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Master Program
on Bio-Based Circular Economy

Course of Renewable Energy Technologies

Waste to energy in China

Students: Huazhen Guo;

Liu Zhang;

Xinyu Zhang;

Ranran Su;

Yun Li

Co-funded by the Erasmus+ Programme of the European Union

Summary

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Chapter 1 Analysis of Chinese energy form

Energy resources are one of the important foundations to promote national development. At present, China is the world's second largest energy and oil consumer, the third largest energy producer, ranking seventh in the world in terms of total natural resources and third in the world in terms of total energy resources. In addition, China has a large population and a relative lack of energy resources per capita. The per capita energy share is only 40% of the world average. Therefore, with the rapid growth of China's economy, the gap between the energy reserves and the development demand in the next few decades will become larger and larger. Especially in recent years, with the rapid growth of energy consumption, the contradiction between supply and demand is increasingly prominent. At the same time, a series of economic and social problems, such as energy shortage and environmental degradation, will directly threaten the national economic security.

From the perspective of China's energy consumption structure, coal consumption has always been dominant. In 1997, the total energy consumption was 1053.9639 million tons of standard coal, which reached 3035.3593 million tons of standard coal in 2016. The proportion of total energy consumption decreased from 66.56% to 59.28%, with a small decrease of only 0.61 per year %The total consumption of crude oil ranks the second, with the consumption increasing from 248.1077 million tons of standard coal to 787.3126 million tons of standard coal, which has been between 13% and 18% of the total energy consumption; The consumption of coke increased from 98774400 tons of standard coal to 394557500 tons of standard coal, accounting for 5% to 8% over the years; the consumption of fuel oil increased from 47932800 tons of standard coal to 106323100 tons of standard coal, but the proportion of fuel oil was always small, not more than 3.03%; the consumption of natural gas increased from 26022800 tons of standard coal to 277133400 tons of standard coal, accounting for the proportion of consumption From 1.64% to 5.41%. From 1997 to 2016, the dominant energy types in China have not changed. They have always been some energy with high carbon emissions - coal and coke. The sum of the two kinds of energy consumption has been higher than 66%. In the highest year, the sum of the two kinds of energy is 72.79%. On the other hand, clean energy has not been developed as it should be, with a very rapid growth rate It was slow and did not exceed 6% by 2016.

Tab1. Major types of energy consumption in China from 2005 to 2016(Unit: 10^4 tons of standard coal)

Year	Coal	Coke	Crude oil	Gasoline	Kerosene	Diesel	Fuel oil	Natural gas
2005	188478.66	22346.01	44134.88	9223.43	1634.09	15558.26	6187.47	6181.04
2006	208482.55	25487.90	47101.44	10154.76	1870.33	17150.53	6042.96	7803.11
2007	227973.22	28216.97	50371.18	11270.01	2055.49	19056.77	5756.39	9507.24
2008	239152.24	30031.84	51764.95	11511.01	2243.19	20389.43	5535.75	11016.66
2009	250849.54	32323.05	55891.45	12344.87	2390.69	21689.98	5314.29	12880.25
2010	272443.52	35202.77	63008.12	14139.21	2691.28	23854.02	6511.13	14847.19
2011	306434.70	38343.80	66093.35	15708.39	2927.97	25520.03	6663.68	17543.63

2012	311759.09	39941.60	68177.63	17075.58	3232.84	26821.48	6687.73	19975.67
2013	308730.10	39521.97	69822.32	16784.95	3458.72	25667.85	7173.51	21920.13
2014	308391.10	40145.54	73373.22	17555.29	3792.77	26019.17	7597.09	24276.89
2015	303919.09	38984.61	76465.51	19459.68	4202.23	26520.33	8713.62	25900.69
2016	303535.93	39455.75	78731.26	20969.39	4781.37	26232.29	10632.31	27713.34

In contrast to the current situation of China's energy shortage, the domestic open energy consumption has caused tremendous waste, which is heartbreaking. In China, the wealth created by unit energy consumption is far lower than that of developed countries. The energy consumption per unit GDP is much higher than the international level, 3-4 times of the world average, 11.5 times of Japan, 4.3 times of the United States, 7.7 times of Germany and France. At present, China has become one of the most serious energy waste countries in the world. If we expand production in a high-energy and extensive way, it will be difficult for the world's energy to maintain the high-speed operation of China's economy.

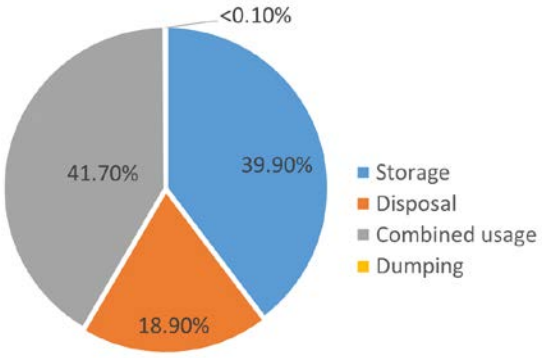
In the long run, in order to meet the needs of economic development for energy, we must not only change the mode of economic growth and strive to improve the efficiency of energy utilization, but also attach great importance to the development and utilization of renewable energy from now on. Waste is a renewable resource misplaced, but if not properly used, it will become an important factor of environmental pollution. Only scientific and reasonable treatment of waste can turn waste into treasure, so as to realize circular economy and sustainable development.

Chapter 2 Overview of Waste disposal in China

Sub C1 General industrial solid waste

According to statistics, in 2018, the output of general industrial solid waste in 200 large and medium-sized cities reached 1.55 billion tons, the comprehensive utilization amount was 860 million tons, the disposal amount was 390 million tons, the storage amount was 810 million tons, and the dumping amount was 46000 tons. The comprehensive utilization of general industrial solid waste accounts for 41.7% of the total amount of utilization and disposal, and the disposal and storage accounts for 18.9% and 39.3% respectively. The comprehensive utilization is still the main way to deal with general industrial solid waste. Some cities have made effective utilization and disposal of the general industrial solid waste which has been stored in history. See Figure 2-1 for utilization and disposal of general industrial solid waste.

Fig2- 1 General utilization and disposal of industrial solid wastes



Sub C2 Industrial hazardous waste

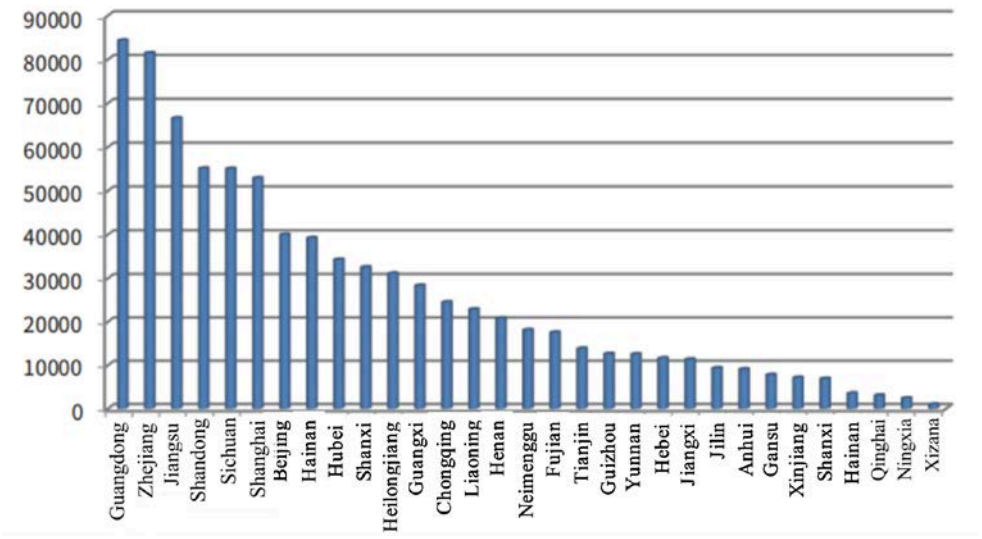
In 2018, the amount of industrial hazardous waste generated in 200 large and medium-sized cities reached 46.43 million tons, the comprehensive utilization amount was 23.673 million tons, the disposal amount was 24.825 million tons, and the storage amount was 5.624 million tons. The comprehensive utilization of industrial hazardous waste accounts for 43.7% of the total amount of utilization and disposal, and the proportion of disposal and storage accounts for 45.9% and 10.4% respectively.

Sub C3 Medical waste

In 2018, the medical waste generated in 200 large and medium-sized cities was 817000 tons, and the disposal volume was 816000 tons. Most of the medical waste in most cities was properly disposed in time.

See Figure 2-2 for the production of medical waste issued by large and medium-sized cities in each province (District, city). Guangdong, Zhejiang and Jiangsu are the top three provinces in terms of medical waste production.

Fig 2-2 The generation of medical waste in each province (autonomous region or municipality) in 2018 (Units: t)



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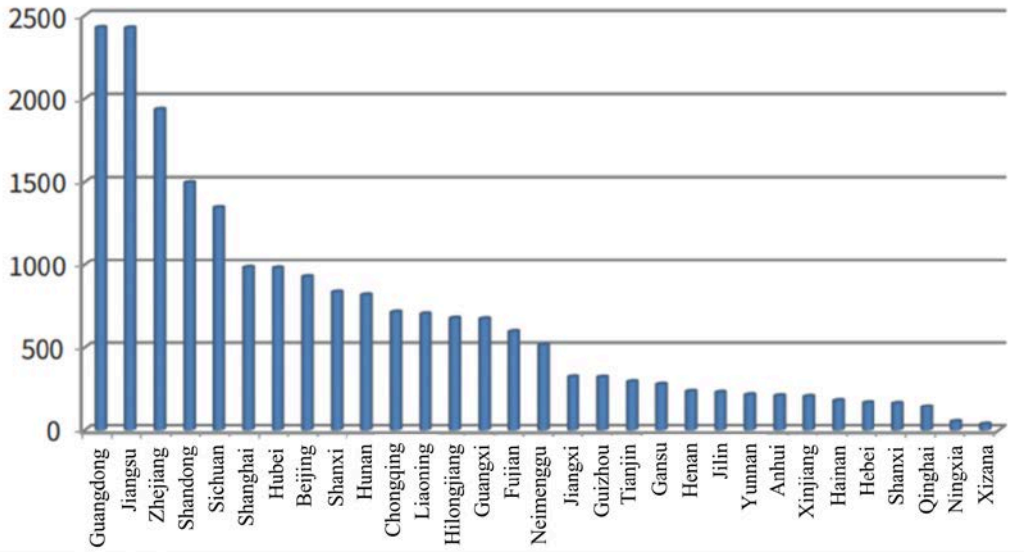
Sub C4 Municipal solid waste

In 2018, the amount of domestic waste generated in 200 large and medium-sized cities was 211473000 tons, and the disposal amount was 210.289 million tons, with a disposal rate of 99.4%. See Figure 2-3 for the generation of domestic waste issued by large and medium-sized cities in each province (District, city)

Fig 2-3 The production of household garbage in each province (autonomous region or municipality) in 2018

(Units: Ten thousand tons)



Sub C5 Resource utilization of bulk solid industrial wastes

Tailings

In 2018, the amount of tailings produced by industrial enterprises under investigation was mainly published as 880 million tons, accounting for 27.4% of the total amount of general solid waste produced by industrial enterprises under investigation, and the comprehensive utilization was 240 million tons (including 11.516 million tons of storage in previous years), with the comprehensive utilization rate of 27.1%. The two industries with the largest production of tailings are nonferrous metal mining and dressing industry and ferrous metal mining and dressing industry, with the production of 400 million tons and 370 million tons respectively, and the comprehensive utilization rate of 23.4% and 26.8% respectively.

The fly ash

In 2018, the survey focused on the production of 530 million tons of fly ash by industrial enterprises, accounting for 16.6%, and the comprehensive utilization of 400 million tons (including 3.25 million tons of storage in previous years), with the comprehensive utilization rate of 74.9%. The industry with the largest production of fly ash is the power, thermal production and supply industry, with a production capacity of 450 million tons and a comprehensive utilization rate of 75.7%; followed by the chemical raw materials and chemical products manufacturing industry, non-ferrous metal

smelting and rolling processing industry, petroleum, coal and other fuel processing industry, papermaking and paper products industry, with a production capacity of 25.653 million tons, 15.609 million tons, 8.878 million tons and 65.60 million tons, respectively Ten thousand tons, with comprehensive utilization rate of 61.8%, 62.1%, 68.8% and 78.2% respectively.

Coal gangue

In 2018, the coal gangue output of industrial enterprises mainly published the survey was 350 million tons, accounting for 10.9%, and the comprehensive utilization was 190 million tons (including 3.88million tons of storage in previous years), with the comprehensive utilization rate of 53.7%. Coal gangue is mainly produced by coal mining and washing industry, with an output of 340 million tons and a comprehensive utilization rate of 53.1%.

Smelting waste residue

In 2018, it was mainly published that the output of smelting waste slag of industrial enterprises was 370 million tons, accounting for 11.6%, and the comprehensive utilization was 330 million tons (of which, the storage capacity of previous years was 4.919 million tons), and the comprehensive utilization rate was 88.7%. The industry with the largest production of smelting waste is ferrous metal smelting and rolling processing industry, with the production of 330 million tons and the comprehensive utilization rate of 91.8%; the second industry is non-ferrous metal smelting and rolling processing industry, with the production of 26.917 million tons and the comprehensive utilization rate of 60.5%.

Slag

In 2018, the slag output of key industrial enterprises was 310 million tons, accounting for 9.6%, and the comprehensive utilization was 220 million tons (including 1.566 million tons of storage in previous years), with the comprehensive utilization rate of 71.0%. The industry with the largest slag production is the power, thermal production and supply industry, with a production capacity of 160 million tons and a comprehensive utilization rate of 71.5%; the ferrous metal smelting and rolling processing industry, with a production capacity of 72.612 million tons and a comprehensive utilization rate of 82.5%; the third industry is the chemical raw material and chemical products manufacturing industry, with a production capacity of 37.614 million tons and a comprehensive utilization rate of 56.0%.

Desulfurization gypsum

In 2018, the output of desulfurized gypsum of key industrial enterprises was 120 million tons, accounting for 3.9%, and the comprehensive utilization was 92.233 million tons (including 1.218 million tons of storage in previous years), with the comprehensive utilization rate of 73.6%. The industries that produce the largest amount of desulfurized gypsum are electric power, thermal power production and supply industries, with an output of 100 million tons and a comprehensive utilization rate of 74.3%; followed by ferrous metal smelting and rolling processing industries, non-

ferrous metal smelting and rolling processing industries, chemical raw materials and chemical products manufacturing industries, with an output of 746.0 respectively 10000 tons, 5.757 million tons and 3.887 million tons, with comprehensive utilization rates of 73.9%, 66.4% and 62.7%, respectively.

Chapter 2 Energy management in China

Sub C1. China's energy waste management policy

According to the provisions of the law of the people's Republic of China on the prevention and control of environmental pollution by solid waste: 1. The State implements the principles of reducing the generation of solid waste, making full and rational use of solid waste and harmless disposal of solid waste in the prevention and control of environmental pollution by solid waste. 2. The State encourages and supports the development of cleaner production and the reduction of solid waste production; the State encourages and supports the comprehensive utilization of resources, the full recovery and rational utilization of solid waste, and the adoption of economic and technical policies and measures conducive to the comprehensive utilization of solid waste. 3. The people's Government of a city shall improve the fuel structure in a planned way and develop urban gas, natural gas, liquefied gas and other clean energy.

In addition, the national development and Reform Commission previously issued the "renewable energy medium and long term development plan" proposed that the proportion of renewable energy in the energy structure should reach 16% by 2020, which is less than 1%. Some tax experts said that taxation will play a very important role in strengthening energy and resource conservation and ecological environment protection in the future. At present, China's tax policies and improvement measures in this respect are summarized as follows:

One There are five kinds of value-added tax: from January 1, 2001, implement the value-added tax immediate refund policy for the waste power generation belonging to the biomass energy; from January 1, 2001, implement the value-added tax half reduction policy for the wind power generation; from 2005, implement the value-added tax in advance and backward for the denatured fuel ethanol produced and sold by the designated enterprises approved by the state; implement the value-added tax for the small-scale hydropower generation units below the county level The value-added tax can be calculated and paid according to the simple method and 6% collection rate for the electricity produced; the VAT refund policy can be implemented for some large-scale hydropower enterprises. In terms of consumption tax, since 2005, the state approved production and sale of denatured fuel ethanol by designated enterprises has been exempted from consumption tax. Although some preferential tax policies are only applicable to individual enterprises, they play a good exemplary role.

According to the guidance of the national key R & D plan "solid waste recycling" in 2019, the proposed project will be announced, "solid waste recycling" in 2019, 45 research directions will be deployed, and the national budget is about 1 billion yuan; "solid waste recycling" in 2019, 10 research directions will be deployed, and the national budget is not more than 300 million yuan, and the project implementation period is 3-4 Year.

The medium and long term development plan of renewable energy proposes to steadily develop biomass power generation. On the premise of good site selection and implementation of environmental protection measures, combined with the new urbanization construction process, the focus is on the prefecture level cities and some counties with resource conditions to steadily develop

urban domestic waste incineration power generation. By 2020, the installed capacity of urban domestic waste incineration power generation will reach 7.5GW. According to the conditions of biomass resources, the direct combustion power generation of agricultural and forestry biomass and biogas power generation will be developed orderly. By 2020, the installed capacity of direct combustion power generation of agricultural and forestry biomass will reach 7GW, and the biogas power generation will reach 500MW. By 2020, the total installed capacity of biomass power generation will reach 15GW, and the annual power generation capacity will exceed 90TW hours.

Sub C2. Merits and demerits

This year, policies and measures on the rational use of energy, energy conservation and emission reduction, and promoting the development of new energy have become more and more perfect. Take the law of the people's Republic of China on energy conservation as an example, it makes resource conservation a basic national policy in China, further improves the energy conservation system in China, and formulates a series of basic systems for energy conservation management, such as the implementation of energy conservation target responsibility system and energy conservation assessment and evaluation system.

China's energy conservation and emission reduction tax policies are more comprehensive. China has issued more than 30 tax policies in four categories to promote energy and resource conservation and environmental protection, which has played a positive role in promoting energy and resource conservation and environmental protection.

Although various policies and systems have been quite perfect, there are still the following problems in the current energy management in China: first, the industry management is relatively comprehensive. The national energy administration, as the competent department of the industry, carries out industry management on the energy fields covering electric power, coal, oil, natural gas, nuclear power and renewable energy. Second, industry management is not independent. In terms of energy management responsibilities, the energy administration and the development and Reform Commission have both division of labor and overlapping functions, especially in terms of energy project approval, energy system operation management and energy market system cultivation. The positioning of "National Bureau under the management of ministries and commissions" leads to low efficiency of decision-making and coexistence of offside and vacancy. Third, related management responsibilities involve multiple departments. Part of the functions of the energy industry chain are scattered in the Ministry of land and resources, the Ministry of water resources, the Ministry of environmental protection, the State Administration of work safety, the state owned Assets Supervision Commission and the Ministry of finance. Fourth, the supervision function of energy economy is weakened. Compared with the previous mode of "separation of administration and supervision", the current mode of "integration of administration and supervision" of energy (power) supervision has significantly reduced the regulatory vitality, efficiency and market order.

In addition, from the implementation of these years, there are still some deficiencies in the current tax policy. These deficiencies mainly include: first, there is a certain gap between the scope and strength of support and the requirements of relevant laws and regulations such as the renewable energy law, the energy conservation law and the clean production law, and there is a lack of necessary tax support policies for the development and promotion of renewable energy such as solar energy and geothermal energy, as well as the development and promotion of energy-saving and environmental protection technology and equipment encouraged by the state; second,

although it has been issued Some preferential tax policies supporting energy and resource conservation and environmental protection have been adopted, but due to the lack of overall understanding of the development of this work, some policies have not been adjusted in time, some new policies have not yet been implemented, and the role of tax support in energy and resource conservation and environmental protection needs to be strengthened. Compared with the relatively perfect ecological tax and circular economy tax system in foreign countries, China is lack of special taxes for the development of circular economy. At the same time, in the current tax system, the tax preferential measures taken to implement the idea of circular economy are relatively single, mainly tax reduction and exemption, lack of pertinence and flexibility. There are few international common methods in China, such as accelerated depreciation, reinvestment tax refund, tax credit and deferred tax.

Chapter 3 The solutions

The analysis of the problem is to solve the problem. In view of the various causes of waste, we put forward the Countermeasures of energy waste, mainly focusing on the following four aspects.

1、 Setting up energy saving target and establishing energy saving certification system

Energy conservation is an important work to implement the scientific outlook on development in an all-round way, which is of great significance to ease resource constraints and reduce environmental pollution. At present, we must take effective measures to reduce the level of excessive energy consumption. He stressed that to do a good job in energy conservation, we should focus on the big and start from the small. The so-called "big" is to increase energy conservation efforts in major energy use areas, such as power, steel, chemical industry, building materials industry to reduce unit consumption, building energy conservation, lighting energy conservation, etc. The so-called "small" is to do in-depth and detailed work, and implement energy-saving measures one by one, one by one, one by one, one by one, one by one, one by one, one by one, one by one, one by one, one by one, one by one, one by one, one by one, so that small energy-saving will become large.

To improve the guarantee mechanism for energy conservation, the State shall organize and implement a number of major energy conservation projects and demonstration projects, and accelerate the research and development, production, promotion and application of new energy-saving technologies and products. We need to expand the channels of funds, increase investment in energy-saving projects, and organize the revision and improvement of energy-saving design specifications and building energy-saving standards for major energy consuming industries. We will further deepen the reform of energy prices and accelerate the introduction of fiscal, tax and financial policies conducive to energy conservation.

2、 Improve energy conservation management capacity

At the same time of relying on the progress of science and technology, we should strengthen management and play the role of management progress. We should strengthen energy and resource conservation and ecological environment protection, and enhance the capacity for sustainable development. Adhering to the basic state policy of saving resources and protecting the environment is closely related to the vital interests of the people and the survival and development of the Chinese nation. We must put the construction of a resource-saving and environment-friendly society in a prominent position in the strategy of industrialization and modernization, and put it into practice in every unit and every family. We should improve laws and policies that are conducive to

energy conservation and ecological environment protection, and accelerate the formation of a sustainable development system and mechanism. Implement the responsibility system for energy conservation and emission reduction. Advanced science and technology need advanced management, and backward management will hinder the progress of science and technology. Compared with the progress of science and technology, in a sense, the backward energy-saving management of government departments will be a more serious problem than that of science and technology. Management progress is a process of continuous improvement and improvement of people's thoughts, theories, organizations, methods and means of organizational management at the micro and macro levels, so as to promote the continuous development and improvement of social productivity.

The progress of management is closely related to the progress of science and technology. With the progress of science and technology, a large number of new technologies, new materials, new processes, new equipment are widely used. For these achievements of scientific and technological progress, there must be corresponding management concepts, management organizations, management methods and means to match, so as to ensure the smooth realization of scientific and technological progress. Management progress is not only the inevitable requirement of scientific and technological progress, but also its guarantee.

3、 Strengthen the construction of legal system

System is an important means for modern society to manage organizations and managers by rules. Scientific system management can reduce the cost of organization operation and improve the efficiency of operation. It can be said that it is necessary for a modern leading cadre to understand the principles of system management and system design. To solve the problem of government energy waste, we should strengthen the construction of legal system. It is necessary to strengthen the research and system construction of the government's energy-saving policies, study and formulate policies and measures to promote the energy-saving work of government departments, and formulate corresponding management systems. Gradually bring the energy conservation work of government departments into the track of legalization. We should use laws to regulate social behaviors, make laws to punish waste behaviors and consequences, enforce laws strictly, stop waste phenomena and enhance the awareness of economy. There is a theoretical basis for making anti waste laws and regulations.

In recent years, the construction of energy-saving legal system has made rapid progress. The law of the people's Republic of China on energy conservation, adopted at the 28th meeting of the Standing Committee of the Eighth National People's Congress, is the highest law on energy conservation in China. The law is divided into six chapters: General principles, energy conservation management, rational use of energy, progress of energy conservation technology, legal responsibilities and supplementary provisions. It is the first law on energy conservation in China. The renewable energy law was deliberated and adopted at the 13th and 14th meetings of the 10th NPC Standing Committee. The law is divided into eight chapters: General principles, resource investigation and development planning, industrial guidance and technical support, promotion and application, price management and cost sharing, economic incentive and supervision measures, legal responsibilities and supplementary provisions. The law clearly regulates the responsibilities and obligations of the relevant government departments and social subjects in the development and utilization of renewable energy, and establishes a series of important systems and measures. Other regulations and policies include the outline of China's energy conservation technology policy, the measures for

the administration of energy conservation, the measures for the administration of China's energy conservation product certification, the measures for the administration of energy efficiency labeling, the medium and long term special plan for energy conservation, etc.

4、 Increase the promotion and application of science and technology

Relying on the progress of science and technology is the basic national policy of our country. The government departments should comprehensively rely on the progress of science and technology to solve the problem of energy waste. The development of modern science and technology makes the role of science and technology in economic and social development more and more significant. Science and technology is the most important means to improve labor productivity. Relying on scientific achievements to improve productivity in quality has become the primary task of economic development, and science and technology has become the driving force of world economic and social development. The competitive strength of a country depends on the speed, scope and effect of using the achievements of scientific and technological progress. Science and technology have been deeply involved in solving the major problems of economic growth, social development, national security and foreign policy.

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CONTENTS

1.1 Analysis of Energy forms in China

Energy resources are one of the important bases for promoting national development.

At present, China is the third largest energy producer in the world but also the second largest energy and oil consumer.

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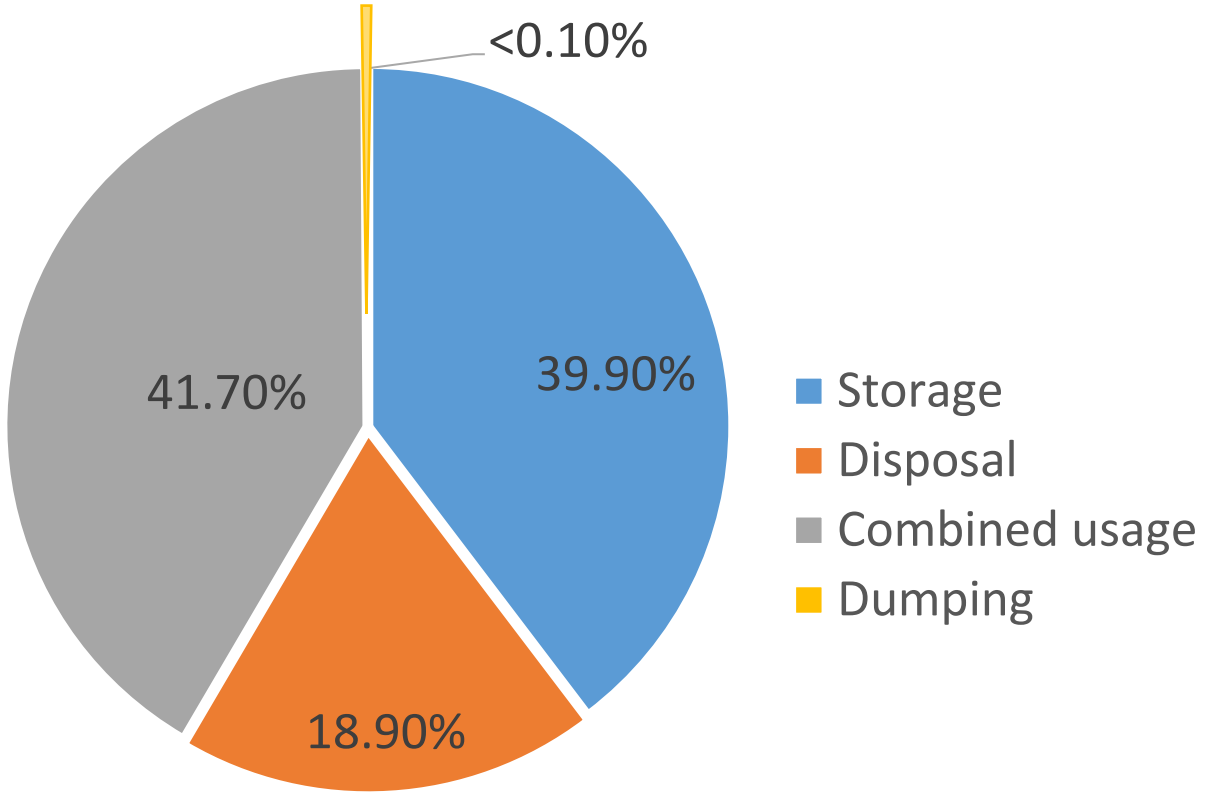
1.1 Analysis of Energy forms in China

Industrial waste

In 2018,200 large and medium-sized cities produced 1.55Gt of general industrial solid waste, comprehensive utilization: 860Mt, treated :390Mt, stored :810Mt and dumped: 46Kt.



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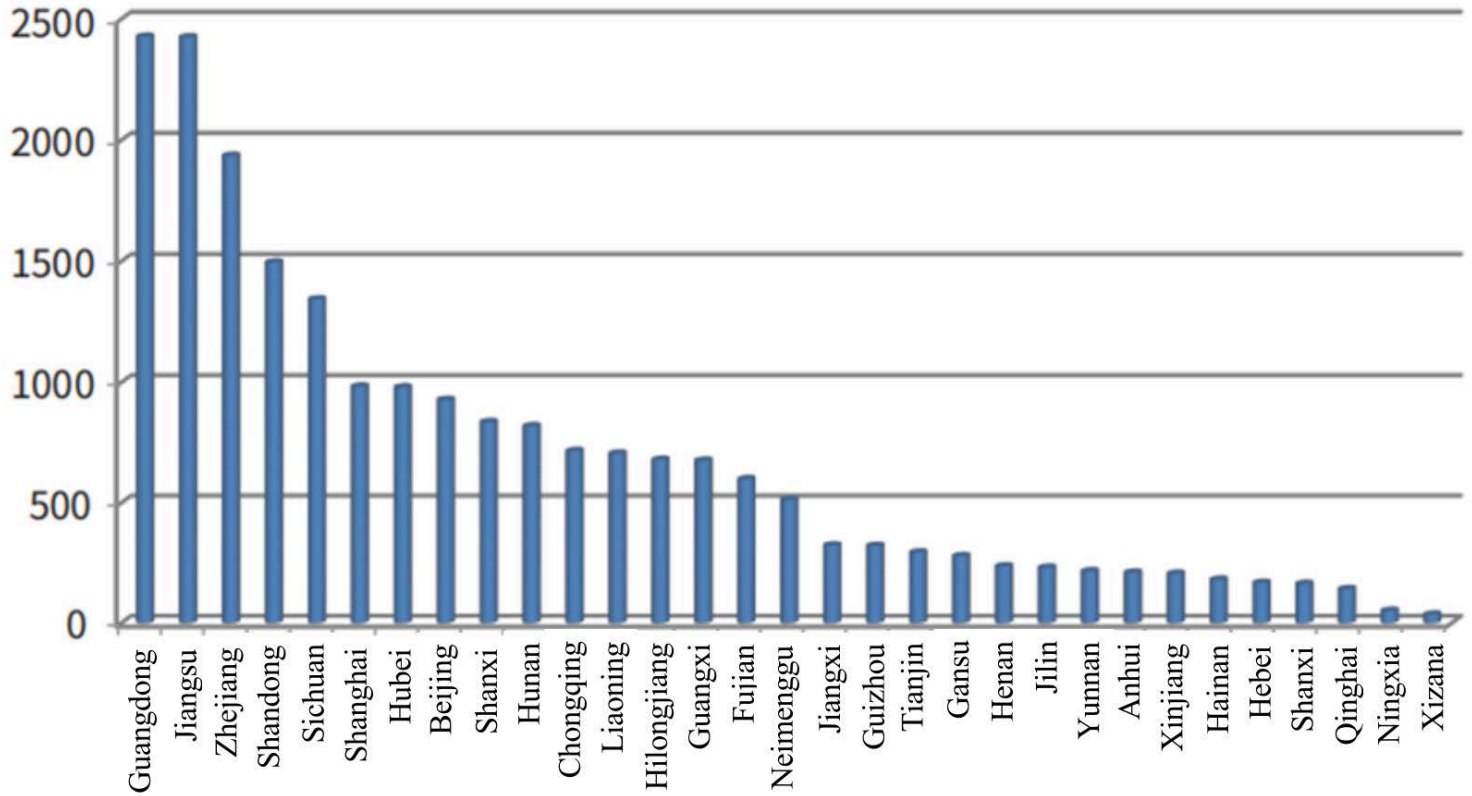
1.1 Analysis of Energy forms in China

Household waste

In 2018, the amount of Household waste generated in 200 large and medium-sized cities was 211Mt, and the disposal amount was 210Mt, with a disposal rate of 99.4%.



1.2 Waste recycling related technologies

Industrial waste

Agricultural waste

Household waste

1.2 Waste recycling related technologies

Industrial waste

At present, various wastes generated by industry are mainly treated in the following ways :

(1)internal digestion between enterprises. For example, coal ash from coking plant and steel slag from steel mill can be used as raw materials or mixed materials for cement production.

(2)The enterprise can turn waste into treasure through process optimization or technical improvement. For example, waste rubber can be used as fuel for preheating raw materials, and waste plastics can be recycled into plastic products.

(3)Conduct deep burial treatment, such as nuclear radioactive waste.

1.2 Waste recycling related technologies

Agricultural waste

- ✓ Energy utilization of agricultural waste:The common ways of energy conversion of agricultural wastes are solidification, liquefaction and gasification, among which biogas is the main energy technology promoted by rural areas in China. Not only does raw material have cost advantages, but also can solve the two major problems of environmental degradation and energy shortage.
- ✓ Feed utilization of agricultural waste:Agricultural wastes contain mineral elements and proteins, which are of high value and suitable to be utilized through feedstuffs. Crop straw and livestock manure can be utilized through feedstuffs.
- ✓ Utilization of agricultural waste by fertilizer:Agricultural waste contains relatively rich nutrient elements, suitable for making organic fertilizer.The use of agricultural waste through fertilizer not only contributes to the increase of soil organic matter, but also contributes to the improvement of crop yields.
- ✓ Utilization of industrial raw materials from agricultural wastes

1.2 Waste recycling related technologies

Household waste

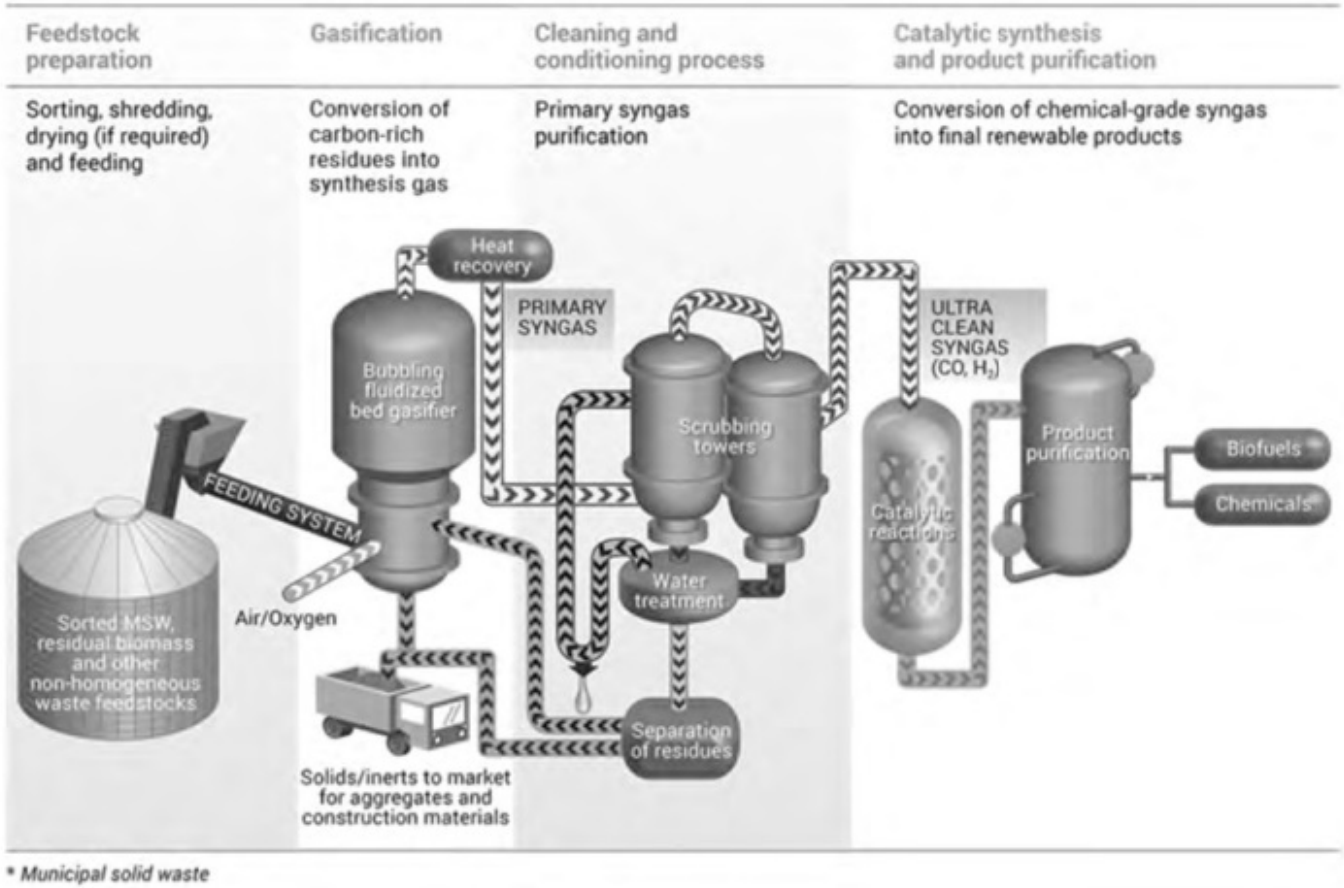
Nowadays, people pay more and more attention to the classification of household garbage, which is of great help to the recycling and harmless treatment of household garbage.Household garbage can be divided into the following categories:

(1)industrial recyclable garbage, such as plastic products, metal products and rubber products.

(2)Biomass wastes, such as melon rind and fruit rind, leftover soup, etc., are currently mainly treated by biological fermentation or fertilizer.

(3)Excreta and garbage.

1.2 Waste recycling related technologies



Process flow chart of waste biomass gasification and catalytic conversion to biofuel

2.1 Policy

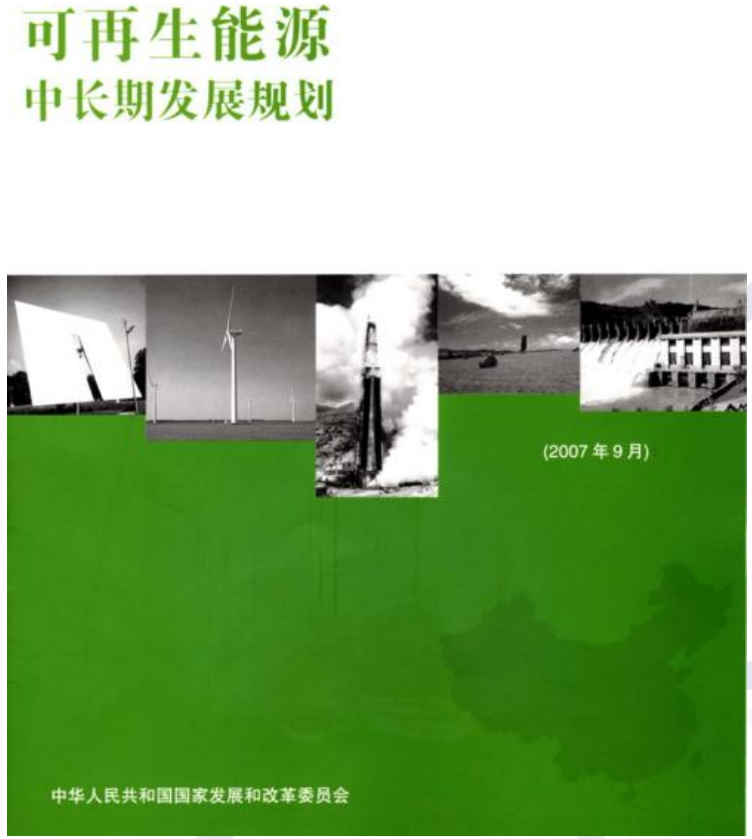
According to the provisions of “the law of the people's Republic of China on the prevention and control of environmental pollution by solid waste“:

- The State implements the principles of reducing the generation of solid waste, making full and rational use of solid waste .
- The State encourages and supports the development of cleaner and the reduction of solid waste; the State encourages and supports the comprehensive utilization of resources， the full recovery and rational utilization of solid waste.

2.1 Policy

According the "renewable energy medium and long term development plan" :

- From January 1, 2001, for the waste power generation belonging to biomass energy, the value-added tax is levied and refunded immediately.
- In combination with the process of new urbanization, we will focus on the prefecture level cities and some counties with resource conditions, and steadily develop urban domestic waste incineration power generation. By 2020, urban domestic waste incineration power generation will reach 7.5GW, and biogas power generation will reach 500MW.



2.1 Policy

According to the announcement of national key projects of "solid waste recycling" in 2019:

- In 2019, 45 research directions are planned to be deployed for the key project of "solid waste recycling", with a budget of 1G yuan allocated by the state;
- At the same time, 10 research directions are planned to be deployed for the targeted project of "solid waste recycling" in 2019, with a budget of no more than 300M yuan allocated by the state and a project implementation period of 3-4 years.
- According to the actual project establishment, there are 47 projects in the public list, including directional projects, and the total fund is expected to exceed 1G yuan. 23 projects are led by universities, accounting for about half of the total

2.2 Advantages

- policies and measures on the rational use of energy, energy conservation and emission reduction, and promoting the development of new energy have become more and more perfect.
- The energy conservation and emission reduction tax policies of China are more comprehensive. And the policies have played a positive role in promoting energy and resource conservation and environmental protection.

2.2 Disadvantages

- The industry managements are relatively comprehensive. And they are not independent.
- The related management responsibilities involve multiple departments.
- The supervision function of energy economy is weakened.

2.2 Disadvantages

- The policies have lots of deficiencies, which include:

  - There is a certain gap between the scope and strength of support and the requirements of relevant laws and regulations , and there is a lack of necessary tax support policies for the development and promotion of renewable energy.
  - Due to the lack of overall understanding of the development of this work, some policies have not been adjusted in time, some new policies have not yet been implemented.
  - At the same time, in the current tax system, the tax preferential measures taken to implement the idea of circular economy are relatively single.

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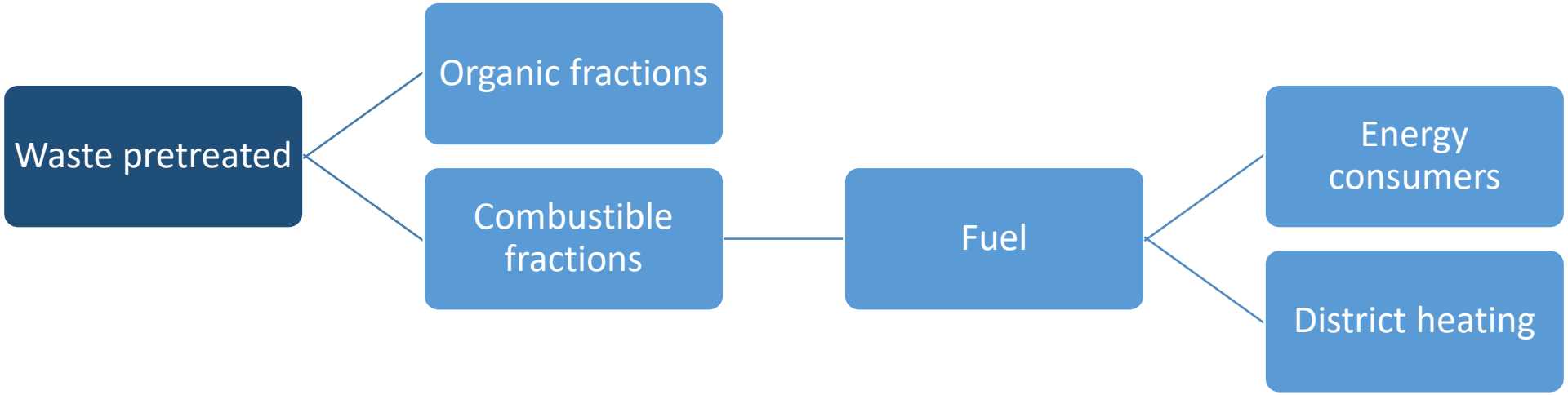
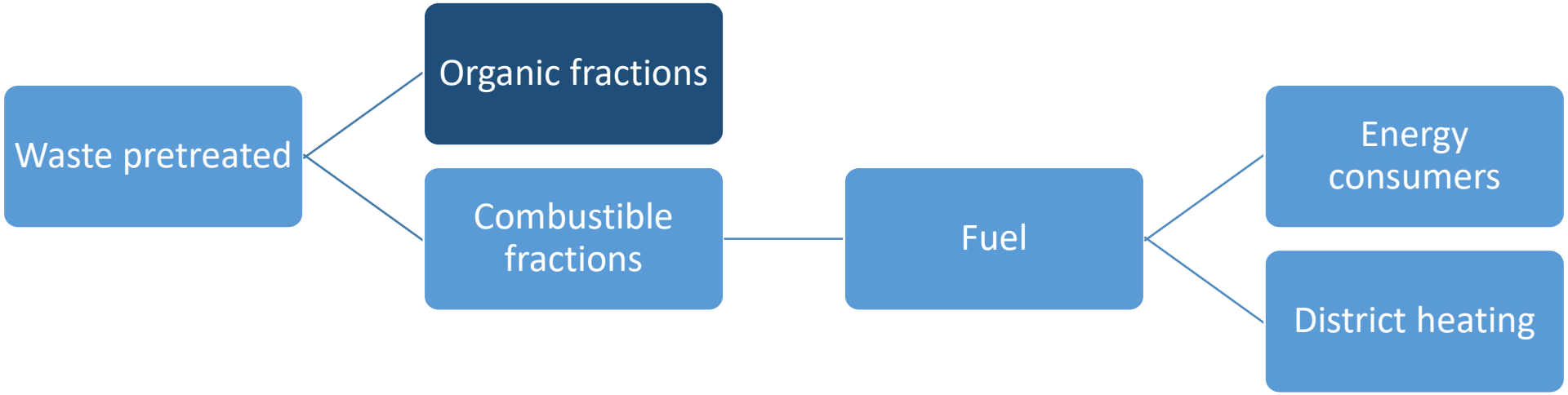
3 A proposed scenario for better waste management and reduction



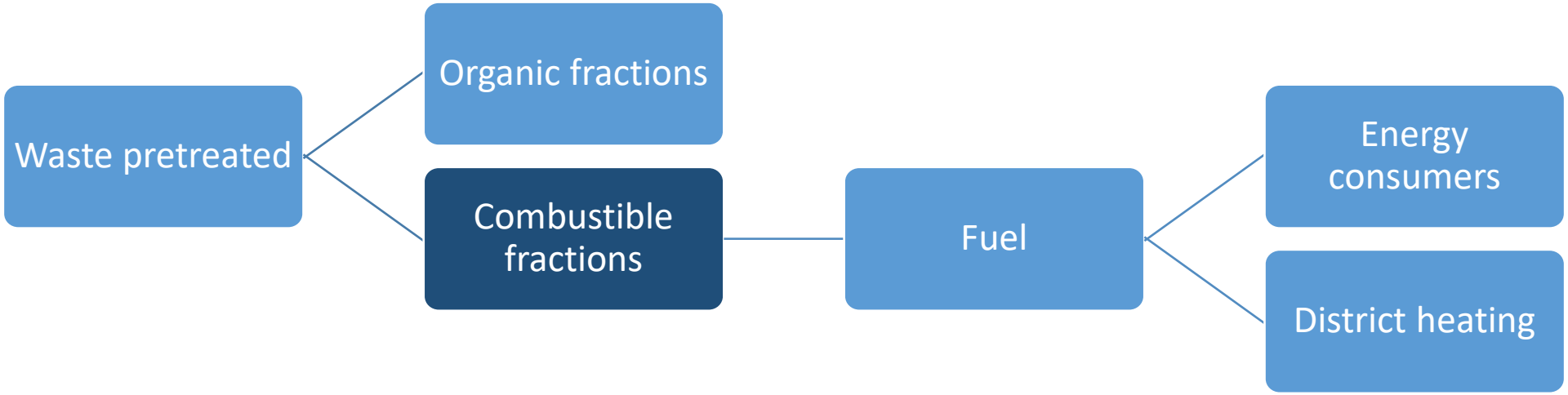
- Waste pretreated：Waste normally destined for landfills or older environmentally unfriendly incineration plants can be pretreated to remove recyclable materials such as paper, plastic, glass, cardboard, newsprint, ferrous metal, aluminum and other salable products.

3 A proposed scenario for better waste management and reduction



- Organic fractions can be separated and either partially dehumidified for combustion or converted to fertilizer or other products.

3 A proposed scenario for better waste management and reduction



- The combustible fraction which can include the plastic, paper and other combustibles mentioned above, combined with wood, textiles, tires and other non-recyclables comprise valuable constituents for the production of fuel which is better suited to clean combustion and highly efficient steam and electrical energy production.

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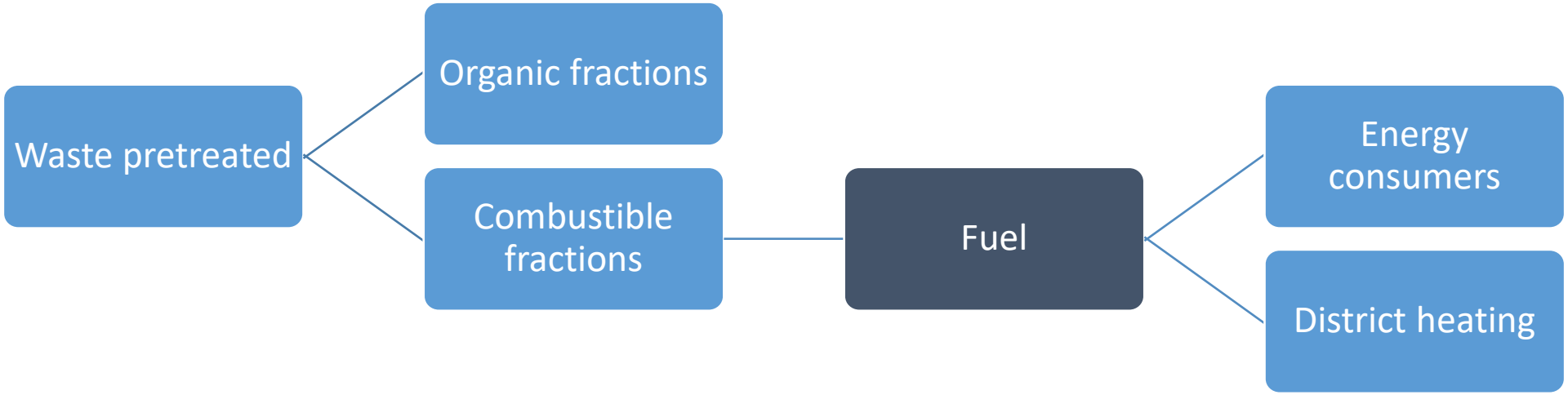
3 A proposed scenario for better waste management and reduction



- Energy may be derived from waste streams generally in the form of a processed or derived fuel which can then be used in various processes to produce steam and therefore, electricity, or chilled water.

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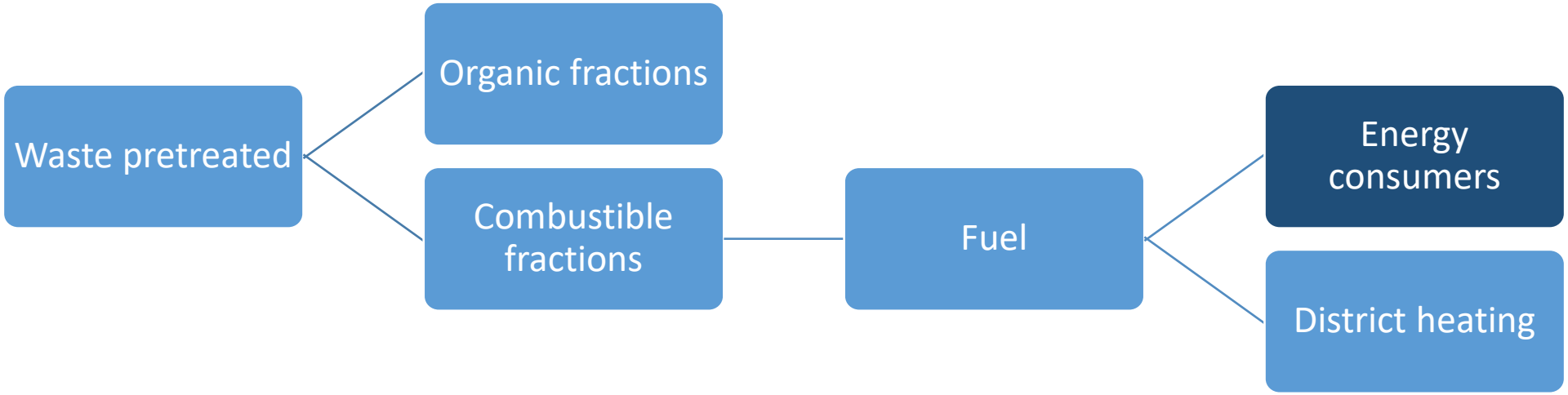
3 A proposed scenario for better waste management and reduction



- These products may be sold directly to energy consumers who need fuel to produce their own steam, or in the case of those wishing to produce steam and then utilizing a turbine-generator producing electricity may satisfy their own base electrical demand and introduce the excess directly onto the electrical grid.

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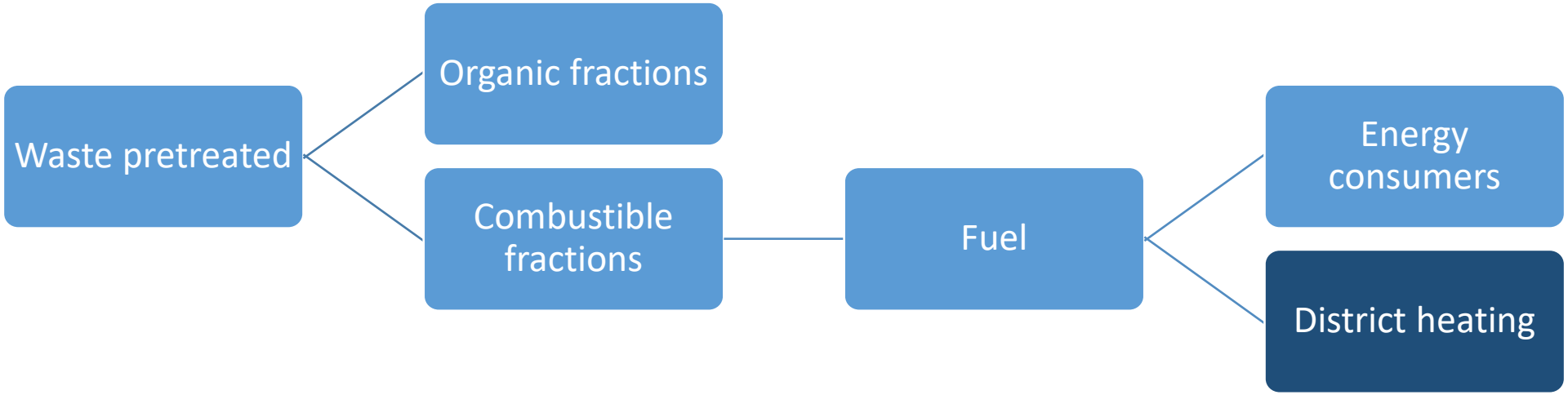
3 A proposed scenario for better waste management and reduction



- Steam and chilled water have also historically been used for district heating in large and small cities, universities and smaller communities. Waste converted into energy as described above is an effective energy solution to nearby energy consumers in a cogeneration application.

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Thanks for your watching!

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