



Study of China's wind electricity industry based on low-carbon economy model

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ABSTRACT

The unwanted world climate change has attracted so many governments' attentions, for sustainable development and decrease the negative effect of carbon relieving to the atmosphere, the developed and developing countries all pay attentions to the clean energy's development and construction. In all of the clean energy, wind electricity is a very good choice for commercial use. This thesis analyze the status and restricting actors of China's wind electricity industry, and it also prospect this industry's development by the tool of Gray System.

Key words: wind electricity; clean energy; Gray System

INTRODUCTION

Development and environment protection have become the serious problems human must faced in 21 centuries. So much CO₂ relieved to the atmosphere has weakened the earth environment, human being's health, society reform cost and intra-generational equity arose by the pollution force us to think about how to develop new energy.

Develop renewable energy is the tend, most developed and developing countries have regard the wind energy and solar energy as the important measures to deal with energy and climate change. Especially in the developing countries, during the process of development, it will have to sacrifice the environment and duplicate the route of construction—development—pollution—govern. [1] Contrast to traditional energy, wind energy is a wide distribution and renewable clean energy, it doesn't relies on external energy and has no fuel price risk, the cost of electric power generation is steady, and it has no environment cost such as carbon let. So wind power generation has been regarded as the efficient plan to weaken climate change and enhance energy safe. So many policy making units, investment units and technology research units have pay a lot of attentions to such a kind of energy. In all of the renewable energy, wind power generation has become a technology which has commercial development value except hydropower generation, and it also makes one part of so many countries' sustainable development strategy.

2. Status of China's wind electricity industry development

2.1 Distribution of China's wind energy

China is a country with vast expanse which has 20000 kilometers long's land boundaries and 18000 kilometers long's coast line, wind energy is so abundant. The inland area which annual even wind speed over 6m/s is about 1% of national gross area, it is only second to America and Russia. The exploitable equipped capacitor 10 meters high inland is about 2.5 billion KW, it centralizes in North-east district, North China and North-west district. But such districts' development is laggard, the development of wind electricity will be restricted. The East coastal district's economy is developed and the exploitable wind energy over the seas is about 7.5 billion KW, but the typhoon becomes the obstacle and bottleneck. China's wind energy distribute in such follow four districts:

(1) coastal and relative islands' wind energy abundant belt

In this area, annual valid wind density is over $200\text{W}/\text{m}^2$, the wind density line is parallel with the coast line, wind density in coastal island is over $500\text{W}/\text{m}^2$, the exploitable hours is about 7000-8000hrs.

(2) Three North (North-east, North China and North-west) wind energy abundant belt

In this area, wind density is over $200\text{--}300\text{W}/\text{m}^2$, some areas can reach to $500\text{W}/\text{m}^2$, such as Ala Mountain, Dabancheng city, Huitengxile, Huiliangteng in Xilinguole and hunting ground in Chengde city. The exploitable hours is over 5000 and some areas can reach to 7000hrs.

(3) Inland wind energy abundant area

In this area, the wind density is $100\text{W}/\text{m}^2$ below and the exploitable hours is 3000hrs below, but in some districts, the wind energy is also abundant for lake and special land form such as Boyang Lake, Hengshan mountain in Hunan province and Songshan mountain in Henan province. Although the wind speed is fast in Tibetan Plateau, air density is small for high altitude, the exploitation of wind energy in this area is generic.

(4) nautical wind energy abundant area

In this area, the wind speed is fast and quantity of power generation is huge, it can decrease the machine-groups' load and prolong its using life, but the access cost is high. China has abundant marine wind energy, the East coastal area whose depth is 2 to 15 meters has vast expanse, the exploitable wind energy in 10 meters high is three times of inland area, that is 7.5 billion KW, and it is near to power load centre, with the development of electricity technology, it will become a very important resource.

2.2. The status of China's wind electricity's equipment manufacturing**(1) Homemade equipment start up in a late time, but the market occupancy is rising fast**

The development level of China's wind electricity is low before 2002, the manufacturing technology of large-scale equipment is laggard, and foreign manufacturers monopolized the market, licensed bid system induced by National Development and Reform Commission has aroused the ardor of wind electricity investment since 2003.

(2) plural investment pattern which includes national one, private one and foreign one

From the view of property rights, it includes the wind electricity manufacturing large scale national corporation, shareholding corporation, private one and foreign corporation. The national corporation include electricity equipment, AERO space and heavy machine manufactured corporations such as Dongfang Electricity Group in Sichuan province, Shanghai electricity and Haerbin electricity station equipment group and so on; in private corporations, we have Jinfeng technology corporation which has so much market occupancy and also have some corporation which is less of experience; foreign corporations have mature development experience of electricity equipment such as Vestas (Denmark), Gamesa (Spain) and GE (America).

3. Analysis of factors which restrict China's wind electricity's development

The main contradiction of wind electricity is high cost and low price. To settle this problem, we have to debase the cost or improve the price. The current theory viewpoint is that the development must be supported by financial support and the measures are government support, government found, and favourable taxation policies, the frondose restricted factors are as below: [2]

3.1 Wind bidding price system is unreasonable and it restrict industry development

Some domestic decision makers ascribe the low level development of wind electricity to the high price, so they debate the net electricity price by administrative measures, especially in wind electricity licensed bidding items. We can see the active aspect in theory and it is also a new research, but it will bring a series of problems if the development of wind electricity wholly relies on government bidding.

3.2 Relative policies and regulation are not perfect

We have published relative laws, regulations and policies, but they are lack of validity, especially they are lack of feasibility to wind electricity industry's development. Although China's wind electricity industry has formed a large scale, the cost share system is not perfect, so it restrict its development.

3.3 Loan and taxation system are not perfect

With the extending of market, the wind electricity cost will be debated gradually. But the renewable energy such as wind electricity is still lack of competitive power contrast to traditional resource on current technology level. There is still lack of relative policies such as financial, taxation and loan to support this industry's development. [3]

3.4 Financing channel is not perfect

The development of China's wind electricity industry mainly relies on government investment or international cooperation items. The whole investment in Neimenggu Wind Group includes 57%'s central government investment, 30%'s foreign aids, there is only 13% of the whole investment comes from self raised.

3.5 The upper and lower course of industry chain can not fit well

The wind electricity industry chain includes equipment manufacturing industry and wind electricity operation industry. The upper course' level is very low in the world, but the lower course's level is very high, this contradiction seriously restrict the industry's development.

3.6 The level of domestic manufacturing is low, and technology innovation system is not perfect

The power generation equipment in China mainly relies on foreign ones, domestic corporations possess only 18% of the gross equipped capacitor in mainland, but the imported corporations possess 82%, especially it centralize in Denmark, German and Spain corporations. Wind electricity equipment manufacturing is a comprehensive high technology industry, but we still have not one research unit which has solid economic power and have not formed a wind electricity research network.

4. Prospect of China's wind electricity industry development

As a abundant wind energy reserved country in the world, we have large potential to exploit, since the upper and lower courses can not fit well, we can enhance the power of exploitation and support high-tech corporation's development to enlarge the equipped capacitors.

In China, although we can get the equipped capacitors statistics information of a few years ago, the future capacitors' change is still unknown for it is affected by policy, economy, environment and society factors. This situation is fit for Gray System's order and we can forecast the future data by this tool. For the whole wind electricity system, national factor is known and the comprehensive effect is unknown, so we can construct a Gray model to predict. [4-6]

4.1 Computing process

Gray System theory pay more attentions to dynamic information's exploitation, use and processing, based on research of discrete function, we can construct dynamic differential equation.

Now we use the statistics data came from China Electricity Supervising Committee (2000-2012) as original serial X

Equipped capacitors(2000-2009) ×10000KW

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
capacitor	34.48	40.20	46.62	57.00	76.40	126	259.9	605.0	784	865	951
year	2005	2006	2007	2008	2009	2005	2006	2007	2008	2009	2010
capacitor	126	255.9	605	784	865	126	259.9	605.0	784	865	951

Resource: China Electricity Supervising Committee

For $X(0) = (X(0)(1), X(0)(2), \dots, X(0)(10))$

$X(1) = (X(1)(1), X(1)(2), \dots, X(1)(10))$

satisfy $X(1)(K) = \sum_{i=1}^k X(0)(i)$ (k=1,2,3,...,10)

relative differential equation is ;

$$\frac{dX(1)}{dt} + aX(1) = u$$

Inspection: $C = 0.2616 < 0.35$ (perfect); $P=1 > 0.95$ (perfect), so we can use this model to predict future wind electricity's development

RESULTS AND DISCUSSION

By prediction, we can get the result that our equipped capacitor will reach 41723420KW, the growing speed of wind electricity equipped capacitor in 2011-2015 is 42.13%; it will reach 100210000KW in 2020. The growing speed of wind electricity equipped capacitor in 2016-2020 is 20.63%, it indicate that China's wind electricity is on the step of fast development, we will possess 8.15% of world's equipped capacitor till 2020.

CONCLUSION

Wind electricity is a new clean energy industry, it need not only the innovation of marketing, technology, human resource and management, but also need the support of government, only by the cooperation of such factors can we make great progress in a short time.

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