Implementation Status and Suggestions of “Coal-to-gas” Policy in Beijing-Tianjin-Hebei Region of China

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Abstract. With the acceleration of industrialization for the past few years, the level of air pollution has also increased significantly. The Beijing-Tianjin-Hebei region is one of the regions that need to be improved urgently. The air pollutants produced by coal burning are the main source of pollution in this region, so it is of great practical necessity for the Beijing-Tianjin-Hebei region to replace coal burning with clean energy. At present, the status of the "coal-to-gas" policy of the Beijing-Tianjin-Hebei region has achieved remarkable results. With the strong support of the government, air pollution has been effectively improved. However, there are still many problems such as "one-size-fits-all" policy, imperfect financial subsidy mechanism, tight gas source, differentiated scope of policy implementation, and hidden dangers of rural equipment safety. For these reasons, the government should formulate differentiated policies according to local conditions, implement "coal-to-gas" and "coal-to-electricity" synchronously, improve the subsidy mechanism, strengthen technical and equipment support, enhance gas supply security, stabilize gas price and strengthen publicity and training.

Keywords: "coal-to-gas" policy, Beijing-Tianjin-Hebei region, air pollution control.

1. Introduction

With China's rapid economic growth, extensive economy mode has brought serious environmental pollution problems. As the 2018 Bulletin on the State of China's Ecological Environment mentioned, 217 of China's 338 cities at the prefecture level and above exceeded air quality standards in 2018. In addition, studies have shown that less than 1 percent of China's major cities meet the World Health Organization's recommended standards of air quality. At the same time, air pollution affects the physical fitness of residents, reduces the happiness of residents, and increases the actual economic inequality [1].

China has implemented differentiated heating policies for cities on the north and south sides of the Qinling-Huaihe River, with central heating for cities north of the Qinling-Huaihe River, and decentralized household heating for cities south of the Qinling-Huaihe River. In recent years, there are many enterprises in Hebei with high energy consumption and high pollution, especially in the steel, cement, power plant industries, etc., which consume a large amount of coal in the production process. In the process of coal consumption, carbon monoxide, carbon dioxide, sulfide and fine particles will be produced, and the pollution caused by geographical environment and climatic conditions [1]. Due to its special geographical location, the wind blowing from the southeast and south is easily blocked by mountains, which weakens the flow of air and makes it easier for pollutants to gather. Under suitable conditions, various pollutants undergo complex chemical reactions. Smog will form [2]. Second, after entering the winter, the demand for coal in the northern area increases, so industrialization and winter coal-fired heating will inevitably pollute the quality of China's air environment, and the northern region is particularly affected. A large number of atmospheric pollutants such as nitrogen oxides, sulfur dioxide, inhalable particulate matter and smoke produced in all aspects of coal mining, production and processing are the main sources of pollution in the Beijing-Tianjin-Hebei region. Therefore, the atmospheric environment of China's Beijing-Tianjin-Hebei region has been seriously damaged.

In May 2013, Beijing and Tianjin entered the ranks of China's top ten cities for the first time in terms of air pollution. In the first 11 months of 2013, Shijiazhuang had the worst air quality for 5 months. Xingtai and Tangshan each had 2 months to rank the worst cities. In order to speed up the improvement of the ecological condition, especially air quality, the state will take the 3 regions and areas around as the key areas to promote the "coal-to-gas" project. In 2013, various departments issued the Implementation Rules for the Implementation of the Action Plan on Air Pollution Prevention and Control in the Beijing-Tianjin-Hebei Region and its surrounding Areas. The Ministry of Environmental Protection and local governments in the Beijing-Tianjin-Hebei region jointly issued the 2017 Air Pollution Prevention and Control Work Plan for the Beijing-Tianjin-Hebei Region and areas nearby on February 17, 2017. The policy calls for replacing polluting and inefficient coal with clean energy [2]. For the analysis of the air pollution control effect of the "coal-to-gas" policy, switching from coal to natural gas effectively reduces the emissions of air pollutants, and also saves coal consumption. Compared with 2013, the average annual reductions of PM2.5, PM10, SO2 and NO2 in 2020 were approximately 40%, 46%, 20% and 7%.

This paper mainly analyzes the current situation and suggestions of the "coal-to-gas" policy, and adopts the research method of literature analysis. Compared with the existing literature, this paper will analyze the policy from the problems including the implementation status in the Beijing-Tianjin-Hebei region and suggestions on policy optimization of "coal-to-gas" in Beijing-Tianjin-Hebei region.

2. Implementation Status of the Policy

2.1. Policy Implementation and Financial Subsidy Mechanism

At present, the effect of "coal-to-gas" policy in this region is obvious, and the system is perfect. Various state departments have issued a series of normative documents to jointly guide the implementation of the "coal-to-gas" policy. Since The State Council put forward the "Ten Atmospheric policies" to combat air pollution in 2013, air pollution during the heating season in northern cities has been significantly reduced [3]. In 2016, the 14th meeting of the Central Financial and Economic Leading Group officially opened the prelude to "coal-to-gas". The Beijing-Tianjin-Hebei region has become the leading area of "coal-to-gas" transformation. The Ecological and Environmental Protection Plan for the Coordinated Development of the Beijing-Tianjin-Hebei Region, the Action Plan for Coordinated Energy Development of the Beijing-Tianjin-Hebei Region (2017-2020), and the Action Plan for the Comprehensive Control of Air Pollution in the Autumn and Winter of 2019-2020 in the Beijing-Tianjin-Hebei Region and its surrounding Areas have been gradually introduced [4]. Beijing, Tianjin and Hebei jointly formulated the 2017 Air Pollution Prevention and Control Work Plan for the Beijing-Tianjin-Hebei Region and its surrounding Areas, proposing the implementation of the "coal-to-gas" project in the "2+26" cities of the Beijing-Tianjin-Hebei region transmission channel, proposing to improve regional air quality as the core, reduce heavy pollution weather as the focus, and take a number of measures to strengthen the prevention and control of air pollution in winter.

Beijing had achieved gas central heating in six urban areas by the end of 2015, but about 15 percent of residents in rural areas still use coal for heating. Only six districts in the city have completed gas heating. In addition to Shijiazhuang, Baoding and other cities in Hebei, the rest of the rural areas still use coal heating [5]. By the end of 2019, a total of 10.0738 million households in the Beijing-Tianjin-Hebei region had been renovated for clean heating, exceeding the policy target.

The central government allocated huge subsidies to support the transformation of coal into gas projects. According to the Notice on carrying out the Pilot Work of Central Financial Support for Clean Heating in Winter in North China in May 2017, Beijing and Tianjin, as municipalities directly under the Central Government, can receive a subsidy of 1 billion yuan per year, and Shijiazhuang, as the provincial capital, can receive a financial subsidy of 700 million yuan per year. Other prefecture-level cities can get a subsidy of 500 million yuan per year. For rural low-income areas, the government

subsidizes the gas consumption links such as the purchase price of equipment, and the cost of residents is basically zero [6].

Since 2018, the government has continuously introduced relevant policies, focusing on the development of natural gas storage technology, pipeline construction, price reform, cost monitoring and monopoly compliance [7]. The air pollution in the Beijing-Tianjin-Hebei region has been effectively improved, as well as the quality of life of residents.

2.2. Environmental Governance Effectiveness

After the implementation of the policy, the proportion of days with good air quality in Beijing-Tianjin-Hebei heating season has increased to a large extent. The proportion of days with good air quality in the 2019/2020 heating season was nearly double that in 2013/2014. By comparing the air quality index and main pollutant index from January 2013 to March 2020, the air quality comprehensive index in the region has significantly decreased since 2017 [6]. The implementation of the "coal-to-gas" policy also has a significant effect on reducing the content of industrial smoke and dust in the air. At the same time, the use of clean energy has been promoted, upgrading of the energy structure.

3. Analysis on Issues of "Coal-to-gas" in Beijing-Tianjin-Hebei Region

3.1. "One-Size-Fits-All" Problem

At the beginning of the policy, the implementation has a certain degree of impatience and a rush to success, due to the consideration of political performance assessment. Some regions do not fully consider the local actual situation, such as economic capacity, climate conditions, energy structure, etc., but adopt a one-size-fits-all approach, forcing all rural areas to carry out the coal-to-gas transformation. In some rural areas with relatively poor economic conditions, due to imperfect infrastructure, shortage of funds and other reasons, it is difficult to fully realize the transformation from "coal-to-gas", which has brought economic pressure to local residents. In the short term, large-scale "coal-to-gas" has shown some drawbacks, leading to the urgent "suspension" of the policy by the Ministry of Environmental Protection in 2017 [6].

3.2. Imperfect Financial Subsidy Mechanism

Transformation is closely related to subsidies. How much central financial subsidies and whether local finances are strong directly restrict the development scale of clean heating method. At present, the "coal-to-gas" results are achieved at the cost of high subsidies. In the initial stage it does make up for the high investment in infrastructure construction. However, in the long run, the subsidy mechanism is prone to inefficient and ineffective, and is not a long-term solution [6]. The Beijing-Tianjin-Hebei region has benefited from high subsidies and is expected to achieve 100% completion of the transformation, but other less developed regions need to be considered how to implement the policy sustainably. In some areas, the subsidies for "coal-to-gas" are not strong enough, and the scope is limited, resulting in farmers having to bear higher economic burden. The high regulatory cost of implementing energy subsidy policies is also an important factor. The high cost of supervision makes it difficult for regulators to truly achieve fair and reasonable supervision process, which is always limited by some internal and external factors. In addition, the problem that subsidies are not timely and opaque has also affected the promotion effect of "coal-to-gas".

3.3. Shortage of Gas Supply and High Cost

The ability of natural gas source security is the short board of the smooth implementation of the "coal-to-gas" policy. China is the largest importer of natural gas. The gas resources are controlled by foreign countries. In addition, the demand of clean energy in China is uneven in seasons. At present, the construction of gas storage and peak regulation facilities is seriously lagging behind, which also

causes the shortage of natural gas supply in the heating season, resulting in frequent gas shortages [5]. In 2017, the Hebei Provincial Development and Reform Commission issued an urgent notice on the full implementation of the work related to the heating season natural gas supply, and the province's natural gas supply entered the second-level warning state, which broke the normal operation of the public. The source of the gap in natural gas supply has become the main challenge facing the the "coal-to-gas" policy's execution, and is an important issue to be considered.

In addition, gas prices are remaining the main limiting factor. The cost of "coal-to-gas" is about 4 to 5 times that of bulk coal, and due to cost considerations, residents in some areas have resisted the "coal-to-gas" policy. Although the policy has achieved some results, the transformation of heating costs is still high. Some areas have been facing the "return of coal" situation. There are also some self-employed households found it difficult to afford and manage due to high costs.

3.4. Different Scope of Policy Implementation

In terms of the improvement of various pollutant indicators, Beijing is obviously better than the whole Beijing-Tianjin-Hebei region, indicating that the implementation effect of "coal-to-gas" policy is not balanced. Compared with prefecture-level cities, the "coal-to-gas" policy has a stronger air pollution reduction effect on provincial cities, and the air pollution reduction effect on "high-subsidy" cities is stronger than that on "medium and low-subsidy" cities [1]. The "no-coal zone" policy will indeed reduce PM2.5 concentrations, but most areas are limited by economic and scientific resources, and still cannot meet national standards and World Health Organization standards [8]. The difference of regional development degree will differentiate the effect of policy implementation to some extent. Beijing, Tianjin, Hebei, and the neighboring areas have a predominantly heavy industrial structure. Except for Beijing, which is dominated by the tertiary industry such as finance and service industry, Tianjin, Hebei, Henan, Shandong and Shanxi all take traditional industrial industries as economic pillars, such as steel, cement and other energy-intensive manufacturing industries [9]. After gas reform, coal still exists, which has a big gap with the original intention of the policy design [10]. Therefore, it is important to assess whether the policy effect can be maintained when extending the scope of policy implementation.

For the enforcement of the "coal-to-gas" policy mainly adopts the central heating of coal-fired boilers in cities, and mainly reflects the installation of gas heating equipment in rural areas, there are differences in the intensity of subsidies in policy practice.

3.5. Security Risks of Rural Equipment

China's clean heating technology research started late, and in the past, it was mainly implemented on a large scale in cities, and the clean heating technology and model in rural areas are still immature, and the standardization of gas laying and facilities is facing difficulties and security risks. Pipeline and other infrastructure construction is still incomplete, and most towns lack pipeline gas. The overall functional layout of most villages has not been systematically planned, and the functional zoning, fire prevention and energy saving effects of houses are not ideal. At present, the quality of the equipment on the market is poor but there are not many maintenance personnel, resulting in the equipment failure. The villagers cannot find someone to repair, so they give up using it.

In addition, the lack of popularization of clean energy equipment and low safety awareness and understanding among villagers seriously restrict the sustainable development of the "coal-to-gas" policy.

4. Suggestions on Policy Optimization of "Coal-to-gas" in Beijing-Tianjin-Hebei Region

4.1. Formulate Differentiated Policies According to Local Conditions

In the process of making the "coal-to-gas" policy, the performer should fully consider the local actual situation and individual differences, and formulate policies and measures that meet the local reality.

The Beijing-Tianjin-Hebei region should ensure that policies are carried out steadily and orderly under the guidance of the government, strictly review and approval procedures, abandon the "one-size-fits-all" implementation idea, and adopt an appropriate approach. The government should promote the policy of "no-coal areas" and give priority to ensuring the heating of the masses during the heating season [8].

The government should also strengthen inter-departmental coordination, clarify responsibilities, and avoid power blind spots and gaps [5]. For areas with poor economic conditions and imperfect infrastructure, the government can adopt a gradual and phased approach.

The efforts implemented in Beijing, Tianjin and Hebei need to formulate differentiated policy goals according to the affordability of local development. Beijing and Tianjin have less coal consumption, so they can increase the "coal reform" efforts, or even try to completely ban coal. Hebei region should maintain a relatively moderate "coal reform" efforts cause high-consumption coal industry still occupies a certain proportion. In addition, for the sake of the particularity of Beijing, priority should be given to ensuring the transformation [4].

4.2. Conduct "Coal-to-electricity"and "Coal-to-gas" Simultaneously

Considering that in the future, the Beijing-Tianjin-Hebei region may have insufficient natural gas production capacity due to the reason of resource allocation, so that imports must be increased, in this case, the economy of "coal-to-gas" will be greatly reduced. Meanwhile, domestic natural gas production cannot fill the gap in natural gas demand in the Beijing-Tianjin-Hebei region. It will also lead to energy security problems to a certain extent. However, domestic electricity has sufficient production capacity. To sum up, the "coal-to-electricity" and "coal-to-gas" need to be carried out simultaneously, under the principle of "suitable electricity for electricity" and "suitable gas for gas", which should be reasonably controlled.

4.3. Improve the Subsidy Mechanism

The government can increase the intensity of subsidies for "coal-to-gas", expanding the scope of subsidies to ensure that farmers can afford the economic burden. The related department should establish a transparent and fair subsidy payment mechanism, to ensure that subsidy funds can be timely [1].

4.4. Strengthen Technical and Device Support

Clean energy has unique value, which not only promotes energy conservation and emission reduction at the ecological level, but also brings sustainable economic benefits to the society [11]. Local governments should implement the construction of pipe networks and the renovation of heating and combustion equipment, establish a whole-process supervision and after-sales service guarantee system for "coal-to-gas" construction in rural areas and equip specialized personnel in villages for safety inspections and maintenance. Relevant departments should actively improve the natural gas production technology and increase the exploration of unconventional natural gas.

4.5. Increase Gas Supply Support and Stabilize Gas Price

The Beijing-Tianjin-Hebei region should steadily increase its natural gas generation capacity and strengthen the construction of transmission grids and natural gas transmission pipelines in the region. For the natural gas imports, except for continuously consolidating trade relations with existing natural

gas importing countries such as Qatar, Russia and Australia, China should also actively seek international cooperation with major natural gas supplier, the Middle East for instance, and signs long-term stable supply contracts.

Environmental protection departments should strive to enhance the capacity of clean energy storage and peaking, strengthen the construction of emergency gas storage facilities, and ensure peak gas supply through underground stations of gas storage.

For the gas prices, the government should adopt a combination of peak load pricing and ladder pricing and reasonably divide standards, levying certain taxes on high gas consumption. It is also necessary to establish a dynamic mechanism for the cost of imported natural when the international gas price is high. Increasing taxes when the international gas price is low, and balance the market price.

4.6. Strengthen Publicity and Training

In the process of promoting the policy, relevant departments should implement publicity and training work to improve farmers' awareness and understanding of "coal-to-gas". This can help farmers better grasp the technology and equipment, improve the "coal-to-gas" effect. In addition, the publicity department should enhance people's confidence in the policy and make the policy universal to people's livelihood [12].

5. Conclusion

Currently, the enforcement effect of "coal-to-gas" policy in the Beijing, Tianjin and Hebei is obvious. A series of documents issued by various departments of the state have promoted the status of the "coal-to-gas" policy and the prevention and control of ecological pollution has made effective progress, and the number of households in the Beijing-Tianjin-Hebei region completed the clean heating transform is greater than expected, and has been supported by the central financial subsidies during the construction of the project. After the implementation of the policy, the number of days with high quality of air in the heating season in Beijing, Tianjin and Hebei has increased significantly and the content of pollutants has decreased significantly.

There are also some problems in the implementation of the "coal-to-gas" policy. When the policy was implemented, the executors were eager to use a "one-size-fits-all" approach, which led to the policy being urgently halted. In the process of transformation, a large number of subsidies are needed to promote the promotion of the policy, or farmers in the poor areas need to afford the economic burden. Moreover, the excessive costs make it difficult for the regulatory process to be fair. China's high reliance on the natural gas imports and the excessive price have caused the shortage gas. And the enforcement of the policy has differentiated scope. There are also safety risks due to the backwardness of facilities.

To solve these problems, the following suggestions are put forward: Carry out policies due to local economic conditions, and abandon irritable targets. The joint implementation of "coal-to-gas" and "electricity" is also a solution. In addition, the author should increase the intensity of subsidies and establish a fair mechanism. Moreover, the upgrading of heating equipment is also very important. In terms of the demand, the source of natural gas is achieved by expanding imports and stabilizing prices.

This paper analyzes the implementation status of the energy policy and puts forward the policy problems and analyzes them, which is helpful for the government to improve and develop the "coal-to-gas" policy. However, there are some objective limitations in this paper, such as the consideration of the government's economic cost bearing capacity and the investigation of residents' acceptance of the policy, which should also be included in the consideration of factors and solutions.

Authors Contribution

All the authors contributed equally and their names were listed in alphabetical order.

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