

Seminar on Integration of Renewable Energy in Central Heating and Cooling Systems

Policy and Market of Renewable Heat in China

**Energy Research Institute, NDRC, China
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- **国家发展和改革委员会能源研究所**
- Energy Research Institute National Development and Reform Commission

Outline

- Policy measures
 - Plan for Clean Heating in Winter in North China (2017-2021)
 - In 2017, the Ministry of Finance supported pilot cities for clean heating
 - In 2017, the NDRC issued the Opinions on Clean Heating Price in North China
 - In 2021, the NEA publishes Renewable Heat
- Technology and Market Prospects

Great Attention to Clean Heating: from Central Government to Local

- **Xi Dada: Clean heating in winter in North China is a major livelihood issue**
- **Central Government**
 - **10 ministries issued: Plan of Clean Heating in Winter in North China 2017-2021**
 - 14 provinces and regions in Northeast, North and Northwest China, and some regions in Henan
 - **Ministry of Finance and 3 other ministries: 43 pilot cities for clean heating in winter in North China**
 - 1 billion RMB per year for municipalities directly under the central government, 700 million RMB for provincial capitals and 500 million RMB for other cities
 - **NDRC: Opinions on Price Policy of Clean Heating in North China**
 - **Ministry of Finance and SAT: To continue the tax incentives for heating enterprises and support heat supply by residents**
 - Heat supply by residents: To exempt these residents from VAT, property tax and urban-land-use tax
- **Provincial and municipal governments: To break down objectives, tasks and policies**

Plan for Clean Heating in North China (2017-2021)

- **In December 2017, issued by 10 ministries**
- **Clean heating:** geothermal, biomass, solar energy, natural gas, electricity, industrial waste heat, clean coal combustion, nuclear energy, etc.
- **Ambitious target: 50% clean heating rate by 2019, 70% by 2021**
 - **Fossil energy:** 11 billion square metres of clean coal, 1.8 billion square metres of natural gas, 1.5 billion square metres of **electric heating (including heat pumps)**
 - **Renewable heating: 1 billion square metres of geothermal, 2.1 billion square metres of biomass, 50 million square metres of solar energy**
- **Policies**
 - Multi-channel funding: demonstration of 2+26 key cities
 - Price and market mechanism: preferential price mechanism for electricity and gas
 - Securing energy supply for clean heating
 - Reform of central heating methods, regulation of emissions in the heating sector, etc.

Renewable heat
accounts for 18%

Scope of Plan Coverage

North China: 15 provinces and municipalities

- Beijing, Tianjin, Hebei, Shanxi, Inner Mongolia
- Liaoning, Jilin, Heilongjiang
- Shandong
- Shaanxi, Gansu, Ningxia, Xinjiang, Qinghai
- Part of Henan Province

2+26 key cities on Beijing-Tianjin-Hebei air pollution transmission channel:

- **Beijing**
- **Tianjin**
- **Hebei Province:** Shijiazhuang, Tangshan, Langfang, Baoding, Cangzhou, Hengshui, Xingtai, Handan
- **Shanxi Province:** Taiyuan, Yangquan, Changzhi, Jincheng
- **Shandong Province:** Jinan, Zibo, Jining, Dezhou, Liaocheng, Binzhou, Heze
- **Henan Province:** Zhengzhou, Kaifeng, Anyang, Hebi, Xinxiang, Jiaozuo, Puyang

Renewable Energy: Integrated into the Large System, with Opportunities and Challenges

- **III. Selecting heat sources according to local conditions**
- **1. Renewable heat**
 - **Geothermal heating**
 - Hydrothermal (medium to deep) geothermal heating.
 - Developing shallow geothermal energy for heating
 - **Clean biomass heating**
 - Cogeneration of agricultural and forestry biomass in county town, cogeneration of urban solid waste incineration, biomass boiler, biomass biogas, etc.; strict standard requirements for clean heating of biomass energy
 - **Solar heating**
 - Solar heating, solar water heating applications
- **3. Electric heating**
 - Actively promote various types of electric heating: electric boilers and heat pumps
 - Encourage the implementation of electric heating in areas with large renewable energy generation
- **IV. Safeguard measures**
 - Improve the price and market mechanism
 - Securing energy supply for clean heating
 - Organise potential exploration and selection evaluation of geothermal resources in North China
 - Establish a sound supply system for bio-feeds
 - Strengthen the regulation of emissions in the heating sector
 - Boiler emissions, geothermal energy development

Ministry of Finance: Support for Pilot Cities

- The Ministry of Finance supports 43 pilot cities
 - First batch in 2017: 12 cities
 - Second batch in 2018: 23 cities
 - Third batch in 2019: 8 cities
- 1 billion RMB per year for municipalities directly under the central government, 700 million RMB for provincial capitals and 500 million RMB for other cities
- Budget for prevention and control of air pollution: clean heating in North China
 - In 2019: 15.2 billion RMB (139.2 + 12.8), 43 cities
 - In 2021: 7.34 billion RMB, 31 cities
- Future:
 - Northeast and northwest China
 - Great demand for heating in South China

| Tianjin | Hebei 11 | Henan 10 | Shandong 7 | Shanxi 8 | Shaanxi 6 |
|---------|--|---|---|--|--|
| | <ul style="list-style-type: none"> • Shijiazhuang • Tangshan • Baoding • Langfang • Hengshui • Handan • Xingtai • Zhangjiakou • Cangzhou • Dingzhou • Xinji | <ul style="list-style-type: none"> • Zhengzhou • Kaifeng • Hebi • Xinxiang • Luoyang • Anyang • Jiaozuo • Puyang • Sanmenxia • Jiyuan | <ul style="list-style-type: none"> • Jinan • Zibo • Jining • Binzhou • Dezhou • Liaocheng • Heze | <ul style="list-style-type: none"> • Taiyuan • Lvliang • Yangquan • Changzhi • Jincheng • Jinzhong • Yuncheng • Linfen | <ul style="list-style-type: none"> • Xi'an • Xianyang • Tongchuan • Weinan • Baoji • Yangling Demonstration Zone |

Clean heating is a long-term, arduous task with high market demand

- 1. General requirements**
- 2. Improve the electricity price policy of "coal to electricity"**
 1. Improve the peak-valley TOU tariff system; 2. Optimise the policy of tiered pricing for residential electricity consumption; 3. Vigorously promote the market-based trading mechanism
- 3. Improve the gas price policy of "coal to gas"**
- 4. Establish a sound price mechanism of heating according to local conditions**
 1. Improve the price policy of central heating; 2. Promote market-based principles to determine prices for regional clean heating on a trial basis; 3. Strengthen cost monitoring and price regulation of heat supply enterprises
- 5. Coordinate relevant support policies**
 1. Increase financial support; 2. Exploring diversified financing methods; 3. Expand market access and securing good supply

Policies Related to Renewable Energy

- **II. Improve the electricity price policy of "coal to electricity"**
 - **Improve the peak-valley TOU tariff system**
 - **Optimise the policy of tiered pricing for residential electricity consumption**
 - Reasonably determine residential heating electricity consumption
 - Encourage superimposed peak-valley price
 - Clarify the electricity price policy of "coal to electricity" at the village level
Ensure the same policy for heat pump heating as household electric heating
 - **Vigorously promote the market-based trading mechanism**
 - Encourage clean heating electricity to participate in power market transaction, slow down the rate of wind and solar power generation decrease, and reduce electricity costs
 - Reasonably develop electric heating transmission and distribution tariffs, and make valley section transmission and distribution tariffs 50% of the flat section
- **IV. Establish a sound price mechanism of heating according to local conditions**
- **Priority of renewable energy**
- **Linkage between electric heating and wind and solar power generation decrease**

NEA: Notice on Implementing Renewable Heat Supply According to Local Conditions

Background and Purpose

- January 2021, National Energy Administration, No. 3 [2021] NEA
- It had been planned to be introduced in 2017 and later merged into clean heating
- Background and Purpose
 - Peak by 2030, carbon neutral by 2060
 - Renewable heat has become a certainty

Main Contents

1. Overall scientific and **planning** of renewable heat
2. Promote various types of renewable **heat technologies** according to local conditions
3. Continue **promoting pilot demonstration work and major project construction**
4. Guarantee **policy support** of renewable heat
5. Strengthen **R&D support** for key technical equipment
6. Improve the **government management system** for renewable heat

NEA: Notice on Implementing Renewable Heat According to Local Conditions

Requirements for Planning

- **Regional energy planning:** renewable energy is important, so its development goal should be clearly defined.
- **Make good connections with other plans** and support complementary heating systems
 - Planning for urban regeneration, new town areas and industrial parks
 - Planning for strategy of rural revitalization

Policy Assurance

- **Reasonably set heating prices** and try to establish a renewable heating investment and operation mode in line with market-based principles
- Encourage active **local government** support for the project
- **Give priority to** the construction of **biomass cogeneration projects** and strictly control projects that only generate electricity but not heat
- Biomass power **subsidies should be granted in priority** to support biomass cogeneration projects
- Methods of heating by residents such as geothermal energy and household moulding fuel stoves are **not subject to heating franchise**
- Support companies **involved in geothermal exploration and evaluation to be given priority** in obtaining franchise of geothermal resources.

NEA: Notice on Implementing Renewable Heat According to Local Conditions

Define directions to be encouraged

- Actively promote the development and use of **geothermal energy**
- Develop **biomass** heating in a sensible way
- Continue to promote **solar heating and wind power heating**

Define restrictive requirements

- **Restrictions on geothermal energy**
 - **It is forbidden to use the protected target aquifer as the source of heat pump** in the source of groundwater application and its protection area.
 - **It is forbidden to use groundwater as the source of heat pump** in restricted areas for groundwater exploitation, deep (confined) aquifers, areas where geothermal water cannot be recharged effectively or the corresponding aquifers.
 - Groundwater recharge shall not cause groundwater contamination
- **Biomass energy**
 - Biomass boilers **shall not be fed** with other materials such as coal, rubbish or industrial solid waste
 - Give priority to the construction of biomass cogeneration projects
 - Introduce **biomass moulding fuel standards** and **biomass stove product standards**, etc.

Mature Renewable Heat Technology for Wide Range of Needs

Central heating area: counties, development zones

- Biomass cogeneration
- Biomass boiler
- Medium and deep geothermal energy
- Multi-energy complementary systems: shallow cryogenic heat pump systems/solar, etc.
- Numerous practical cases
- Heating franchise
- Commercialized operation

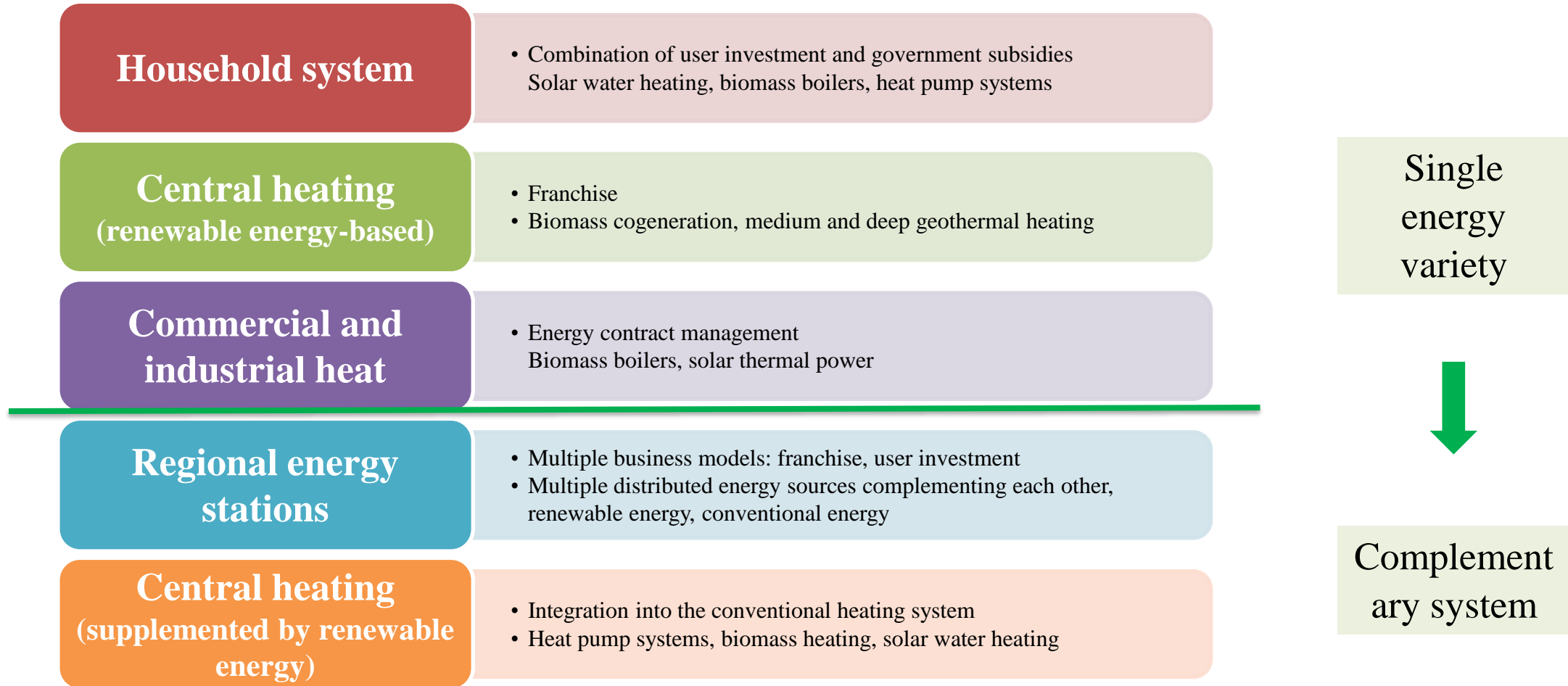
District heating: townships, parks

- Huge market demand
- Rising living standards and demand for central heating
- Renewable heat is a good option
 - Higher initial CAPEX, low OPEX.e.g., middle and deep geothermal

Domestic heating systems: rural areas

- Heat pump systems: ground source, water source, air source
- Biomass boiler
- Solar water heating systems
- Combination of household investment and government subsidies

Renewable Heat: Development Model



Renewable Energy Integrated into the Large System, with Opportunities and Challenges

- **Huge market**

- 74.84 million tce in 2017
- 478 million square metres/57.34 million tce of solar thermal collector area, 5 million tonnes of standard coal for biomass, 500 million square metres/ 5 million tce of geothermal heating floor area

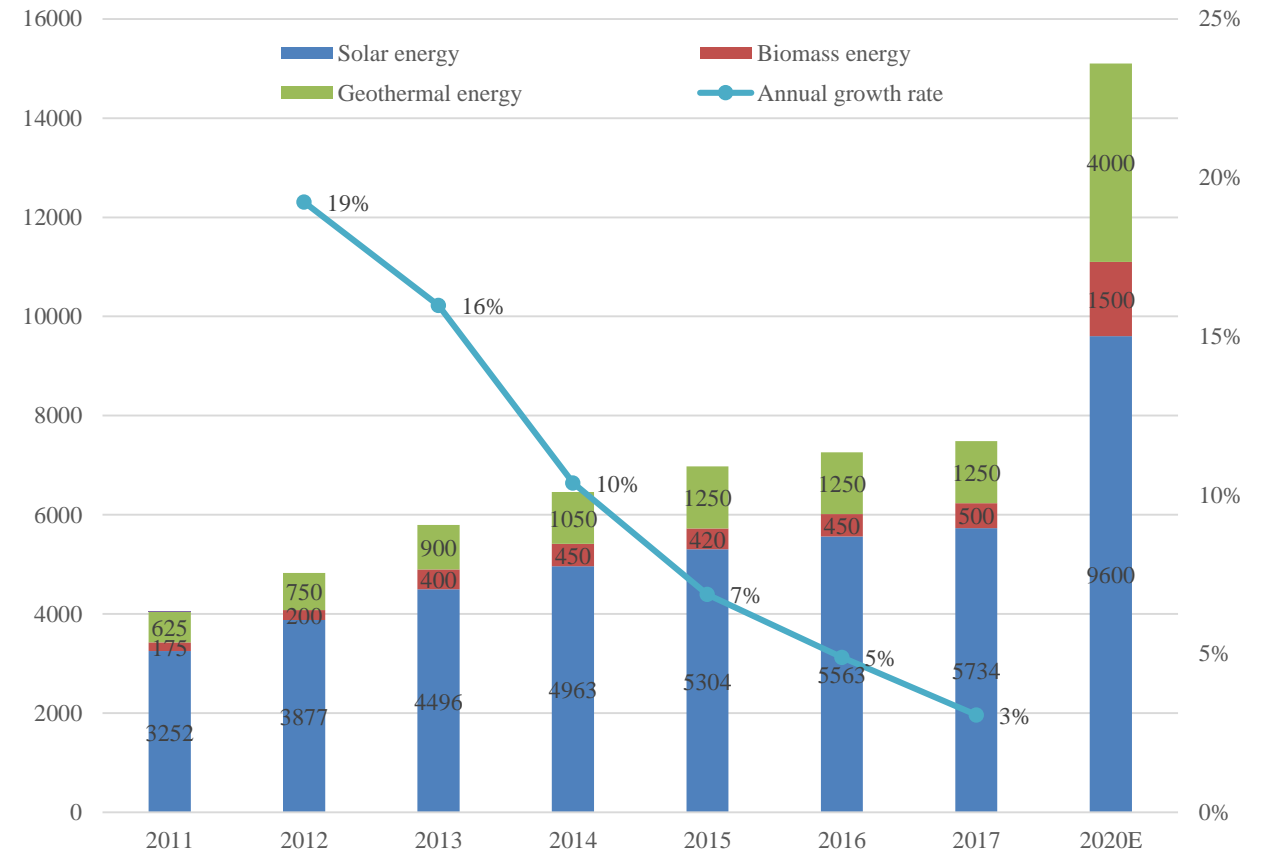
- **Large gap to the 13th Five-Year Plan target, large market space**

- 800 million square metres of solar collector area, 15 million tonnes of standard coal for biomass and 1.6 billion square metres of geothermal heating floor area

- **Market faces serious challenge of decline**

- **Geothermal energy: main force of growth in the heating market**
- **Solar energy:** the market has declined for three consecutive years since 2014, with an average annual decline of more than 15%
- **Biomass energy:** some increase in recent 2 years.

Utilization amount of renewable heat (ten thousand tce)



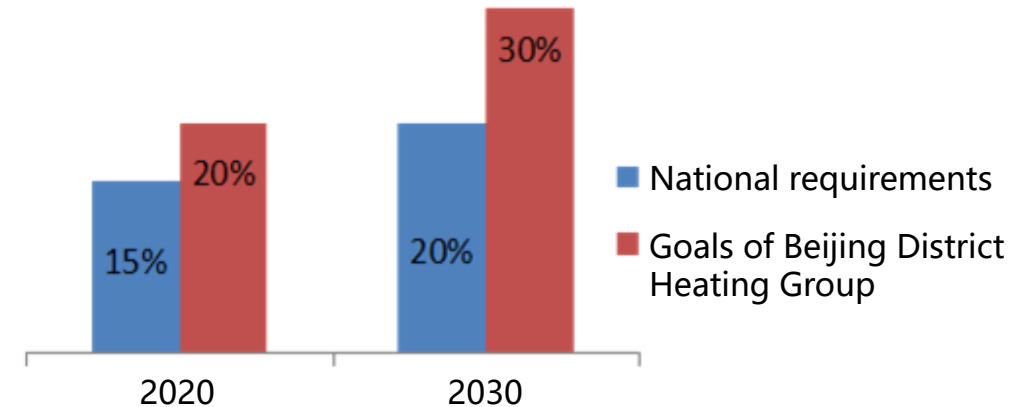
Targets for the Share of Renewable Heat: State? City? New Heating Area?

New energy development objectives of Beijing District Heating Group

By the end of 2017, the Group had a total heating supply area of **296** million square metres, a pipe net work length of **1,564** kilometres and **4,143** heat stations.

In 2020, Beijing District Heating Group will reach 20% of new energy heating and renewable heat in the core area of the city.

In 2030, Beijing District Heating Group will reach 30% of new energy heating and renewable heat in the core area of the city.



Fangzhuang Heating Plant: Green Energy Utilisation



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When completed, it will be a heating plant with a **renewable energy share of nearly 20%** (not including waste heat of flue gas)

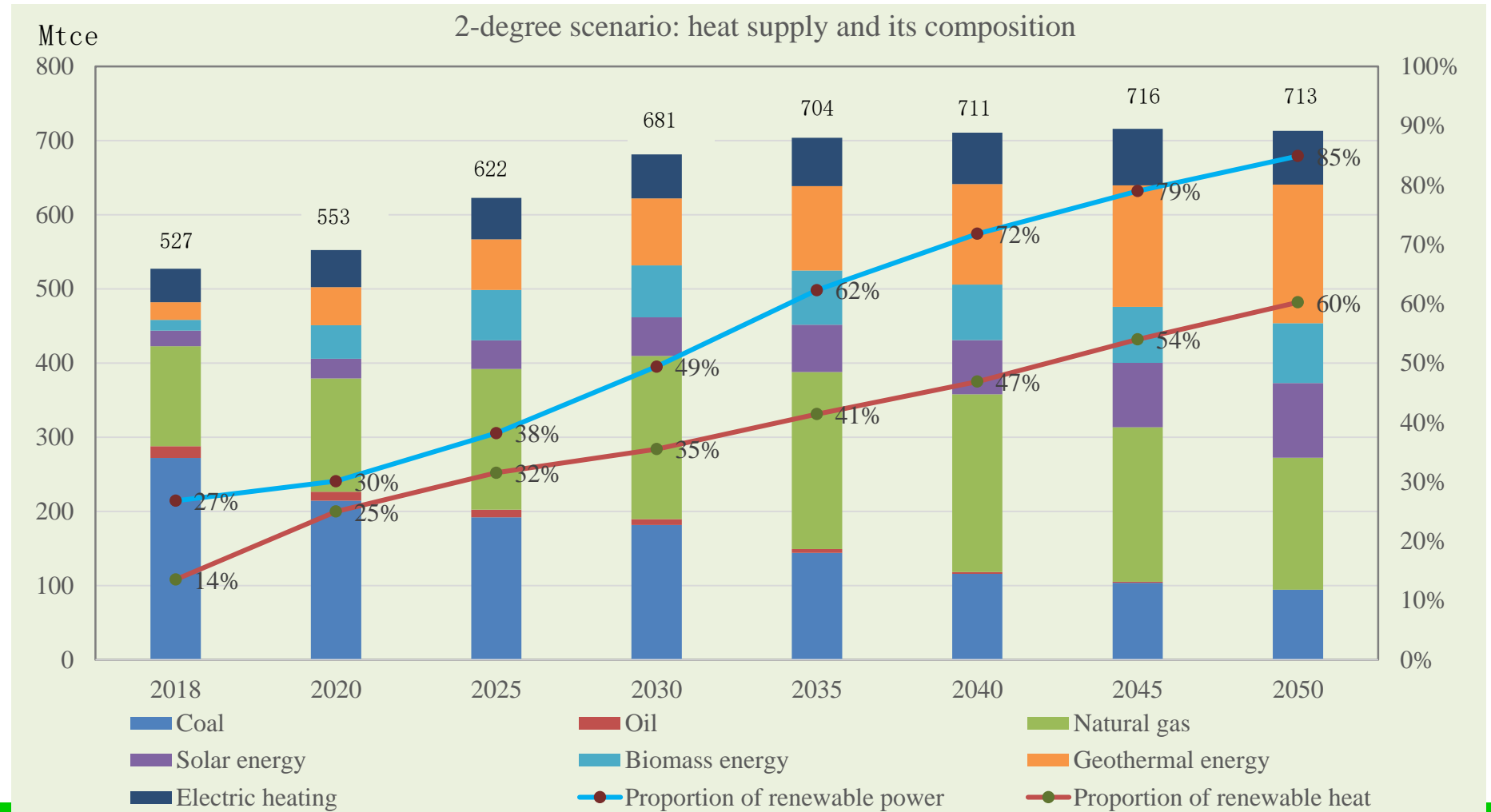
| S/N | Energy utilization mode | | Types of energy generated or saved | | | | Utilization rate of renewable energy | |
|--------------|----------------------------|---|---------------------------------------|------------------------|--------------------------|---------------------|--------------------------------------|--------|
| | | | Heating capacity GJ | Cooling capacity GJ | Domestic hot water GJ | Power supply kWh | | |
| A | Traditional energy sources | 1 | Gas boilers | 3081888 | | | | |
| B | Renewable energy | 1 | Electric boilers | 118360.4 | | | 3.09% | |
| | | 2 | Sewage source heat pump systems | | 54517.54 | 509290.67 | 14.74% | |
| | | 3 | Ground source heat pump system. | | | 37635.84 | 0.98% | |
| | | 4 | Photovoltaic power generation system. | | | | 880000 | 0.08% |
| | | 5 | Ice rink CCHP system | | 6989.41 | 13246.59 | | 0.53% |
| | | | Subtotal | | | 54517.536 | 546926.52 | 880000 |
| Total | | | | 3200248.4 | 54517.536 | 546926.52 | 880000 | 19.43% |



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Prospect of Renewable Energy in China CREO 2020

- Existing policy scenarios
- 2-degree scenario



Summary

- With the goal of carbon neutrality: renewable heat has become an inevitable choice
- Renewable heat technologies are mature, but its integration into the large energy system is still a big challenge
 - Integration technology: complementary systems, thermoelectric synergies
 - Economics: incentive policies, price policies that incorporate environmental externalities
- High potential for development



Thanks!

