Path Analysis of Implementing Carbon Neutral Target in Customer Side of Power Grid Company

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Abstract. China puts forward the goal of carbon neutralization, which puts forward new requirements for China's energy production, consumption and utilization. This paper analyzes the impact of "power supply + energy efficiency service" implemented by the grid company on the carbon reduction target, designs the implementation path in the future, and puts forward relevant suggestions.

Keywords: Carbon neutral; Customer side; Path; Suggestion.

1. Introduction
At the 2015 Paris conference, China promised that "CO2 emissions will reach the peak around 2030 and strive to reach the peak as soon as possible". On September 22, 2020, President Xi Jinping delivered an important speech at the general debate of the seventy-fifth UN General Assembly, and put forward that China will enhance its national independent contribution and adopt more effective policies and measures. CO2 emission will strive to reach its peak by 2030, and strive to achieve carbon neutralization by 2060. This is China's first long-term climate goal after the Paris Agreement, and the first time it has mentioned carbon neutrality. Carbon neutralization refers to the total amount of greenhouse gas emissions directly or indirectly generated in a certain period of time. Through afforestation, energy conservation and emission reduction, carbon dioxide emissions can be offset and "zero emission" of carbon dioxide can be realized. As a new form of environmental protection, carbon neutralization can promote green life and production, and realize the green development of the whole society. The goal of 2060 is to realize the leap from total amount control to carbon neutrality. After that, China will achieve "net zero carbon emission" and become a "zero carbon country".

President Xi's speech in the United Nations climate conference speech, President Xi proposed carbon peaking and carbon neutralization goals have a great impact on the energy industry, put forward new requirements on China's energy production, consumption and utilization, and pointed out a new direction for energy enterprises in energy conservation and emission reduction. There are many studies on carbon peaking, such as references [1-6]. These literatures analyze and study carbon peaking from different industries, different regions and different time periods. But the research on carbon neutralization target is relatively small. However, there are few research projects on carbon target implementation on the customer side. The research in this paper can provide support for grid companies to implement the carbon target.

2. Impact of Carbon Target on Customer Side of Power Grid
At present, dozens of countries and regions have put forward the goal of "zero carbon country", most of which follow the principle of "net zero carbon", which is consistent with the carbon neutrality proposed
by China. The main measures to be taken are: first of all, we should adjust the energy structure, gradually reduce or even give up fossil energy, and then we should improve the energy efficiency of all walks of life, especially the manufacturing industry.

At present, China's largest emission sector comes from power and heat production, industry and transportation. Experts predict that the utilization range of electric energy will be expanded unprecedentedly in the future, and its proportion in the terminal energy consumption will be greatly increased. The future power grid will no longer be a pure transmission carrier, but will become the hub of multi energy conversion and the platform of resource optimal allocation. Some experts have estimated that in order to achieve the goal of carbon neutral in 2060, coal and oil for transportation, industry and other fields will be basically replaced by electricity. It is estimated that China's power demand in 2060 will be more than three times of the current level, exceeding 20 trillion kwh. At the same time, the terminal energy demand of eastern region, central region, western region and northeast region will reach the peak in 2030. Technological progress, energy efficiency and digital development make it possible to meet the same service demand with less energy. The realization of carbon neutralization requires the maximum emission reduction in the fields of energy, industry, construction and transportation. Energy saving, substitution and removal are the three main measures to achieve carbon peak and carbon neutralization, among which energy conservation and substitution are important means to achieve the goal. As the main body of carbon neutral implementation, power grid companies need to strengthen their efforts to make positive contributions to the goal of carbon neutrality through the implementation of "power supply + energy efficiency" business such as electric energy substitution, comprehensive energy services and demand response.

Figure 1. Analysis of the relationship between carbon neutrality and energy consumption of power customers.

3. Path Analysis of Carbon Target Implementation in Power Customer Side

Power supply + energy efficiency service is based on power supply service and centered on electricity, focusing on customer energy optimization, promoting terminal energy consumption electrification through electricity substitution, developing demand response and comprehensive energy services, improving energy efficiency of the whole society and promoting carbon reduction. Energy efficiency services include public services and market-oriented services.

Figure 2. Connotation of "power supply + energy efficiency service".
Table 1. List of energy efficiency services.

| Classification          | Specific business                                                                 |
|-------------------------|-----------------------------------------------------------------------------------|
| Public services         | power monitoring, energy efficiency diagnosis, provision of solutions, trade      |
|                         | matching, etc                                                                      |
| Market-oriented services| Energy substitution servicesClean heating electric energy replacement              |
|                         | transformation, industrial (agricultural) production and manufacturing power       |
|                         | substitution transformation, transportation power substitution transformation,       |
|                         | power supply and consumption power substitution transformation, household           |
|                         | electric energy substitution transformation, etc                                    |
|                         | Integrated energy servicesEnergy saving services: energy efficiency diagnosis       |
|                         | and evaluation, intelligent operation and maintenance, waste heat, pressure and    |
|                         | gas utilization, building energy consumption optimization, power distribution       |
|                         | and energy saving, etcMulti energy supply services: heat pump, electric boiler,    |
|                         | integrated cold and hot supply, comprehensive echelon utilization, etcClean        |
|                         | energy services: distributed photovoltaic, distributed wind power, biomass        |
|                         | power generation, energy storage, etcEmerging energy services: exclusive            |
|                         | charging station design, construction, operation, Internet of vehicles, hydrogen    |
|                         | energy development and utilization, etcDemand response serviceLoad integration      |
|                         | service, power consumption strategy optimization, etc                               |

3.1. Power Substitution

In the long run, most of clean energy needs to be converted into electric energy to be used efficiently. Electric energy substitution can improve fuel efficiency and reduce pollutant emissions through large-scale centralized conversion of coal, oil, gas and other conventional terminal energy. At the same time, electric energy substitution also provides a greater market demand for accelerating the development and utilization of clean energy.

From the perspective of efficiency, the advantage of electric energy substitution to improve energy efficiency is prominent. Before the transformation, most of the fossil energy combustion equipment mainly used surface heating, and the energy utilization efficiency was low, and the general utilization efficiency was between 20% and 75%. The energy efficiency of the engine driven by gasoline and diesel is between 30% and 40%. After the technical transformation of electric energy substitution, the utilization efficiency of electric energy can reach 90% or more. Improving electrification in the industrial sector will also help reduce coal use and emissions. The electric boiler, which uses heater to convert electric energy into heat energy, is suitable for chemical industry, papermaking, printing and dyeing, pharmaceutical industry and other industries. The thermal efficiency can reach 98%, which is much higher than that of coal-fired boiler about 60%.

From the perspective of carbon reduction potential, new energy vehicles use clean energy such as electricity or hydrogen fuel as their power source, and there is no fossil fuel combustion and almost zero emission of pollutants during the use period. Therefore, new energy vehicles are the key energy substitutes. Many scholars at home and abroad believe that the energy efficiency of electric vehicles is 46% higher than that of traditional fuel vehicles, and has 13% - 68% CO₂ emission reduction potential. The next step is to deeply tap the potential of electricity alternative stock, strive to develop the incremental potential, and increase the proportion of electric energy in terminal energy consumption. Adhere to the development direction of "electricity as the center", focus on industrial and agricultural production, transportation, building cooling and heating and residents' life, promote the technological innovation of electric energy substitution, actively promote the demonstration of new models, expand new fields of power substitution, and constantly increase the proportion of electric energy in terminal consumption. We will increase the research on the policy of power substitution and carry out the research on the special support policy in the field of electric energy substitution. Learn from the Internet
thinking, sharing economy and other new ideas, unite the upstream and downstream of the industrial chain, gather broad consensus and work together, innovate the business model of electric energy substitution, and create an ecosystem.

3.2. Comprehensive Energy Services
With the rapid development of clean energy technology based on electric energy, the integrated energy system will have the following three important characteristics: first, the proportion of renewable energy is high, the centralized energy base and distributed micro energy network, the combination of cross regional long-distance transmission and local consumption of regional renewable energy; second, the coupling and complementary of multiple energy sources, the complementary development and configuration of various heterogeneous energy, and the formation of multi energy The third is to develop the energy supply system of joint supply; the third is to coordinate and interact with the source network, load, storage and utilization of energy in multiple links, the energy transportation network coordinated by large-scale comprehensive energy production base, ultra-high voltage power grid and long-distance oil and gas pipeline network, terminal multi-level comprehensive energy supply and various forms of energy storage units to realize the full link optimization of energy resources.

The next step is to build an energy transportation network that includes large-scale energy base, extreme high voltage power grid and long-distance oil and gas pipeline network, various forms of energy storage units cooperate and interact, and multi-level energy terminal utilization is used to realize the whole link optimization operation of energy resources. With electricity as the center and hydrogen and gas as the auxiliary, the multi-directional flow of electricity, hydrogen and gas is realized, and the strong link of source network charge and storage is multi link. Promote the wide application of heat storage, electrochemical energy storage, gas storage and hydrogen storage, and realize cross regional and seasonal load storage.

3.3. Demand Response
Demand response is helpful to ensure the balance of power supply and demand, reduce the installed capacity of power supply, delay the power investment, relieve the pressure of power grid operation, help to save energy and reduce emissions, and promote the consumption of new energy. There is still a large space for demand response potential. The development of energy Internet, intelligent manufacturing, smart home and other technologies has expanded the ability of demand response. Business models such as load integrator have a greater role in promoting the implementation of demand response. By formulating appropriate incentive policies and strengthening publicity, the proportion of demand side mobile peak shaving capacity can be increased to 5% - 15%. According to the load estimation by experts, if the demand response reduces the load by 13% - 15% in 2050, the carbon dioxide will be reduced more.

4. Suggestion
The carbon target has forced the introduction of more stringent environmental protection policies and strengthened the enforcement of environmental protection standards and law enforcement. Governments at all levels should be encouraged to introduce more stringent environmental protection policies, standards and measures to restrict decentralized coal and fuel facilities. Efforts should be made to introduce urban restrictive environmental protection policies and improve environmental emission standards for various enterprises and energy consuming equipment.

It is suggested to strengthen technical support. The first is to improve the technical standards of power substitution, comprehensive energy services and demand response. Promote the issued technical standards, evaluate the implementation effect, and timely carry out revision and continuous improvement. The second is to provide policy support for the research and development of new technologies. We will provide support in investment, loans and taxation for the products in the process of research and production with alternative technologies and new technologies.

It is suggested to improve the market-oriented operation mode of "power supply + energy efficiency service". The first is to break down the barriers of power, oil, natural gas, heat and other energy industries, and gradually establish a comprehensive energy market system to form a unified market rule for multi energy varieties; the second is to implement cross regional and cross provincial direct transactions to
realize the organic interaction between power transmission, distribution and power sales; the third is to flexibly adopt various business models for projects with large market potential and good economic benefits; the fourth is to cultivate new energy sources. The fifth is to promote the improvement of carbon emissions and explore the establishment of capacity trading mechanism, improve carbon emissions and other policies and regulations, and effectively use market-oriented means.

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