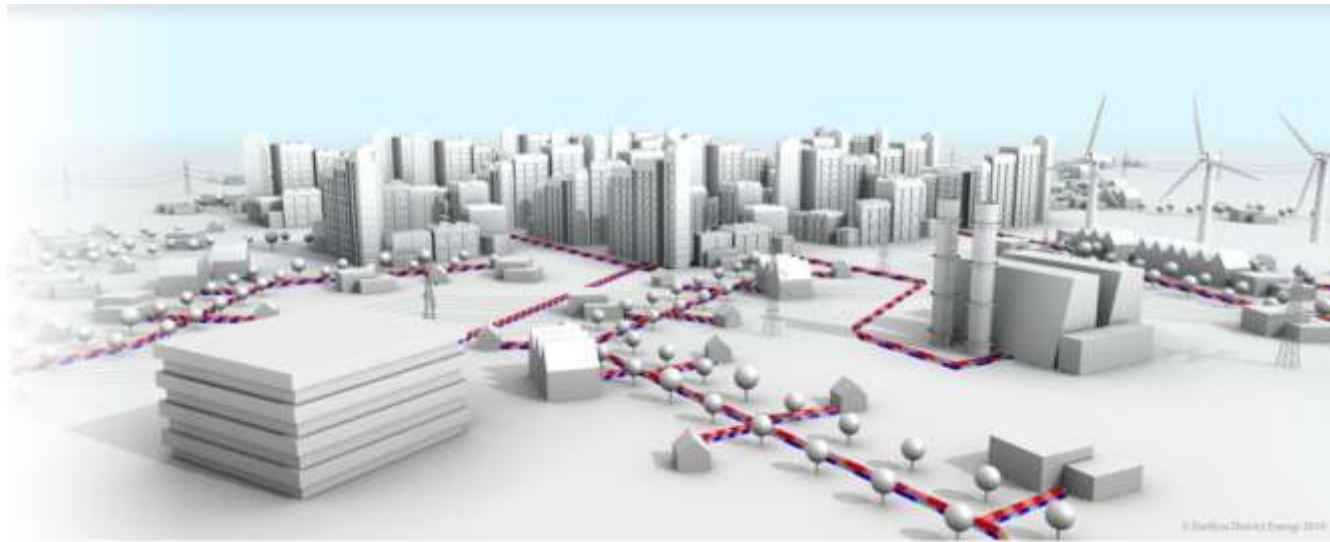
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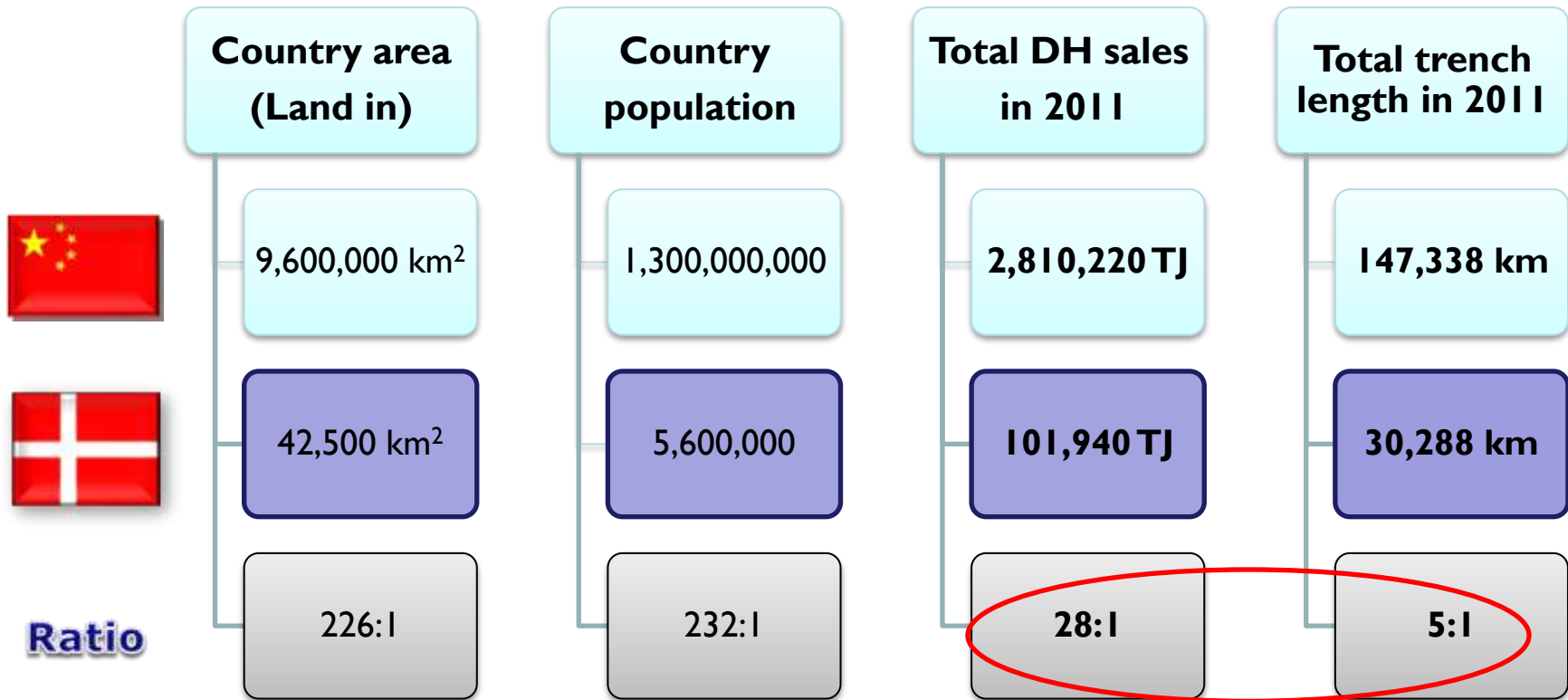
Objectives



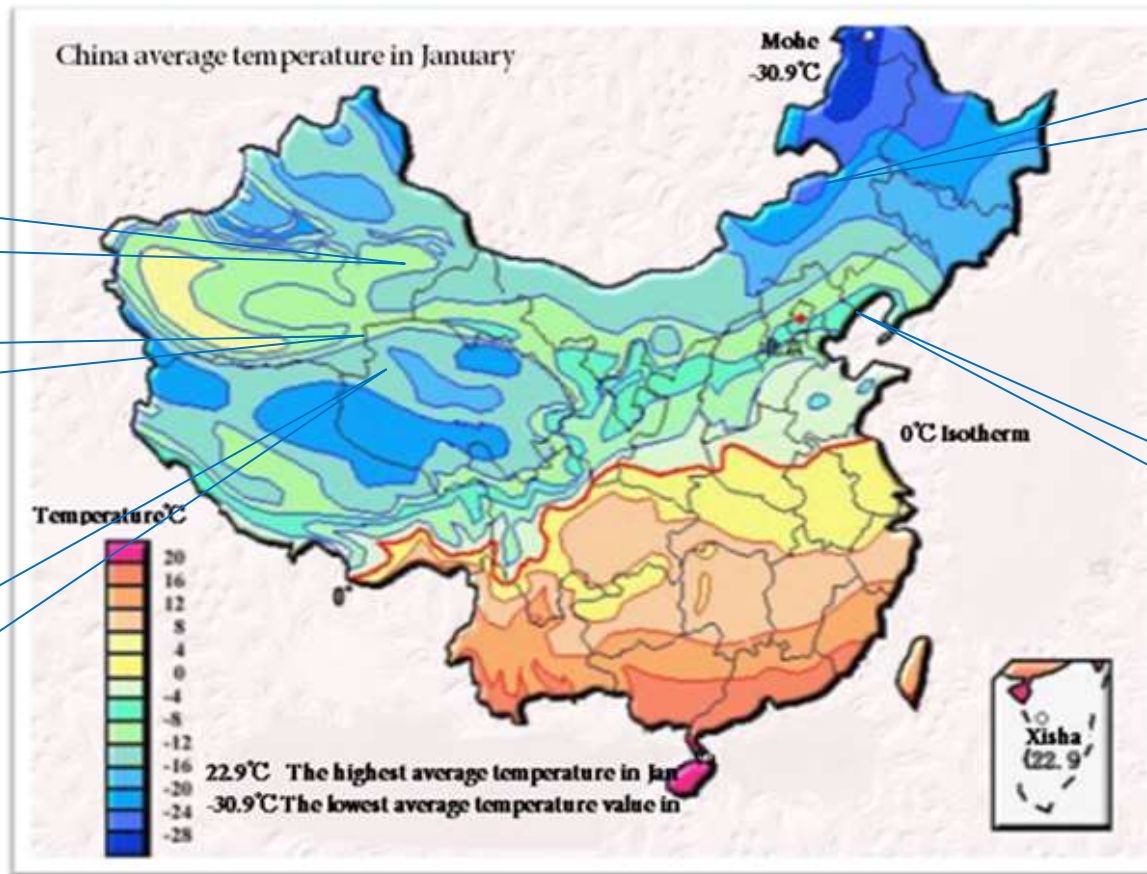
- Share the research results through the **industrial PhD project**
- Identify the **difference** between Chinese and Danish District Heating (DH) systems.
- Figure out the **potential** of China's DH system and the **opportunities** of Danish DH technologies by analyzing the **main elements** in DH system.



District heating profile in China and Denmark *Danfoss*



Heating status of China



Cover about **2/3** of national territory

550 million inhabitants live

43% of the total residential and commercial building in China

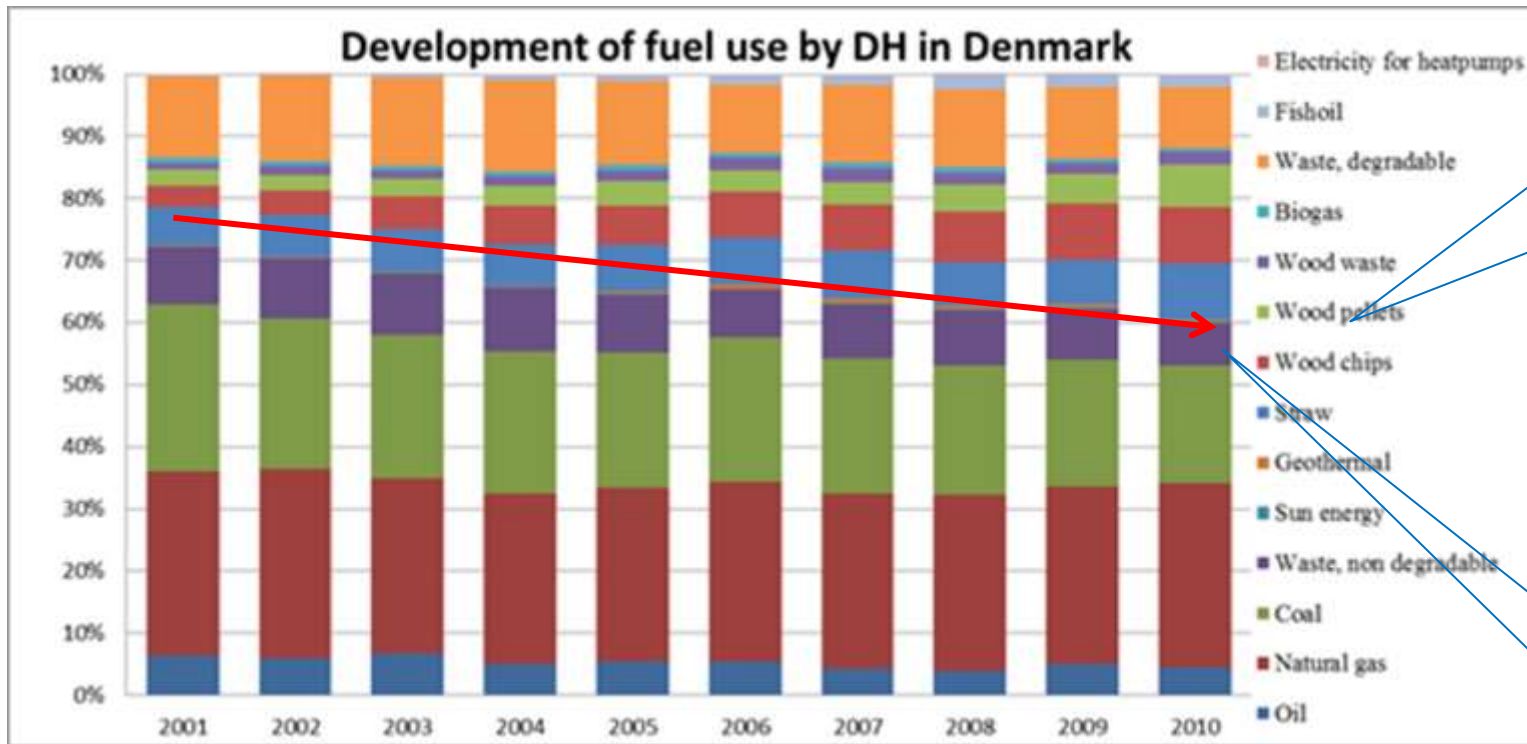
Two climate zones: Severe cold and Cold

Heating duration: **150**days

General DH differences between Denmark and China

Items	Denmark	China
District Heating supply	Whole year available	Only Winter time
District Heating system	Space heating and domestic hot water (DHW)integrated together.	District heating is mainly for space heating, DHW preparation from DH is uncommon.
Heating Comfort of residential building		Un-adjustable indoor temperature, legal min 18°C.

Energy generation- Denmark's DH fuel structure *Danfoss*



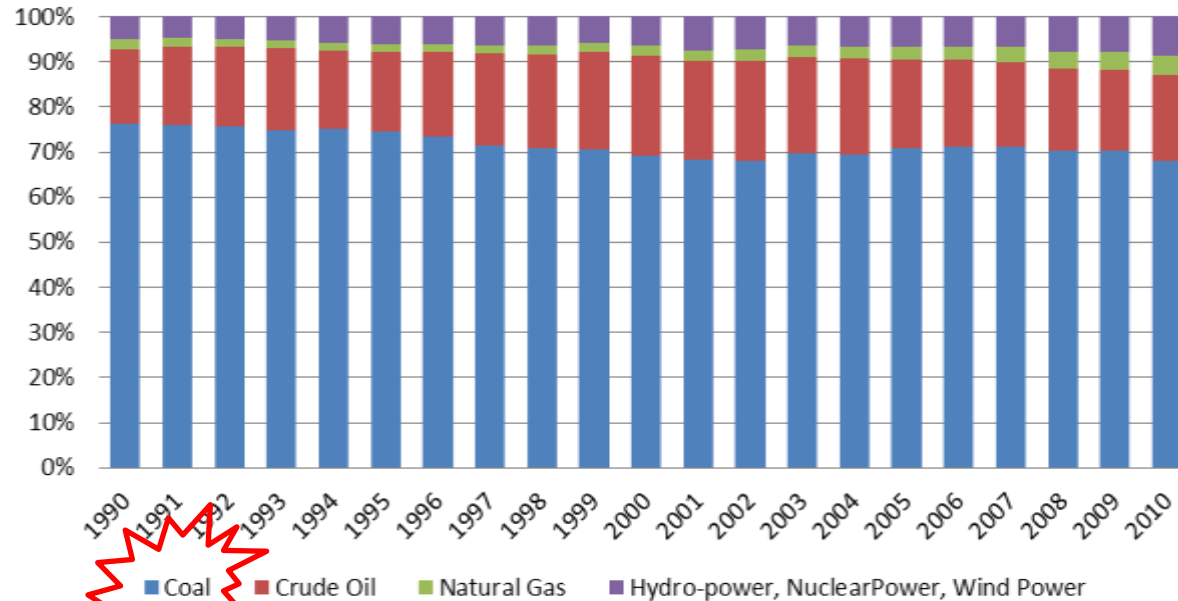
Diverse
 DH fuel sources:
 Waste energy
 Renewable energy
 Fossil fuel

Tendency
 More renewable
 Less fossil fuel

Energy generation- China's DH fuel structure



1990~2010 China's energy Consumption and Composition



- Coal is the dominant fuel in China, and the situation will remain steady in the coming years.
- Heavy reliance on coal presents a number of environmental, healthy and economic challenges.
- The majority of the air pollution in China is caused by the burning of coal to generate electric power. Some monitoring data show pollutants mainly came from coal dust (41%).

Energy generation- China's DH fuel structure



- Energy mix

Recognizing the impact, China has sought to increase the diversity of energy mix.

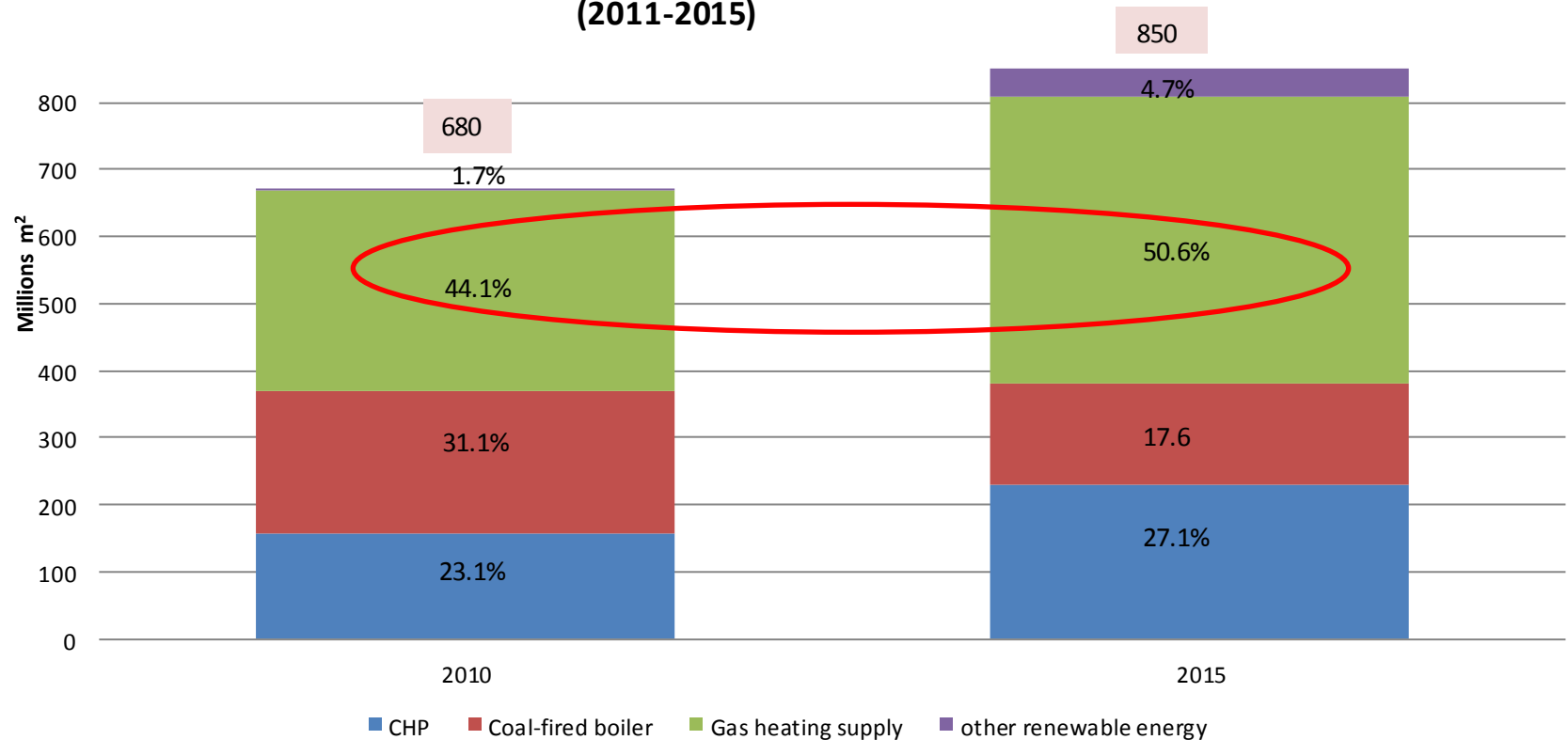
- Fuel conversion, convert from coal to natural gas

- Emission benefits: converting coal to natural gas in operating boilers will reduce **NO₂ emissions by 60% and SO₂ emissions by 99.5%.**
- Relevant Policies: Government defined the policies for main cities to restrict new heating plants to gas-fired technology, e.g. **Beijing, Tianjin and Taiyuan...**
- **China's demand for natural gas** is projected to be around **100 billion cubic meters(bcm) in 2010 and 200 bcm in 2020.** The implied annual rate of growth in the first two decades of the 21st century is about 9 % according to Chinese researchers.

Fuel conversion in China

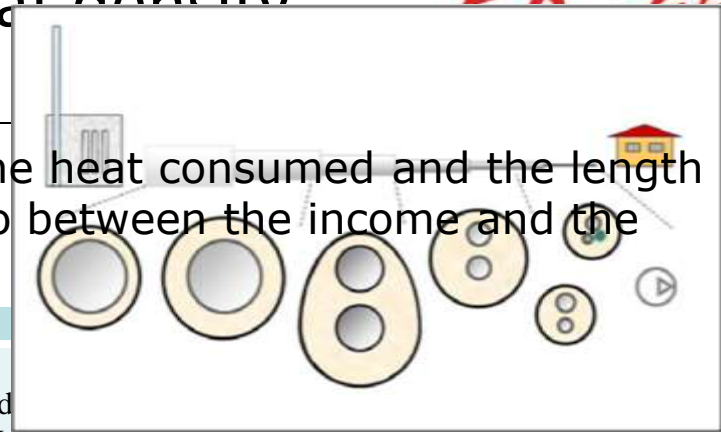


Beijing District heating planning during 12th Five-year plan (2011-2015)



Distribution network-Linear heat density

Linear heat density: the ratio between the heat consumed and the length of pipes in km, a good indicator of the ratio between the income and the distribution cost.



Linear Heat Density	China	
Average level	94.6GJ/a/m Varying from 47.3GJ/a/m in Tianjin and 75.7GJ/a/m in Heilongjiang to 148.2GJ/a/m in Beijing	
Development tendency	Increasing -District heating is a viable option in urban areas with high population density. -Typical building is multi-storey building or high-rise building. -Rapid urbanization: to 51.5 % during the 12th Five-Year Plan period (2011–15)	Decreasing -wide range of energy saving measures have considerably decreased the unit heat consumption -More single-family houses with large garden decrease the geometrical consumer density.
Response measures	Improve the efficiency of district heating network	Prompted the optimal design on heat distribution systems to reduce the heat loss, pipe cost as well as operation cost
Technical schemes	<ul style="list-style-type: none"> - Single pipe is mainstream due to larger dimensions of pipes - Reduce the heat loss which is estimated around 25% - Reduce the water loss which happened due to water leakage, and unauthorized usage 	<ul style="list-style-type: none"> - Small dimension: co-insulations principle - Medium dimension: egg-shaped pipe - Large dimension: single insulated pipe - Special design for branch consumer pipe - Reduced the media pipe dimensions +pressurizing pump

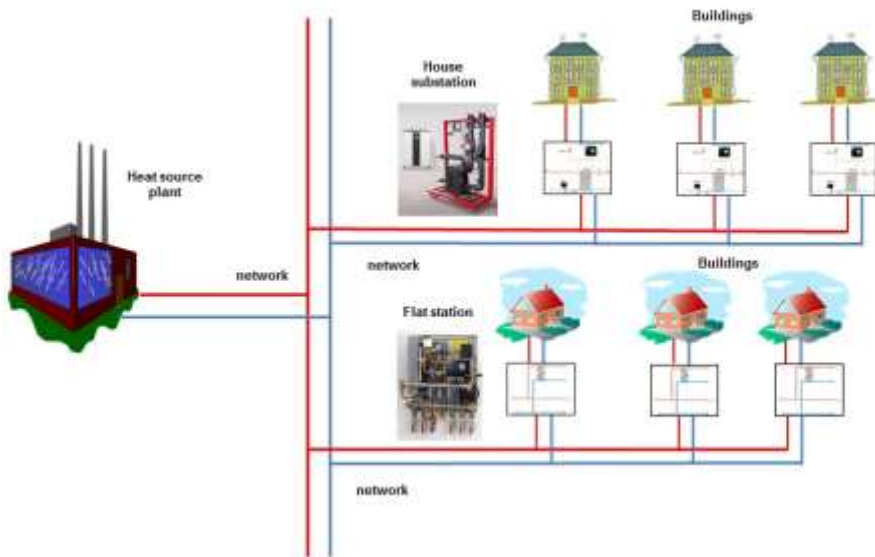
Substation -Network control method



Denmark



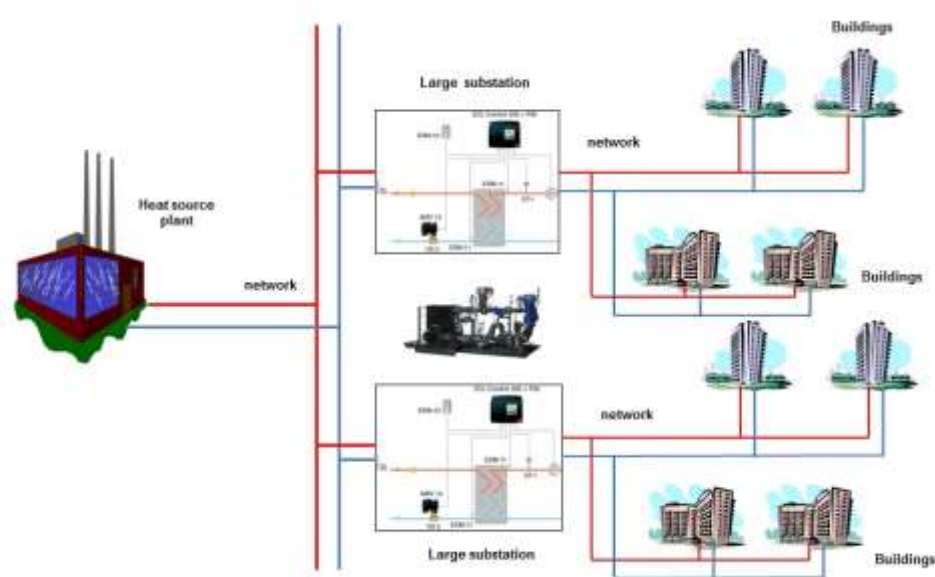
- The tendency is to move the control of the system closer and closer to the consumer



China



- District heating systems commonly to have large substations serving a number of buildings (typically, high-rise buildings)



Heat consumers- heat billing

Denmark

- Heat billing=Fixed cost +variable cost
- Cost of the distribution network + actually consumed and metered heat

China

- Heat billing= Fixed cost
- Heat fee is charged for per square meter

Composition	Heat cost	Items	Denmark	China
A	Fixed cost	Effect contribution	×	×
		Subscriber contribution		
		Unit service		
B	variable cost	Heat consumption	×	
Total of heat billing			A+B	A

Heat consumers- heat metering

- The difference of heat cost billing reflects whether heat consumers have the incentive to save energy, and if the heat is efficiently used.
- China is continuing the heating reform, with focus on the promotion of demand-side measures, including
 - Building energy efficiency,
 - consumption-based billing,
 - and the modernization of district heating supply systems.

Thank you for your attention!

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More details, please read the article which will be published in the 4th issue of the English edition of the EH&P magazine, 2013.