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# Small hydropower financing in China: External environment analyses, financing modes and problems with solutions

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## ABSTRACT

The development of small hydropower in China plays an important role in many aspects reflecting national and local public policies such as raising the level of rural electrification, driving rural economic and social development, improving farmers' production and living conditions, promoting energy conservation and reducing greenhouse emissions. This paper introduced the current development of small hydropower; analyzed the external environment of small hydropower investment; summarized small hydropower financing models in China; dissects the problems existing in the small hydropower investment and financing; finally puts forward some suggestions to improve the current situation of the small hydropower investment and financing policies and measures.

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## Contents

1. Introduction	814
2. The development status of small hydropower in China	814
2.1. Distribution and characteristics of the small hydropower resources	814
2.2. Small hydropower development stage and development status	816
2.2.1. The stage of development of small hydropower	816
2.2.2. The status of small hydropower resources development	816
3. China's small hydropower investment external environment analysis	817
3.1. Investment management environment analysis	817
3.2. Private investment policy environmental analysis	817
3.2.1. National policies	817
3.2.2. Local policies	819
4. China's small hydropower investment and financing current situation and financing model	819
4.1. Reviewing the history of China's small hydropower investment and financing	819
4.2. China's small hydropower financing mode	821
4.2.1. Funding sources	821
4.2.2. Bank financing	821
4.2.3. Other domestic financing methods	821
4.2.4. International financing	821
5. The problems and countermeasures	821
5.1. Problems in small hydropower investment and financing	821
5.2. Countermeasures	822
6. Conclusion	823

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Acknowledgments.....	823
References.....	823

## 1. Introduction

There are abundant and widely distributed Small hydropower<sup>1</sup> (SHP) resources in China. The technically exploitable capacity of small hydropower in China is estimated as 128 GW, with an average energy generation of 450 TWh/year. During the 11th Five-Year Plan period (from 2006 to 2010), new small hydropower installed capacity exceeded 20 million kilowatts, and the total installed capacity reached 58 million kilowatts at the end of 2010. Annual power generation capacity increased from 135.7 billion kWh in 2005 to more than 2000 kWh at the end of 2010. The installed capacity of newly and transformed small hydropower was nearly 500 million kilowatts, having made 880,000 people have access to electricity.

The annual per capita electricity consumption increased from 627 kWh to 1026 kWh in 2010. By the end of 2012, more than 45,000 small hydropower stations had been built in China with the installed capacity of more than 65 million kilowatts. There are 1531 rural hydropower counties in China, in which 400 counties rely mainly on small hydro power. China's small hydropower generation was 217.3 billion kWh in 2012, more than two times of the Three Gorges hydropower generating capacity. Small Hydroelectric power has replaced coal-fired power generation, equivalent to saving 70.4 million tons of standard coal and reducing 180 million tons of carbon dioxide emissions.

According to the strategic planning of the Ministry of Water Resources (The Ministry of the People's Republic of China, 2004) by 2020, six actions will have taken place in China: (1) small hydropower stations with larger than 100,000 kW installed capacity will be built in 300 counties; (2) 100 large small hydropower bases with larger than 200,000 kW installed capacity; (3) 40 super-large small hydropower bases with larger than 1 million kilowatts installed capacity; and (4) small hydropower stations with larger than 5 million kilowatts installed capacity will be built in 10 counties. (5) China's total installed capacity of small hydropower plants will increase from 20 million kilowatts in 2000 to 35 million kilowatts in 2010. Furthermore, it will reach 50 to 55 million kilowatts in 2020, annually replacing 800 to 1000 billion tons of standard coal.

According to the national plan, 28.3 million households would require 33.95 billion kWh of electricity to replace fuel wood for cooking and heating, needing a further 24,038 MW of installed capacity. The required investment reaches 127.26 billion Yuan. In addition, 122.60 billion Yuan will be used for power station construction and 4.66 billion Yuan will go towards the construction of transmission lines [1].

"The Twelfth Five-year Plan" is crucial period for China to develop water conservancy and people's livelihood. The small hydropower development is facing a serious challenge in this period. The development focus of small hydropower during "The Twelfth Five-year Plan" is shown in Table 1.

With the development of the rural economy and society, the small hydropower has developed rapidly, but there are still some problems existing. For example, the basic five main problems are: (1) the overall disproportionate small hydropower development

in China; (2) the actual electricity generation is difficult to reach the designed level due to the existing old SHP equipment; (3) Though SHP cost is relatively low, the electricity price is not acceptable in remote rural areas due to the households' low income (4) the lagging of electric power system reform which is not conducive to the small hydropower enterprises participating in the competition; and (5) the fund shortage of small hydropower construction, etc., Among these issues, the financing bottleneck is the main problem in small hydropower development in China.

Therefore, leadership by government needs to for the good of people and can best be done through establishing a reasonable and effective system of small hydropower investment and financing to guarantee the reasonable and effective input of funds. China's small hydropower can be vigorously developed, and further promote the progress of the whole national economy as well as reduce carbon emission and greenhouse gases that impact the general public.

In view of these, this article chose the small hydropower investment and financing as the main research focus. The first part introduces the development status of small hydropower. On this basis, the second part analyses the external circumstances for China's small hydropower investment from the two conditions of investment management and investment policy. The third part discusses the current situation of small hydropower financing and financing mode. Finally the problems of small hydropower investment and financing are discussed, and some suggestions and recommendations on SHP development in the future in China are putted forward.

## 2. The development status of small hydropower in China

### 2.1. Distribution and characteristics of the small hydropower resources

China has abundant small hydropower resources which are widely distributed in more than 1600 mountainous counties around the country as shown in Fig. 1. According to the data provided by the China Hydropower Engineering Society, the developing potential of the domestic small hydropower resources amounts up to 128 million kW, West China accounts for 67.6% of the total capacity, while for Central China and East China, the shares are 16.8% and 15.6%, respectively [3]. Small hydropower resources are mainly distributed in remote mountainous areas of the upper Yangtze River, Pearl River and the upper Yellow River, which is not suitable for large power grid to long-distance transmission due to vast territory, sparsely populated, dispersive loads. While there is no need to install long distance transmission lines, the development of small hydropower in the western region has the resources and geographical advantages, and has conducive to the protection of the local ecological environment [4]. Considering costs and the potential benefits, Large-scale power generation companies have very little interest in scattered small hydropower resources. However, for decentralized social capital, they express higher interest in small hydropower projects with small investment scale and higher efficiency. For small hydropower in western provinces, the Chinese Government has formulated a series of preferential policies including taxes, resource development, new technologies, on-grid energy and feed-in tariff, etc. [5].

(1) Yangtze River basin and its south area include 10 provinces such as Zhejiang, Fujian, Hunan, Hubei, Guangdong, Guangxi,

<sup>1</sup> Small hydropower (SHP): small hydropower refers to such SHP project whose installed capacity is not more than 50 MW. According to the scale of installed capacity, it can be divided into four grades: 0.5–5 MW, 5–10 MW, 10–25 MW, and 25–50 MW.

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