The Development and Innovation of China's New Energy Industry in the Post-Crisis Era

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Introduction

In the post-crisis era, the renewable energy industry is emerging as the focus of the new round of global green technological innovation. As the largest developing country and the second-largest energy producer and consumer in the world, China is facing greater pressure on energy-saving and emission reduction. Developing renewable energy[1] is an inevitable choice for China's sustainable economic growth.

In recent years, supported by market demands and polices, China's renewable energy industry has got amazing growth. However, due to various reasons, the development of China's renewable energy industry faces a number of constraints: the low level of core technology, imperfect market and disorderly competition. Therefore, the Government needs to promote technological innovation, to accelerate the market cultivation and industrial regulation so as to create favorable conditions for the healthy development of renewable energy industry.

This paper examines the position of the new energy industry in China's economic development; analyzes the major contradictions that confront China's renewable energy industry; and outline the policies that handle the problems concerning technology progress, market cultivation and industrial regulation.

Global Green New Deal and the position of China's renewable energy industry

Historic experience has shown the fact that economic crisis has often been followed by a burst of a new round of industrial innovation. Obviously, the same is true for this financial crisis. In the post-crisis era, Green New Deals have been very popular in the world and the renewable energy industry is emerging as a new hot hub for investment. For instance, President Obama promised in his policy agenda to invest $150 billion in clean energy in the next decade, which will create 5 million jobs. He also pledged to have 10 percent of US energy come from renewable sources by 2012 and 25 percent by 2025; The EU's leaders endorsed an integrated approach to climate and energy policy that aims to combat climate change and increase the EU's energy security while strengthening its competitiveness. The EU Climate and Energy Package

[1] Renewable energy usually refers to those energies that do not pollute the environment and could be recycled in nature. Renewable energy is categorized to be traditional and new renewable energy. The former mainly includes giant hydropower and biomass burnt directly; the latter mainly refers to small hydropower, solar energy, wind energy, biomass energy, geothermal energy and ocean energy, etc. The renewable energy (RE), or new energy (NE), mentioned in this article all refer to the latter.

has set the targets to increase the share of RE in primary energy consumption to 20% by 2020[2]. In addition, several governments have picked up on the green investment and new energy through stimulus packages to promote the economies of recovery and sustainable development.

In China, new energy industry will be the specific focus of the investment in the coming era because of its following characteristics:

(1) A broad market prospect. China has built an energy supply framework with coal and oil as the main energy resource, while renewable energy accounts for only 9 percent of energy use. This kind of energy structure depending heavily on fossil energy is facing challenges. In 2009, China became the net importer of coal, petroleum and natural gas, and also is the world's second-largest energy producer and consumer. With the economy growing so fast, the rapid growth in energy demand and an inevitable decline in the availability of cheap and abundant oil make an early start on a renewable energy transformation all the more imperative. The renewable energy law that took effect on January 1, 2006, is aimed at boosting the overall contribution of renewable energy to an ambitious 15 percent by 2020[3]. Therefore, the vast majority of new energy development is expected to occur in the coming decade.

(2) Huge space of technological advances. Currently, a global green new deal is expected to be an engine of true "green growth", improving incomes and employment in countries around the world. In this context, expanded markets for renewable energy, and faster growth rates in production, will lead to rapid technology changes. In reality, great progress has been made in the fields of new energy technologies, including the 17 key low-carbon technologies identified by the International Energy Agency (IEA), such as wind power technology, nuclear power, photovoltaic systems, solar thermal technology and the second generation of bio-technology. As for China, the gap between China and developed countries in the area of new energy technology is relatively narrower than in other areas. Especially, China is surging ahead in the commercialization of solar and wind energy. As such, by strengthening the independent innovation and international cooperation, China is expected to catch up with developed countries in the fields of new energy technologies.

(3) A wide range of permeability. The rise of the new energy industry will give major changes to many industries such as power, IT, construction, automotive, new materials, telecommunications, and promote the development of related industries. For instance, new energy industry can pull its upstream industries such as wind turbine manufacturing, solar cell module, silicon processing and many other manufacturing industries; it can stimulate the development of a smart grid, electric vehicles and transportation; it can also promote energy efficient buildings and buildings with photovoltaic power. Thus, faced with upgrading the

[2] Cai Linhai, low- Carbon Economy, Economic Science Press, 2009(in Chinese)

[3] This target includes large hydropower

industrial structure and transition in an economic development mode, NE industry has much to accomplish in China.

(4) A combination of capital- technology intensive industry and labor-intensive industry. On one hand, the new energy industry is a capital- technology intensive industry which needs technological breakthroughs and substantial investment in equipments. On the other hand, compared with traditional energy production which mainly relies on natural resources, the equipment manufacturing and maintenance for new energy industry will drive the upstream and downstream industrial chains, and many of them are labor-intensive industries. It has been estimated that investments in renewable energy will create two to three times as many jobs as investments in conventional energy development. According to United Nations Environment Programme (UNEP) estimates, by 2030, global investment in renewable energy industry is expected to reach at least 630 billion U.S. dollars and will create 20 million additional jobs[4].

In short, in the post-crisis era, new energy industry will be the competing priority of national industry, and play an important role in the new round of technological revolution. At the same time, China has great resources potential and development advantage in the new energy industry. Therefore, when entering the new period of industrial innovation, new energy industry is not only positioned to support short-term economic recovery and job creation, but also is the key strategic industry to promote China's economic growth and structural transformation. It's necessary for China to pay close attention to the trends of the world's new energy development, to accelerate the progress of new energy technology, and to strengthen support for the development of a new energy industry.

T**hree major conflicts are challenging China's new energy industrial development**

China's new energy industry has gone through its initial period and stepped into a rapid growth period. However, the following deep-seated contradictions are emerging, which seem to be critical barriers for its further development.

1. Industrial scale keeps expanding while core technology supply is insufficient

In recent years, driven by demands and a series of policies, China's investment in new energy development has ushered in an unprecedented boom, particularly in wind and solar energy. By the end of 2009, China's cumulative wind power capacity reached 25,100 MW, behind the United States and Germany, ranked third in the world; new installed wind power capacity is 13,000 MW, ranking top in the world[5]. Meanwhile, China jumped to become the world's largest producer of solar energy panels. In 2008, China manufactured over 2,000 MW of solar photovoltaic (PV) cells, accounting for more than 30 percent of global production. In 2009,

[4] United Nations Environment Programme(UNEP), Global Green New Deal: A Policy Brief, March 2009, http://www.unep.org/pdf/A_Global_Green_New_Deal_Policy_Brief.pdf

[5] The Global Wind Energy Council (GWEC), Globe Wind Report 2009, http://www.gwec.net

China also had more than 145 million square meters of solar water heaters, accounting for 76 percent of the world's market[6].

However, as a newly risen industry, renewable energy abounds in technical bottlenecks. As a capital-technology intensive industry, renewable energy requires stable and rapid inputs in R&D so as to break through the technical problems. Currently, China has ranked top in terms of investment on renewable energy, but a very small proportion is applied in technical research and development. This leads to the fact the some advanced techniques and equipments depend much upon importation. For instance, although China has the world's third largest wind power installed capacity, many Chinese wind turbine producers, which had never designed and produced a complete wind turbine, bought production licenses from overseas firms and jumped straight to making turbines; Chinese companies can only import 1.0 MW to 1.5 MW wind turbines while EU countries and the United States monopolize more than 3 MW wind turbine technology; China is a solar cell manufacturing superpower, but the vast majority of enterprises are concentrated in the solar panel manufacturing and assembling, while PV industry's core technology - silicon purification technology - still rely on importation.

2. The new energy industry grows rapidly while the market lags behind

On one hand, compared with traditional fossil energy, although the unit cost of renewable energy generated electricity (solar energy in particular) has fallen significantly in the last two or three years, it remains substantially higher than the unit cost of coal generated electricity (see table 1). It's obvious that without the preferential policies and government subsidies, most of the new energy could not be accepted by the market.

Table 1 The Cost of Electricity

Items	Cost (yuan/ kwh)	Equipment cost (yuan/ kw)
Thermal power	0.25-0.30	4000-5000
Hydropower	0.3	6000-7000
Solar energy	3.0	50000-60000
Wind energy	0.5	About 6000

Source: Cuiyi, Thinking on the renewable energy under a low-carbon economy, Ecological Economy, No. 5, 2010

[6] Xinhua, "China Speed" in Clean Energy Business, **http://news.xinhuanet.com/english/2009-12/13/content_12641526.htm**

On the other hand, lack of systematic and effective policy support, China's renewable energy market system is incomplete. The Chinese government has issued Renewable Energy Law in 2006, in which the electricity price for new energy and the cost-sharing mechanism was provided; amendments to the Renewable Energy Law passed in 2009, further defined renewable energy priority scheduling and the principle of full acquisition, which essentially required grid companies to connect and purchase all renewable energy generated. However, because of the price and interest barriers, it is difficult to implement the above measures. As such, new energy industry is suffering from overproduction, or depending on foreign markets. For example, China's installed wind capacity has doubled every year for the last four years, but about 30% of China's wind capacity is not connected to the grid and may be lying idle. Solar PV industry is another example. China has established itself as the leading global manufacturer of solar photovoltaic panels with over 30% of global production. However, domestic utilization of solar PV panels has been very limited and over 90% of solar PV panels have been exported.

3. New energy industry development keeps a strong momentum while the disorderly competition calls for effective planning and regulation

Since 2008, new energy industry has gotten a big boost from China's stimulus program, and became the impetus of local economic growth. At the same time, however, the trends of blind expansion are emerging, especially in wind and solar energy industry. In 2009, the National Development and Reform Commission (NDRC) has put the two industries into the ranks of overcapacity[7]. By now, there are an estimated 80 manufacturers of wind turbines in China, and more companies are trying to enter the market. By 2010, the installed capacity of China's wind power generators will reach 22 GW, while the annual wind power installed capacity is only 10 GW. Polysilicon, which is used to make solar panels and wind power equipment, was another sector with overcapacity. China's polysilicon production capacity is 20,000 tons a year, with an output of about 4,000 tons in 2008. In addition, projects designed for an annual production capacity of 80,000 tons are under construction.

The above phenomenon highlighted the deficiencies in China's new energy policies and regulations. (1) Due to the flaws of resource assessment, technical standards, product testing and certification system, market access standards are relatively low, leading companies rushing into mass action, and causing vicious competition. For instance, as the mandatory testing and certification system has not yet been established in wind power and PV equipment industries, many companies flood the market with lower prices at the expense of product quality and reliability. (2) The new energy development plan and the practice are separated, losing the function of guiding industry development. China has introduced a new energy development plan as "Medium and Long-Term Development Plan for Renewable Energy", "Eleventh Five-Year

[7] National Development and Reform Commission (NDRC),On Curbing Overcapacity in Some Industries and Redundant Construction and Guide the Healthy Development of Industry, September 2009, http://www.sdpc.gov.cn/zcfb/zcfbqt/2010qt/t20100513_346554.htm. (in Chinese)

Plan for Renewable Energy” and “long-Term Nuclear Power Development Plan (2005-2020)”, etc., and some industry sectors and local governments also have their own development plans. However, Planning didn’t keep up with changes, and the targets of plans lagged behind the reality. For example, the original target of 10GM of wind power development by 2010 established in the current national program has been achieved in 2008, and 30GW by 2020 will certainly be exceeded in the near future.

The key orientations for China's new energy policies

The above problems indicate that without the right policy, new energy industry well probably follow the old growth pattern characterized by low value-added, high source consumption, and export-dependence. Therefore, national industrial policy should handle the problems concerning independent innovation, market cultivation and industrial regulation.

1. Innovation-oriented industrial technology policy

New energy technology policy should adhere to the principle of encouraging independent innovation. Preliminary research shows that China's low carbon technologies including new energy technology, remained nearly a decade behind the world advanced standards, and there is the possibility and conditions for catching up if we follow the suitable policies to promote the independent innovation as soon as possible .

Firstly, the central government should subsidize research and development on strategic frontier technology research. Frontier technology, as a new potential driving force for new energy development, can blaze the way for the leapfrogging development of energy industry and technologies. Moreover, many studies have shown that sustained public fund support for key basic research and development can be crucial to the success of innovation in the early stage. As such, Chinese government could create more jobs: to arrange a special research fund to support the development of key technologies; to set up national laboratories and open public research platforms for new energy technology research, and so on.

Secondly, enterprises should be the main body of commercialization of innovative technology. Public funds and tax incentives could help to encourage enterprises to apply the new technology. Also, a new kind of organization, such as Industrial Innovation Alliance formed by several large NE enterprises, will help to accelerate the pace of technological innovation. In addition, financial subsidies and government procurement will share the cost and risk of market-ready renewable energy technologies and overcome the barriers that have stood in the way of the industrialization of new technologies.

2. Market -oriented industrial policy

Achieving a sizable, stable NE market requires aggressive implementation of support policies. The policies discussed below aim to create favorable market conditions.

One policy is about the reasonable new energy pricing mechanism. By now, no standard pricing mechanisms or systems exist for renewable energy products, and price is decided on a case-by-case basis with protracted negotiation between power producer and the grid or utility. The new policy should gradually explore suitable pricing for different regions and define the principle for renewable power price adjustments. Also, the price support mechanisms need to be structured in such a way as to reward the most efficient renewable energy suppliers and to give them an incentive to reduce costs as rapidly as possible

The other policy is to mandatory renewable energy targets, also called Renewable Portfolio Standards (PPS) or Mandatory Market Shares (MMS). This policy requires that a fixed percentage of electricity in each retail suppliers' portfolio be generated by renewable resources and thus enable grid companies to fulfill their primary obligations. It has been proved effective to promote the NE market in several countries. In China that an RPS-style target has been expressly provided by the amendments of the Renewable Energy Law. However, the key issue is how these targets will be implemented. Two suggestions could be helpful. The penalty regulations should be introduced so that grid companies will pay the penalty for their non-compliance. Besides, it is worth considering a performance evaluation system for grid company officials based on their performance in meeting their assigned targets.

However, the policy that government subsidizes to support the market, can be regarded as a propellant in the early stage of development of the new energy industry, rather than a long-term strategy, because this would distort the relative prices of various economic options. In the long run, with the advancement of a new energy technology, cost reduction and market development, the policies of government subsidies and direct intervention into the market could soon be adjusted and gradually fade out.

3. Regulation-oriented industrial policy

In order to avoid falling into the vicious cycle of competition, the system of industrial regulation should be established as soon as possible, which includes the main elements: the standards for wind power turbines, solar machine and the key parts; quality testing and certification system; and the standards for RE grid connection technology. In addition, these technical standards should be developed through an inclusive, transparent process.

Conclusions

Faced with a new round of global green technology revolution, China has no choice but to seize the opportunity. In recent years, China gave priority to the utilization of renewable energy and new energy industry is in a rapid growth period. It leads the world in installed solar water heating capacity and will soon be the world leader in wind power capacity. However, lack of core technology and sound, comprehensive policies, the sustainable development of new energy industry is facing enormous challenges. To accelerate the development of better new energy

technology and markets in the next decades, a range of domestic policy interventions are urgently needed. Policies that support a sizable, stable market for NE, in conjunction with policies that specifically promote core NE technology advancement, are most likely to shape China's energy industry bright future.