

Practical experience of low-carbon development evaluation and low-carbon transformation of international energy enterprises

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Abstract: Since the issue of climate change, it has become a general consensus that greenhouse gas emissions will trigger global warming, reduce greenhouse gas emissions is imperative, and actively promote the low-carbon transformation. Moreover, economics can provide a solid theoretical support with a large number of relevant theories. With the continuous dissemination and penetration of the concept of low-carbon development around the world, the internationally renowned multinational large enterprises generally take the initiative to assume their social responsibilities, actively advocate and practice the concept of low-carbon development, and actively take relevant low-carbon measures in practice. This chapter takes state Grid Corporation as an example, and combs and analyzes its low-carbon development evaluation indicators selection and development measures, in order to gain beneficial enlightenment.

1. Introduction

In 2003, the British government released the energy white paper "the future of our energy: to create a low carbon economy" first put forward the concept of "low carbon economy", the book points out: "low carbon economy is through less natural resource consumption and environmental pollution, get more economic output of economic development mode, on the basis of low energy consumption, low pollution." Since then, a series of new concepts such as low carbon development, low carbon production, low carbon consumption and low carbon life have been derived. At present, the concept of low-carbon economy or low carbon development has not been strictly defined, and there is no consensus on these concepts in the academic circles at home and abroad.

The focus of low-carbon development is on reducing carbon dioxide-based greenhouse gas emissions. The Intergovernmental Panel on Climate Change (IPCC) issued a special report in 2018 on the impact of global warming of 1.5°C above pre-industrial levels (1850-1900 average), noting that net global anthropogenic CO₂ emissions must be reduced by about 45% by 2030, and achieve "net zero" emissions by around 2050.

Low carbon development goal is through technological innovation, system innovation, industrial transformation, energy development of new means, improve energy utilization, as far as possible to reduce fossil energy consumption, vigorously develop low carbon energy technology, change the mode of high carbon energy production and consumption, minimize greenhouse gas emissions, achieve economic and social development and ecological environment protection. At present, the carbon referred to in the national carbon peak

action plan mainly refers to carbon dioxide. Therefore, the low carbon connotation in this study also mainly refers to the greenhouse gas emission reduction mainly based on carbon dioxide.

2. Evaluation of the low-carbon development of international energy enterprises

With the continuous dissemination and penetration of the concept of low-carbon development around the world, the internationally renowned multinational large enterprises generally take the initiative to assume their social responsibilities, actively advocate and practice the concept of low-carbon development, and actively take relevant low-carbon measures in practice. Take state Grid here.

National Grid (NG) is a UK electricity and natural gas utility company, operating primarily in the UK and the United States. NG is the largest transmission and distribution business operator in the UK, responsible for the UK transmission business, Western Power Distribution distribution network. NG also has gas-fired distribution networks, distribution networks and high-voltage transmission networks in New England and New York. In 2021, NG achieved a total revenue of 18.45 billion pounds, of which 42.29% were in the UK and 57.71% were in the US¹.

NG attaches great importance to low-carbon development and is committed to creating economic and social systems with nearly zero emissions, which is available in NG's corporate social responsibility report and its official website. In terms of evaluating low-carbon development, NG focuses on indicators such as direct and indirect greenhouse gas emissions, SF₆ emissions, grid-

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connected renewable energy installed capacity, transnational connected transmission capacity, directly invested renewable energy installed capacity, energy emission intensity, and the proportion of light electric vehicles (See Table 1).

In general, The low-carbon evaluation index of NG has the following characteristics: First, similar to EDF, Also centered on the scientific accounting of greenhouse gases, Using the common calculation criteria, The cumulative carbon emission reduction as the core indicator into the annual social responsibility report, the official website for vigorous publicity; Second, although NG is a UK-based company, But the US now has a bigger share, When accounting for greenhouse gas emissions reduction and evaluating low-carbon results, To incorporate all businesses simultaneously, International business is not handled specifically; Third, in the official website publicity to promote the construction of a near-zero society, Taking the narrative of "milestone events", Greatly increased the affinity.

Table 1 Index system for the effectiveness of NG low-carbon development

index of low-carbon development
Range 1 and Range 2 Greenhouse Gas Emissions (ktCO ₂ e)
Range 3. Greenhouse Gas Emissions ((ktCO ₂ e)
SF ₆ Emissions (ktCO ₂ e)
Installed renewable energy capacity (GWh) connected to the transmission grid
Installed renewable energy capacity connected to the distribution network
Transnational networked transmission capacity (GW)
Direct investment in installed renewable energy installed capacity (MW)
Energy Emission intensity (tCO ₂ e / GWh)
Light electric vehicles account for (%)

NG's major initiatives in the low-carbon transition include:

First, clearly put forward the corporate vision of emission reduction. NG proposed quantitative emission reduction targets and paths as early as 2019, and plans to achieve negative emissions in the power grid business

earlier. NG plans to be a company-level carbon neutral by 2050. Among them, in terms of NG direct carbon emissions reduction, the net emissions of NG grid business will be negative by 2033.

Second, we will increase the construction of transnational interconnected power grids. In the transmission link, increase the construction of transnational interconnection power grid, and increase the transnational input of zero-carbon power. In 2020, NG began the construction of the Viking Link of the ± 525 kV HVDC project connecting the UK and Denmark, with a transmission capacity of 1.4 million kilowatts, 765 kilometers long, and an investment quota of about 2 billion euros. By 2030,90% of the electricity the project delivers to the UK is expected to come from zero-carbon power sources.

Third, to improve the clean energy consumption capacity of the power grid. On the one hand, when the distribution side is connected to the transmission network, NG focuses on the integrated application of smart meters, high-speed communication and distribution automation to enhance the level of the grid frame and improve the power configuration and operation level of the main network and distribution network. On the other hand, to meet the needs of distributed energy network connection, NG supports the good interaction of the distribution users by improving the automation, intelligence and control level of the power grid. Since 2011, the UK has been connected to about 13GW of solar power generation (all connected to the distribution network). By 2050, distributed power generation could be up to 58% of the total installed power system capacity (approximately 136GW).

3. Practical experience of low-carbon transformation of international energy enterprises

This chapter selects 5 international power grid enterprises with strong influence and 1 domestic power grid enterprise as samples, and sorts out their current selection of indicators to evaluate low-carbon development and their practical strategies to promote low-carbon development. In general, it can provide the following enlightenment for the company:

First, the low-carbon evaluation of international power enterprises is generally centered on the scientific measurement of carbon dioxide emissions. EDF, NG, Enel, E. ON, TEPCO and other internationally renowned electric power enterprises basically take carbon dioxide emission reduction as the core indicator of their low-carbon development orientation and effectiveness publicity in their social responsibility reports or ESG reports. And, the enterprises are strictly in accordance with the world resources institute (WRI) and the world sustainable development business council (WBCSD) proposed greenhouse gas accounting system "GHG Protocol", divided into scope 1, scope 2,3, in the corresponding social responsibility report or ESG report and other related report have accurate data display². Relatively speaking, the domestic electric power

enterprises have not yet made an accurate calculation in this respect.¹

Second, from the accounting results, the production side emissions account for the largest proportion and is the focus of emission reduction. The above international power enterprises all have power grid business, but there are differences in both power generation, gas and other businesses, resulting in large differences in direct greenhouse gas emissions. As shown in Table 2, EDF and Enel are both engaged in power generation business, and their Scope 1 greenhouse gas emissions are significantly large, NG is not engaged in power generation business, E. With the low proportion of ON power generation business, both Scope 1 of greenhouse gas emissions are low³.

Third, some common indicators are generally formed around carbon emissions, which constitute a "three-dimensional characterization" of low-carbon development (See Table 2). Although different enterprises involved in the development of low carbon evaluation index system is not consistent, but there are also some universal indicators, including carbon dioxide emissions, SF6 emissions, line loss rate, renewable energy installed capacity, renewable energy power generation, enterprise internal electric vehicles in light vehicles, etc., can promote the outside world to enterprise low carbon development produce a three-dimensional vivid impression⁴.

Based on the company's actual international business and the connection with the overall "two-carbon" index, fully draw on the index selection of international well-known power enterprises, and build an evaluation index system of low-carbon development effect of the company's international business with Chinese characteristics (see Table 2).

At present, the company has invested and operated the backbone energy network of nine countries and regions including Brazil, contributing to the clean and low-carbon energy development of the host country (or region) and the whole world through clean power generation, clean energy transmission and other ways⁵. Based on the above established evaluation index system for the low-carbon development effect of the company's international business, the research group carried out relevant data collection and research on the company's overseas subsidiaries (see Table 3), and the research results were found to be conducive to relevant analysis.⁶ And see in table 4.

Table 2 Greenhouse Gas Emissions of major international power enterprises

enterprise	greenhouse gas emissions		
	Scope 1	Scope 2	Scope 3
NG	5271 ktCO ₂ e	2194 ktCO ₂ e	30088 ktCO ₂ e
Enel	51.6 Mt CO ₂ e	4.3 Mt CO ₂ e	69.1 Mt CO ₂ e
EDF	27.38 Mt CO ₂ e	0.29 Mt CO ₂ e	101.8 Mt CO ₂ e
E.ON	3.71 Mt CO ₂ e	5.73 Mt CO ₂ e	100.38 Mt CO ₂ e
TEPCO	192 ktCO ₂ e	6108 ktCO ₂ e	102137 Mt CO ₂ e

¹In short, range 1 emissions are greenhouse gas emissions from the direct company combustion, range 2 emissions are greenhouse gas emissions from the energy purchased by the

Table 3 Contribution index of "double carbon" company service

order number	class	metric	
1	To serve the society	Non-fossil energy power generation capacity	Carbon emission reduction from non-fossil energy generation
2		Electric energy instead of electricity	Terminal electricity replaces carbon emission reduction
3		Energy efficiency increase	Energy efficiency increases carbon emission reduction
4		Comprehensive line loss rate	Line loss carbon emission reduction
5		Power generation right trading electricity quantity	Power generation rights trading for carbon emission reduction
6		Power demand response capacity	Electricity demand in response to carbon emission reduction
7		Supply chain management of carbon emission reduction	
8	service company	Carbon emission reduction in the power transmission and transformation project construction process	
9		Green operation and maintenance of carbon emission reduction	
10		Carbon emission reduction in office energy use	

Table 4 Statistical table of the low-carbon development results of the company's international business

order number	classify	metric	Annual total		Total history
			2021	2020	
1	Green delivery	Clean energy transmission power (100 million KWH)	311	1868	2357
2		The proportion of clean energy transmission of electricity is (%)			
3		Indirect carbon dioxide emissions from delivering clean electricity (10,000 tons)	342	14518	15073
4		Scale of clean energy grid connection (ten million kilowatts)		1640	
5		Transmission capacity for clean energy (GW)		800	
6		Clean energy generation capacity (100 million KWH)	114	125	628
7		Direct emission reduction from power generation (10,000 tons)	70	158	541
8		Installed capacity of clean energy power generation (GW)	410	420	

Company, and range 3 is all emissions generated by the Company other than both.

9		Investment scale of low-carbon EPC project (100 million yuan)	0.15	0.13	0.28
10		Number of international cooperation on low-carbon projects (one)	2	3	5
11	Green innovation	Number of arranged electric vehicle charging stations in China (one)		7	
12		Number of smart meters installed (ten thousand)	42.19	106.7	

4. Conclusions and recommendations

Based on the results and discussions presented above, the conclusions are obtained as below:

Firstly, the emission reduction effect of international business will be included in the company's overall low-carbon development evaluation system. In the company's current low-carbon evaluation system, the international business is regarded to some extent as a "business segment" different from the domestic power grid business, and this evaluation management does not measure the contribution of emission reduction from a global perspective. Internationally renowned power enterprises basically have multinational power businesses, but they all systematically measure the effectiveness of promoting low-carbon development under a unified evaluation system, which is worth learning from.

Secondly, establish and improve a set of index system that can track and evaluate the low-carbon results of international business. On the one hand, based on this index system, the company's low-carbon transformation of its international business can be regularly inspected, tracked and evaluated, and then implemented. On the other hand, with the help of the comparative analysis of the index values, the relevant information can be deeply mined to provide the decision-making information for optimizing the management and proposing the development measures.

Thirdly, strengthen green supply chain management and promote upstream and downstream enterprises in the supply chain to jointly achieve. It should give full play to its strategic influence and ecological dominance in the energy and power industry, and promote the green, low-carbon and high-quality coordinated development of the industrial chain and supply chain by strengthening the management of green supply chain. Using very large scale market driving force, driving upstream and downstream industrial chain supply chain enterprise collaborative chain solid chain strong chain delay chain, promote the supply chain intellectualization, green upgrading, advanced industrial base modernization level, industrial chain supply chain ecosystem, cultivating new power system, for manufacturing power, quality power socialist modernization power development momentum and platform, in order to promote the construction of domestic large cycle as the main body, domestic and international binary mutually promote new development pattern provides strong engine and new kinetic energy.

Fourthly, there is a significant commonality among power companies in adopting low-carbon development initiatives. Common practices include: accelerating the development of renewable energy sources such as wind and photovoltaic power, phasing out fossil fuel power generation units; accelerating the construction of interconnected power grids to import more clean energy; reducing SF6 emissions through technological advancements, equipment upgrades, and management optimization; advocating for green office practices by gradually replacing corporate light vehicles with electric vehicles within the group; accelerating integrated energy services, implementing electricity substitution, and promoting energy-saving retrofits; and so on.

Fifthly, it is essential to fully disclose information related to low-carbon development through ESG (Environmental, Social, and Governance) reports and social responsibility reports. As large multinational and public enterprises, fully disclosing corporate information to society has become a "standard" to provide relevant information to stakeholders (shareholders, employees, communities, governments, investors, etc.). Among this information, low-carbon data has increasingly taken on significant importance and is commonly disclosed through ESG reports, corporate social responsibility reports, green development reports, and similar means. In comparison, internationally renowned power companies such as EDF, National Grid (NG), and TEPCO have more comprehensive and detailed disclosures of low-carbon information, which are exemplary and worth emulating.

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