Development of China’s Clean Coal Technology

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National Energy Administration (NEA), P.R. , China

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I . Policy Orientation and Major Measures

1. Coal is China’s basic energy and important raw material

In 2016, China’s coal consumption accounted for 62% of total primary energy consumption, and in 2017 is 60.4%. Coal plays an important role in safeguarding China’s energy security.

A chart of primary energy consumption in China and the world in 2016
Source: BP statistical review of world energy 2017
2. Characteristics of coal consumption structure

As China continues to promote energy revolution, control coal consumption, optimize energy structure and increase the proportion of clean and low carbon energy, coal utilization will mainly be towards high-efficiency and clean coal power generation and deep processing of coal.

Changes in coal consumption structure in China (%)
3. Main ways of clean utilization of coal

<table>
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<th>Method</th>
<th>Outcome</th>
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<td>Coal cleaning</td>
<td>Improving coal quality for end users</td>
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<td>Efficient and clean coal-fired power generation</td>
<td>Ultra-low emissions and near-zero emissions technologies</td>
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<td>Deep coal processing</td>
<td>Producing energy products and chemicals</td>
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I. Policy Orientation and Major Measures

3. Main ways of clean coal technologies

- Coal quality-based utilization
  - Increasing additional value of terminal products

- Coal-fired boiler upgrading
  - Improving the control level of pollutants

- Improving cleanliness of household use of coal
  - Managing environmental problems from scattered coal users
## I. Policy Orientation and Major Measures

### Recent Governmental Policies on Clean Coal Technologies

<table>
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<th>Issue Time</th>
<th>Policies</th>
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<tbody>
<tr>
<td>Feb. 2017</td>
<td>“The 13th Five-Year&quot; plan of deep coal processing demonstration</td>
</tr>
<tr>
<td>Dec. 2016</td>
<td>“The 13th Five-Year&quot; plan of energy development</td>
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<td>Dec. 2016</td>
<td>“The 13th Five-Year&quot; plan of coal industry development</td>
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<tr>
<td>Dec. 2016</td>
<td>“The 13th Five-Year&quot; plan of electric power development</td>
</tr>
<tr>
<td>May. 2015</td>
<td>Action plan of high-efficiency and clean coal utilization during the period from 2015 to 2020</td>
</tr>
<tr>
<td>Feb. 2015</td>
<td>Action plan of high-efficiency and clean coal utilization in industrial areas</td>
</tr>
<tr>
<td>Oct. 2014</td>
<td>Implementation Plan on Energy Saving and Environmental Protection for Coal-fired boilers</td>
</tr>
<tr>
<td>Sep. 2014</td>
<td>Interim Measures for the Administration of Commercial Coal Quality</td>
</tr>
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</table>
1. Improving coal quality for end users

Quality standards for coal quality guide the coal suppliers to elevate the levels of coal washing, which lays a solid foundation for the clean utilization of coal.

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Lignite</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ash (A_d)</td>
<td>≤30%</td>
<td>≤40%</td>
</tr>
<tr>
<td>Sulfur points (S_{t,d})</td>
<td>≤1.5%</td>
<td>≤3%</td>
</tr>
<tr>
<td>Mercury (Hg_{d})</td>
<td>≤0.6μg/g</td>
<td></td>
</tr>
<tr>
<td>Arsenic (As_{d})</td>
<td>≤80μg/g</td>
<td></td>
</tr>
<tr>
<td>Phosphorus (P_{d})</td>
<td>≤0.15%</td>
<td></td>
</tr>
<tr>
<td>Chlorine (Cl_{d})</td>
<td>≤0.3%</td>
<td></td>
</tr>
<tr>
<td>Fluorine (F_{d})</td>
<td>≤200μg/g</td>
<td></td>
</tr>
</tbody>
</table>

Source: Interim Measures for the Administration of Commercial Coal Quality
2. Implementation of ultra-low emissions and energy-saving renovation of coal-fired power plants

- Adopt advanced and efficient desulfurization, denitrification, and dedusting technologies to fully implement ultra-low emission and energy-saving renovation of coal-fired power plants.

- By 2020, the average coal consumption for coal-fired power units will be controlled at 310 grams per kilowatt-hour, of which the new ones will be controlled below 300 grams, and the concentrations of sulfur dioxide, nitrogen oxides, and particulates will not be higher than 35 milligrams, 50 milligrams, and 10 cubic meters, respectively.
I. Policy Orientation and Major Measures

3. Promoting the demonstration in deep coal processing industry

- Upgrading traditional coal chemical industry, eliminating backward production capacities in coal coking, coal-based ammonia synthesis, calcium carbide and other fields.

- Demonstrating the projects of coal-to-liquids, coal-to-natural gas, coal-to-chemicals, co-processing of coal and petroleum.

- By 2020, the coal-to-liquid production capacity will reach 13 million tons and coal-to-natural gas production capacity will reach 17 billion cubic meters.
4. Vigorously promoting coal quality-based utilization

- Conducting R&D on clean and efficient low-rank coal pyrolysis technologies, carry out demonstration of million-ton level industrialization.

- Conducting research on new generation of technologies such as rapid pyrolysis, catalytic (activated) pyrolysis, pressure pyrolysis and hydro pyrolysis.

- Strengthening research on integration of pyrolysis, gasification and combustion to develop pyrolysis-gasification integration and pyrolysis-combustion integration technologies.
5. Improving cleanness of scattered coal use

- Actively disseminating high-quality anthracite coal, coal briquette, semi-coke and other clean coal, building cleaner coal distribution centers in the scattered coal use areas and improving the clean coal supply network.

- Perfecting the standards for energy efficiency of civil stoves.

- Completely renovating coal-fired industrial boilers that are not equipped with pollution treatment facilities or that cannot meet emission standards, and popularizing efficient ones.

- Promoting the advanced and applicable technologies recovering waste heat, residual energy from industrial boiler.
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1. Coal cleaning

- Washing rate of raw coal reached 68.9% in 2016.

- High-efficiency heavy-medium coal preparation technology has developed rapidly due to its strong adaptability to coal quality and high separation efficiency, and its proportion in coal preparation technology has risen to more than 50%.

- Large-scale coal preparation plants realize high-level automatic control and flexibility, with capacity of more than 10 million tons per year.
Ⅱ. Fruitful results

1. Coal washing and processing

Dense medium cyclone (DMC)
2. Efficient and clean coal-fired power generation

- In 2017, the average coal consumption of coal-fired power units reached 309 gce/kWh.

- The power generation efficiency of the million-kilowatt level of ultra-supercritical and secondary reheating coal-fired generation units has reached 47.92% with coal consumption reached 256.2 g/kWh.

- By the end of 2017, 640 million kilowatts of China's coal-fired power plants realized ultra-low emission upgrading.
II. Fruitful results

2. Efficient and clean coal-fired power generation

Survey on ultra-low emission upgrading
3. Deep processing of coal

- China's deep processing of coal can achieve near-zero discharge of waste water, ultra low emissions of particulates, sulfur dioxide, and nitrogen and nitrogen oxides and high concentration of carbon dioxide emissions can be easily captured and used.
- China has built a direct liquefaction and 6 indirect liquefaction projects with a total capacity of 7.86 million tons.
- Four coal-to-natural gas projects have been put into operation, with a total capacity of 51 billion m$^3$ per year.
3. Deep processing of coal

coal-to-liquids plant with capacity of 4 million tons per year
Ⅱ. Fruitful results

4. Coal-fired boiler upgrading

- China's self-developed high-efficiency pulverized coal industrial boilers have outstanding energy-saving effect, high thermal efficiency, low emissions, and high degree of automatic control.

- The burnout rate of high-efficiency pulverized coal-fired industrial boilers reaches 98%, close to the level of natural gas boilers. The emissions of boilers are equivalent to those firing natural gas.
Ⅱ. Fruitful results

4. Coal-fired boiler upgrading

Flow chart of high efficiency pulverized coal industrial boilers
Ⅱ. Fruitful results

5. Improving cleanliness of household coal use

- Traditional coal-fired stoves can be replaced by advanced coal-fired stoves with equivalent emission level to that using natural gas.
- Each household can save 1 ton of coal per year and reduce pollutants by more than 90%.

Production & Distribution Center of cleaner coal  
Advanced stove
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Ⅲ. Suggestions on cooperation

1. Cooperative research on relevant standards

Study new standards & certification systems for advanced technologies, equipment, products, testing and services among us based on environmental requirements and existing certification criterions for technologies and equipment in China and ASEAN, in order to promote project cooperation and technology and equipment introduction.

Promoting mutual acceptance of related standards and indicators between countries, to realize clean and low-carbon and sustainable development of coal industry and achieve win-win benefits of both countries.
Ⅲ. Suggestions on cooperation

2. Joint promotion of advanced technologies

China's technology and equipment in efficient coal cleaning, ultra-low emissions, deep processing have been widely used and proved good technical.

Coal quality-based utilization technology has been initially verified.

Bilateral technical extension and application for China's advanced technology and equipment to improve the environment in other countries.
Ⅲ. Suggestions on cooperation

3. Investment Cooperation

We are willing to jointly carry out early-stage study on projects in which we all have interests, strengthen investment cooperation and promote project construction in accordance with the principle of mutual benefits and win-win results.
Thank you for your attention!