



Substituting small hydropower for fuel: The practice of China and the sustainable development



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ABSTRACT

The ecological protection project of substituting small hydropower for fuel (SSHF) in China is to consolidate the achievements of conceding the land to forestry and natural forest protection, solve the problems of the peasants' fuel and rural energy, protect the ecological environment, and promote the comprehensive development of rural economy and society. It is of great importance to the sustainable development of China in the 21st century. This paper provides a survey of substituting small hydropower for fuel in China. Over the last ten years, using small hydropower to replace the rural living fuel in China has resulted in great fruits. By the end of 2013, 252 SSHF projects had been completed in China, and the newly installed capacity of the SSHF power plants had reached 564 MW (MW). The demand of 1.593 million rural residents for living fuel and energy had been met in a long term, 6.29 million ac-res of the forest area had been protected, and the emission of a large amount of pollutants had been decreased. Moreover, many SSHF projects all over the country are still under construction. With regard to the challenges existing in the development course, some suggestions have been proposed. Implementation of the SSHF project will help realize the harmonious coexistence between human beings and the nature in China.

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1. Introduction

1.1. Rural energy structure of China

At present, the rural energy in China is consumed in both aspects: the production and life. In the underdeveloped areas, the daily life energy holds an important position in the rural energy consumption. For example, the life energy consumption of rural residents in China amounted to 553.7 million tons of standard coal in 2009, and the energy sources included the firewood, straw, coal, electricity, petroleum, and others (e.g. liquefied gas, and biogas). Their compositions are shown in Table 1 [1].

It can be seen that the energy consumption structure of rural life is dominated by the traditional energy sources, such as the firewood and straw. In this structure, the utilization efficiency of the biomass energy is very low. In order to meet the need of production and life, rural residents have to cut down a large number of trees to get enough fuel.

As a result, the cutting volume and consumption of the forest in China far surpass the growth of trees, and many forest areas are greatly reduced. It has led to soil and water loss, flooding, land desertification, and growth of extreme weather. Moreover, this has aggravated the deterioration of the ecological environment, seriously affecting the sustainable development of China [2,3].

1.2. Purpose of SSHF

Chinese government has regarded protecting the ecology and environment, and realizing the sustainable development as a basic national policy of China. Furthermore, the major ecological construction projects have been launched, such as protection of natural forest and conceding the land to forestry. An enormous sum of money has been invested in them, and significant results have

been achieved [3,4].

However, the living fuel of mountain peasants still gives priority to firewood, because the development of rural alternative energy lags behind seriously. In consequence, the ecological construction achievement is difficult to maintain.

To this end, from the strategic height of sustainable development, Chinese government made the decision of promoting the construction of natural forest protection and conceding the land to forestry, improving the ecological environment, and vigorously developing the ecological protection project of SSHF at the same time, so that the problems of peasants' fuel, becoming rich, and rural energy could be radically solved.

1.3. Related definition

There is no unified definition of small hydropower in the world. In China, the small hydropower means the hydropower station has an installed capacity of not more than 50 MW [5,6].

The SSHF means that the small hydropower station is built to provide cheap electricity to rural residents, substituting the firewood, coal, straw, and other living fuels, perfect the production and living conditions of rural residents, protect the forest vegetation, and improve the ecological environment [7,8].

The ecological protection project of SSHF, the SSHF project for short, means a nonprofit public one that the small hydropower station is invested by the state subsidy, and substituting small hydropower for fuel is carried out in the area that concedes the land to forestry, the nature reserve, the natural forest protection area, and the key control area of soil erosion [8].

The main construction content of the SSHF project includes the construction of the SSHF power station and reconstruction of the project area.

The SSHF power station provides the substitute energy for the residents in the project area, and meets their demand for living fuel. It is an important part of the SSHF project.

The project area means the implementation scope of the SSHF project and the protected scope of the forest vegetation, and more than 80% of the residents in the beneficiary area realize substituting small hydropower for fuel in most of the time. The reconstruction of the project area mainly includes reconstruction of

Table 1
Composition of energy consumption of rural residents in China in 2009 [1].

| Firewood | Straw | Coal | Electricity | Petroleum | Others | Total |
|----------|--------|--------|-------------|-----------|--------|-------|
| 18.42% | 26.36% | 27.46% | 11.76% | 14.32% | 1.68% | 100% |

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