

# Benefit-Sharing Mechanism of Hydropower Development: Nujiang Prefecture in Yunnan

FAN Jie<sup>1,2</sup>, HAN Zhenghai<sup>1,3</sup>, SHENG Kerong<sup>4</sup> and SUN Wei<sup>1,2\*</sup>

1 Institute of Geographic Sciences and Natural Resources Research, CAS, Beijing 100101, China

2 Key Laboratory of Regional Sustainable Development Modeling, CAS, Beijing 100101, China

3 University of Chinese Academy of Sciences, Beijing 100049, China

4 Shandong University of Technology, Shandong 255012, China

**Abstract:** Southwestern China contains rich hydropower resources and a high concentration of impoverished people. The acceleration of hydropower development is an important way for promoting the development of impoverished areas and improving the livelihood assets of rural households. Taking Nujiang Prefecture as our focal area we conducted enterprise interviews and government discussions to arrive at a benefit-sharing mechanism for hydropower development. We found that heavy tax burdens on enterprises, low compensation standards, unreasonable electricity prices and weak development conditions are the main reasons that hydropower development is not accompanied by local economic development and improvement in the livelihoods of rural people. Based on a specific factor model and the theory of persistent income, a theoretical model is proposed and used to assess the scenario before relocation and the scenario after relocation. On this basis, policy recommendations for benefit-sharing mechanisms of hydropower development are proposed.

**Key words:** Nujiang Prefecture; hydropower development; reservoir migrants; benefit sharing

## 1 Introduction

Southwestern China contains this nation's richest hydropower resources and the largest installed hydropower capacity. However, the region also comprises the highest concentration of ethnic minorities and impoverished counties. The acceleration of hydropower development not only provides an important means of harnessing regional comparative advantages, gradually eliminating poverty, and narrowing the regional development gap, but also represents a fundamental goal for local governments and residents. Large-scale hydropower development has not significantly improved local economic and social conditions, and resource concentrations and regional poverty have remained problems affecting local development. A conservative estimate is that 15 million individuals have become reservoir migrants since the founding of modern China; a third of which live in poverty (Duan 2004). A key cause of this phenomenon is that reservoir migrants are at a disadvantaged position with respect to the benefit distribution process and the business of

hydropower development, and there is no good mechanism to ensure that reservoir migrants can fairly participate in the benefit distribution process. Therefore, the study of benefit-sharing mechanisms for hydropower development that ensure the fair participation of both reservoir migrants and all stakeholders will improve the basic production and living conditions, stimulate development and maintain border stability and national unity.

Wang (2005) thought that the current compensation mechanism for the revenue of reservoir migrants engaged in agricultural production on the land can be compensated, but the future use and the value of the land were not taken into account. Shi (1996) pointed out that the lost value of land use rights were transferred to objectively hydropower projects, and its value had been greatly improved. Reservoir migrants should be involved in the distribution of the value. Klimpt *et al.* (2002) observed that hydropower enterprises are responsible for not only combining the construction of hydropower projects with various effective measures that allow the community to participate more fully in

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\* Corresponding author: SUN Wei. Email: sunw@igsnr.ac.cn.

construction but also sharing the benefits from these projects with local residents. Kong *et al.* (2008) described five basic mechanisms of sharing economic benefits for reservoir migrants and used Chinese and international cases to perform in-depth analyses of these mechanisms. Shang *et al.* (2010) classified the resettlement of reservoir migrants due to hydropower development into three categories: replacing land resettlement, long-term compensation resettlement, and shareholder resettlement. Comparing the influences of the three types of resettlement on the income of reservoir migrants, the long-term compensation resettlement represented the direction of future migratory resettlements due to hydropower development. Chen and Wu (2005) believed that the current resettlement mode was not satisfactory because the owners carried out one-time compensation for reservoir migrants in accordance with national accreditation standards and approved compensation fees for land resources, and proposed a long-term compensation mode which facilitated proper resettlement and maintained social stability in the reservoir area. Zhao (2008) presented the concept of shareholder migrants and suggested further reforms to improve the land tenure system and to advance the circulation and optimized allocation of land resources. Van Wicklin (1999) thought that there were two reasons reservoir migrants can not share the project benefits in developing countries. First, migration policy in developing countries failed to guide project planners to include reservoir migrants sharing project benefit into the design range during the engineering phase. Second, private owners do not have the desire to share project benefits with reservoir migrants. Duan (2009b) believed that China's current reservoir resettlement policy remained the idea of "compensation and subsidy at an early stage, production support at later stage", which stressed soil settlement and one-time monetary compensation. This idea and method neglected the big trend of rural land circulation in China, not really reflecting the inherent requirement of reservoir migrants sharing project benefits, lacking a long-term mechanism of safeguarding the recovery and improvement of their life quality after relocation. In order to realize the change from non voluntary migration to voluntary migration, the return after migration must be greater than the cost.

Although there have been numerous theoretical discussions of hydropower development from financial and sociological perspectives as well as useful attempts to construct a modeling approach, it is extremely difficult to directly apply extant research results to real-life situations because of a lack of support from actual cases. This paper takes Nujiang Prefecture in Yunnan as an example and studies effective modes and feasible plans for benefit-sharing related to hydropower development through enterprise interviews and government discussions. This study provides new thoughts and a scientific basis with respect to promoting hydropower development and economic development in Nujiang, solving the development

challenges in concentrated impoverished areas and further improving policies regarding reservoir resettlement.

## 2 Study area

Nujiang Prefecture is located in northwestern Yunnan at the southern edge of the Tibetan Plateau and is a minority autonomous prefecture with the following official set of characteristics: "frontier, mountainous, ethnic, religious, and impoverished" (Fig. 1). In 2010, the total area of the prefecture was 14 700 km<sup>2</sup> and encompassed four counties (Lushui, Fugong, Gongshan, and Lanping) and 29 villages (towns). The total population of the prefecture was 516 700, including a rural population of 420 000. The gross regional product of the prefecture was 5.4 billion CNY, the local government had general budgetary revenues of 580 million CNY, and the per capita net income of farmers was 2005 CNY.

Nujiang Prefecture is rich in water resources, and the total quantity of hydropower reserves is  $2000 \times 10^4$  kW, accounting for 11.6% of the total reserves in Yunnan. A per

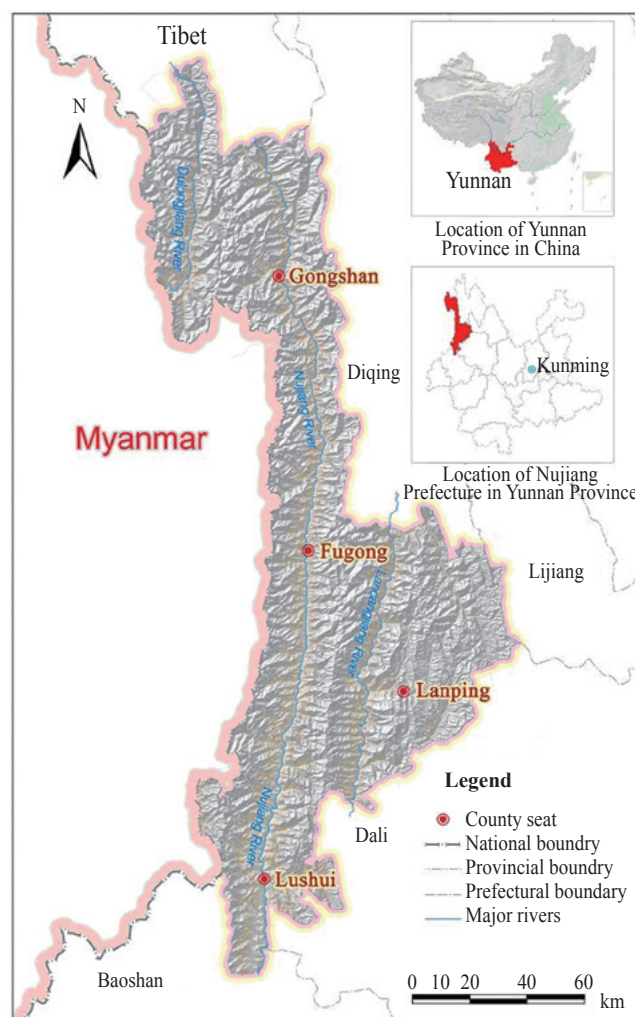


Fig. 1 Location of the study area.

capita hydropower resources is 40 kW, which renders it one of the highest hydropower resources per capita in Yunnan and China. The developable installed hydropower capacity is  $1774 \times 10^4$  kW, and the annual generating electricity capacity is  $850.9 \times 10^8$  kWh. As of 2008, 73 hydropower stations were operational in Nujiang Prefecture; these stations featured a total installed capacity of  $61.36 \times 10^4$  kW and an annual generating electricity capacity of  $18.81 \times 10^8$  kWh. These hydropower stations are all located in the three major river tributaries in Nujiang Prefecture. According to the implementation plans for “One-Reservoir-Four-Level” Hydropower Development in the Middle and Lower Reaches of Nujiang River, compiled by the China Hydropower Engineering Consulting Group Corporation, the installed capacity of the “One-Reservoir-Four-Level” hydropower stations will be  $758 \times 10^4$  kW, and the annual power output of these stations will be  $347.8 \times 10^8$  kWh (Table 1). Compared with other domestic hydropower stations on the same scale, the proposed Nujiang hydropower development would involve a relatively small number of reservoir migrants and relatively low levels of inundation loss. At present, 19 people are migrated on average for every watt of hydropower that is generated in China. The figure is approximately 50 people per watt for the Three Gorges dam, five people per watt for the Nuozhadu dam, and less than two people per watt in the middle reaches of the Nujiang River. The development of hydropower stations in the middle and lower reaches of the Nujiang River is of vital significance for stimulating local social and economic development and helping minority ethnic groups and poor areas overcome poverty. At the same time, this goal is in accordance with the broader Western Development Strategy of China.

### 3 Analysis of causes

Theoretical studies from economics and sociology and practical experiences in various countries indicate that the establishment of benefit-sharing mechanism for hydropower development is reasonable and feasible (Knetsch 1983; Mahoney and Schaefer 2002). In China, academics have proposed various approaches and plans to accomplish this objective, and numerous practical evaluations have been conducted in large water conservancy construction, including the Xiangjiaba, Baihetan, Xiluodu, and Three

Gorges. However, there remain various problems with these approaches regarding levels of economic development and the living situations of migrants in reservoir areas (Zhang *et al.* 2010; Duan and Zhou 2011; Feng 2008). Causes for these problems include the fact that Chinese fiscal and tax reform have experienced significant delays as well as local factors, such as harsh natural conditions, a weak foundation for economic development, and limited conditions with respect to both human capital and social undertakings.

#### 3.1 Heavy tax burdens

Hydropower enterprises in China must pay more than 30 types of taxes and fees, including the value-added tax (VAT), income tax, land occupation tax, water resource tax and freight surcharges. For instance, considering the VAT, current regulations specify that hydropower enterprises can claim almost no input VAT deductions. In Yunnan, the general VAT burden for hydropower enterprises is between 16.3%~16.6%, and the actual general VAT burden for hydropower enterprises is four times the actual average general VAT for industrial enterprises (The research group of The State Taxation Bureau of Yunnan Province 2007). In addition, local governments retain a low percentage of tax revenue. In particular, hydropower tax revenues in China are shared in the following proportions: 60% for the national government, 24% for the provincial government, and 16% for the county government. In locations where hydropower development is most influential, this low retention ratio can render it difficult for hydropower development to play a leading role in the local economy.

#### 3.2 Low compensation standards

According to the “Regulations on Land Acquisition Compensation and Resettlement of Migrants for Large and Medium-Scale Water Conservancy and Hydropower Projects” implemented in September 2006, the stipulated compensation standard for migrants is 16 times the average yield value of the migrants’ land during the previous three years. Although the compensation to migrants has been increased by the Regulations, the annual subsidy of 600 CNY per person for a support period of 20 years is just far too small and cannot completely solve migration-related issues. According to our investigation in Nujiang Prefecture, the per capita income of reservoir migrants remains

Table 1 The status of “One-Reservoir-Four-Level” Hydropower Development in Nujiang Prefecture.

Hydropower station	Installed capacity ( $10^4$ kW)	Annual power output ( $10^8$ kWh)	Investment watt (CNY kW <sup>-1</sup> )	Land occupation (ha)	Reservoir migrant (person)
Maji	420	183.6	4393	1101	32 021
Yabiluo	210	99.3	3334	202	7069
Liuku	18	9.0	5238	5	477
Saige	110	55.9	3645	513	629
Total	758	347.8	—	1821	40196

Source: Yunnan Huadian Nujiang River Hydropower Development (2011).

below the social average, and there is a particularly large income gap between reservoir migrants and hydropower employees. The World Bank (2000) states that only relying on resettlement compensation is unlikely to put reservoir migrants on the road towards sustainable development (Cernea 2000). The restoration and improvement of living standards not only requires compensation for requisitioned land according to market price, but also requires additional funds. An effective way to solve this shortage of funds is that reservoir migrants share a portion of the benefits from projects (Jia and Chen 2002).

### 3.3 Unreasonable electricity prices

The price of hydropower in China is determined by the government. This electricity price does not accurately reflect the relationship between supply and demand on the electricity market, peak and valley variations, and the environmental costs of electricity products. Therefore, hydropower has been under priced for a long time compared with thermal power (Table 2). Thus, the hydropower pricing mechanism must be rationalized such that hydropower is no longer under priced and consumers obtain a greater proportion of hydropower rent. This change to the current unreasonable pricing approach would allow hydropower prices to more truly reflect the market value and thereby achieve a more reasonable distribution of hydropower rent among the national government, local governments and reservoir migrants.

### 3.4 Weak development conditions

Nujiang Prefecture is a frontier minority area that has long remained one of the poorest and least developed areas in China. In 2010, the per capita net income of farmers in Nujiang Prefecture was only one-third of the per capita net income of farmers in China. An impoverished population, defined as farmers with per capita net income less than 1196 CNY, consists of 140 700 individuals, including a deeply impoverished population of 58 900 individuals who have per capita net income of less than 785 CNY. The poverty rate in Nujiang Prefecture is 35%, which is 30 percentage points higher than the national average poverty rate.

Education levels are low, and a large proportion of farmers are illiterate or semi-literate. According to a 2010 survey that sampled 1% of the population, the average number of years of education per capita is only 6.2 years, which is lower than the average number of years of education per capita for Yunnan and China. There is a deficiency of land resources, 98% of the area is mountains and canyons, and cultivated land with slopes greater than 25° accounts for 76% of the total area of arable land. In total, 58.3% of the area in the prefecture has been designated a conserved area, reducing arable land and creating obvious conflicts among individuals with respect to land. As of 2010, the problem of safe drinking water had not been solved for 359 000 residents, 1458 villages cannot be accessed by road, and 752 villages lack electricity. According to a recent follow-up investigation of migratory resettlement in Nujiang Prefecture, the main forms of resettlement are agricultural resettlement, non-agricultural resettlement, small town resettlement, and resettlement due to secondary and tertiary industries. For both local and migratory resettlement, certain migrants will shift into non-agricultural industries, creating a relatively large dilemma in which after migration, migrants have human capital levels that are too low and therefore cannot meet the high human capital requirements for employment (Table 3). Due to additional psychological factors, such as attachment to home, concerns about new production processes and lifestyles, and conflict with ethnic cultural heritage, difficulty in migrant resettlement is an important factor that restricts hydropower development in Nujiang Prefecture (Yang *et al.* 2010).

## 4 Theoretical model of benefit-sharing mechanism

The specific factor model was developed by Paul Samuelson and Ronald Jones. This model has primarily been used to interpret the short-term influence of international trade on income distribution (Samuelson 1971) and presumes that a country produces two products and that the labor supply can be allocated between these two product sectors. This model also includes the assumptions of constant returns to scale, a homogeneous labor supply, a fixed quantity of total labor,

Table 2 Comparison between on-grid price and off-grid price of different power enterprises.

Type	Station	On-grid price (CNY kWh <sup>-1</sup> )	Off-grid price in Guangdong (CNY kWh <sup>-1</sup> )	Price gap
Hydropower	Manwan station	0.17	0.34	-0.17
	Three Gorges station	0.25	0.39	-0.14
	Yantan station	0.16	0.34	-0.18
	Sichuan province	0.29	0.34	-0.05
	Yunnan province	0.26	0.34	-0.08
Thermal power	Average of the whole country	0.45	-	-
	Average of Guangdong province	0.40	-	-
	Average of Yunnan province	0.46	-	-

Source: Yunnan Huadian Nujiang River Hydropower Development (2011).

Table 3 Population features of reservoir migrants in Nujiang Prefecture.

Village	Proportion of urban population (%)	Proportion of population below 15 years old (%)	Proportion of population aged 65 and above (%)	Proportion of illiterate and semi-literate population (%)
Luzhang	22.60	22.67	6.05	19.47
Liuku	43.50	25.28	4.83	17.13
Shangjiang	6.12	28.69	4.80	14.70
Gudeng	7.07	24.77	5.32	29.07
Shangpa	18.75	31.39	4.42	17.78
Pihe	8.20	30.09	6.46	20.22
Lumadeng	3.57	30.52	5.93	31.59
Maji	3.84	27.08	7.80	28.21
Yingpan	4.17	29.19	5.78	25.67
Tu'e	3.74	28.83	6.00	35.94

Source: Yunnan Huadian Nujiang River Hydropower Development (2011).

full employment, and completely competitive commodity markets and factor markets. The model that is utilized in this paper is an extension of the specific factor model.

**4.1 Assumptions in the model**

Rural households have three production factors of land, capital and labor. Land can only be used for agricultural activities, such as planting crops, fruits, and vegetables or raising livestock; capital can only be engaged in non-agricultural operating activities, such as opening a restaurant or a shop; and labor can not only flow freely between these two sectors but also be applied in the external labor market. We examine the persistent income of rural households because the persistent income is the determinant of rural households' consumption and utility. According to Friedman's persistent income theory, persistent income of rural households is obtained from the following three sources:

(1) Agricultural income: The generation of agricultural income requires the two production factors of land  $T$  and labor  $L_F$ . Let  $Q_F$  denote the scale of agricultural output and  $P_F$  represent the market price of agricultural products, as determined by competitive markets. The production function of the agricultural sector is then  $Q_F=Q_F(T, L_F)$ , and the total income from agricultural operations may be expressed as  $P_F Q_F$ .

(2) Non-agricultural income: The generation of non-agricultural income requires the two production factors of capital  $K$  and labor  $L_M$ . Let  $Q_M$  denote the scale of non-agricultural output and  $P_M$  denote the market price of non-agricultural products, as determined by competitive markets. The production function of the non-agricultural sector is then  $Q_M=Q_M(K, L_M)$ , and the total income from non-agricultural operations may be expressed as  $P_M Q_M$ .

(3) Wage income: It is assumed that a wage  $w$  is determined by the competitive labor market; let  $L_P$  denote the quantity of labor that is performed by migrant workers, the total income of migrant workers is  $wL_P$ .

For simplicity, we assume that before hydropower-related inundation, the quantity of land that is owned by rural households is fixed at  $T_0$ , the stock of capital is fixed at  $K_0$ , and the labor supply is fixed at  $L$ . We also presume that every rural household pursues revenue maximization. According to Kuhn-Tucker conditions, the positive marginal productivity of both land and capital implies that at equilibrium, both of these production factors must be fully utilized. In other words, at equilibrium,  $T=T_0$  and  $K=K_0$ . Therefore, the decision problem of each rural household may be expressed as follows:

$$\text{Max } P_F Q_F(T_0, L_F) + P_M Q_M(K_0, L_M) + wL_P \tag{1}$$

$$\text{s.t. } L_F + L_M + L_P = L \tag{2}$$

**4.2 Model solution and analysis**

To solve the model, we divided the persistent income of rural households into the two situations before relocation and after relocation.

**4.2.1 The persistent income before relocation**

Labor is allocated between the three sectors of agricultural activities, non-agricultural operations, and external labor markets. At equilibrium, the marginal product values of labor are equal in these three sectors:  $P_F \times MPL_{L_F} = P_M \times MPL_{L_M} = w$  (Fig. 2). At this time, the persistent income of rural households may be expressed as follows:

$$P_F \int_0^{L_F} MPL_{L_F}(T_0, L) dL + P_M \int_0^{L_M} MPL_{L_M}(K_0, L) dL + wL_P \tag{3}$$

Thus, this income is equal to the sum of the area under the labor marginal product value curve AB of the agricultural sector, the wage curve BC of the competitive labor market, and the labor marginal product value curve CD of the non-agricultural sector. In this case, the land rent is equivalent to the area of the triangle ASB, the capital gain is the area of the triangle CDJ, and labor remuneration is  $w(L_F + L_M + L_P) = wL$ .

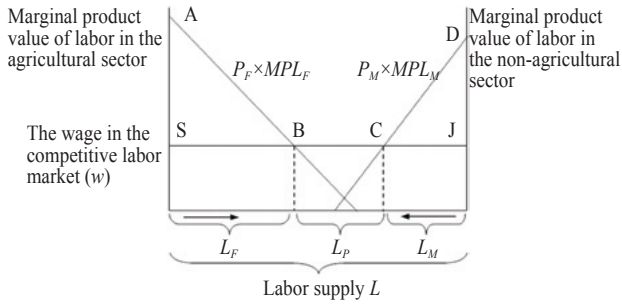


Fig. 2 The persistent income of rural households before relocation.

4.2.2 The persistent income after relocation

The impact of the requisition of land from rural households causes the marginal product value of labor in the agricultural sector to decrease from  $MPL_F$  to  $MPL'_F$ . If the land assets of these households are completely occupied, then  $MPL'_F=0$ ; if rural households continue to occupy portions of their previous land assets, then  $MPL'_F>0$ . To ensure no loss of generality, we always presume that  $MPL'_F>0$ . Given the assumption, the labor marginal product value curve moves leftwards from  $P_F \times MPL_F$  to  $P_F \times MPL'_F$ . At equilibrium, the same marginal product value of labor must exist in each of the three sectors:  $P_F \times MPL'_F = P_M \times MPL_M = w$  (Fig. 3). At this time, the persistent income of rural households may be expressed as follows:

$$p_F \int_0^{L'_F} MPL'_F(T_0, L) dL + p_M \int_0^{L_M} MPL_M(K_0, L) dL + wL_P \quad (4)$$

Therefore, the magnitude of the temporary income reduction of rural households is equivalent to the areas of the rectangles AFEB and EBHG, and a quantity of labor with a magnitude of GH is released from agricultural activities. If the labor that is released from agricultural sections is employed in external competitive labor markets, the labor income increases by the area of the rectangle EBHG, whereas the persistent income of rural households decreases by the area of the rectangle AFEB. In this situation, land rent decreases, whereas labor remuneration and capital remuneration remain unchanged; in other words, land requisition affects the persistent income of rural households by decreasing land rents. If labor that is released from agricultural sectors cannot be hired in external labor markets due to a lack of fundamental skills, this released labor will remain unemployed, and the actual decrease in persistent income of rural households will be equal to the sum of the areas of the rectangles AFEB and EBHG. In this situation, land rent and labor remuneration both decrease, and land requisition affects the persistent income of rural households through both of these decreases.

4.2.3 Determination of the compensation standard

Given the analysis above, to maintain the persistent income of reservoir migrants, the compensation standards may

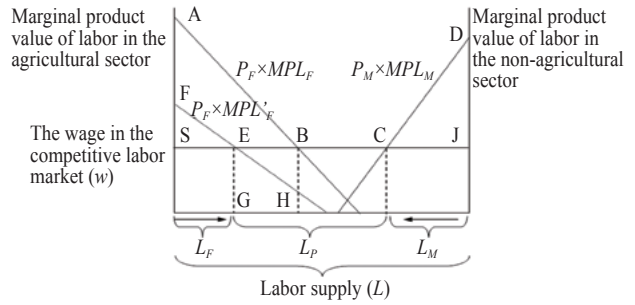


Fig. 3 The persistent income of rural households after relocation.

be reasonably determined based on decreases in the land rents of reservoir migrants, the overall consideration of the decreases in labor remuneration, and the costs of migrant relocation that result from hydropower development. The value of land is clearly less for agricultural activities than for hydropower development. However, these relative values do not change the difficult situations that are faced by reservoir migrants due to hydropower development. In fact, these difficulties conflict with the current policy of China, which advocates supporting the development of impoverished, less-developed areas. According to the poverty alleviation philosophy of Amartya Sen and the framework of sustainable livelihoods, hydropower developments should provide an opportunity for impoverished rural households to build sustainable livelihoods (Chamber and Conway 1992; DFID 2000).

Therefore, we suggest that the compensation for the persistent income of reservoir migrants should reflect the value of requisitioned land to hydropower enterprises. In this manner, hydropower development could lift rural households of impoverished areas out of poverty and towards prosperity or provide opportunities for poor rural households to engage in investment and other activities with higher returns on the available factors of production. Hydropower enterprises are the national monopoly enterprises, which provide public products. Electric power as basic consumer goods, its price is determined by the nation. Therefore, the hydropower enterprises have a relatively stable return on investment. After transferring compensation funds for reservoir migrants into hydropower enterprise's investment capital or transferring land use rights to hydropower enterprises, the reservoir migrants can enjoy long-term dividend income or rental income, which provides a reliable guarantee for reservoir migrants (Duan 2009a).

5 Conclusions and Policy Suggestions

Heavy tax burdens on enterprises, low compensation standards, unreasonable electricity prices, and weak development conditions are the major factors restricting hydropower development from promoting local economic development and improving the livelihood assets of rural

households. Based on the specific factor model and the theory of persistent income, we have proposed a long-term compensation mechanism through which migrants could share the benefits of hydropower development, constructed a model for theoretical analysis, and used this model to assess the following two situations for rural households: the scenario before relocation and the scenario after relocation.

Based on our work, the following policy recommendations are proposed.

(1) The price formation mechanism for hydropower should be reformed. Hydropower costs should include the costs of acquiring development rights, resettling migrants, managing environmental issues and engaging in ecological restoration. This policy change will allow hydropower costs to truly reflect various factors, such as the degree of hydropower resource scarcity, the relationship between supply and demand in the market, and migration and ecological costs. This policy shift could not only establish the fiscal and taxation system involving appropriate compensation for land acquisition, use and transfer with respect to the water resources in China, but also nurture market-based mechanism for determining hydropower prices.

(2) The proportion of hydropower benefits shared with Western China should be increased. To promote a new decade of the Great Western Development Strategy, we should provide certain tax incentives to hydropower projects and increase the proportion of hydropower benefits shared with Western China as part of the implementation of the “West-to-East Electricity Transmission” project. Given that current tax policies are difficult to change, as a transitional measure China should begin to gradually increase the proportion of the value-added taxes and income taxes for hydropower enterprises that it returns to western areas and should allocate hydropower rents to appropriately favor western regions of the nation.

(3) Migration compensation standards should be gradually increased. In accordance with the allowed measures in the current compensation policy, we should regularly adjust the compensation standards based on variation in the price levels for basic subsistence and production to ensure that the living standard of reservoir migrants does not decrease. To eliminate psychological gaps and estrangement and to ensure that the construction and operation of hydropower developments occur in a normal and scheduled fashion, we should gradually flatten the income relationships among power plant employees, civil servants, and reservoir migrants by narrowing income differences.

(4) Regional capacities for sustainable development should be nurtured. The capital that is obtained from hydropower projects should be effectively shared among various entities, and reasonable guidance should be provided regarding the directions in which this capital is applied. In particular, these funds should be focused not only on improving various aspects of local infrastructure,

such as transportation, electricity, radio, television, water supply, and drainage, but also on funding social services, such as the provision of medical care, education, culture, and health benefits. In accordance with approaches from the USA and Europe, capital should be directly allocated either from the operation of power stations or through specific funding and credit financing to support the development of specialty industries (such as agricultural product processing, ecological tourism and folk handicrafts) in Nujiang Prefecture. These developments would expand the income sources of local residents and improve their livelihood.

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## 水电开发的效益共享机制研究——以云南省怒江州为例

樊杰<sup>1,2</sup>, 韩振海<sup>1,3</sup>, 盛科荣<sup>4</sup>, 孙威<sup>1,2</sup>

1 中国科学院地理科学与资源研究所, 北京 100101;

2 中国科学院区域可持续发展分析与模拟重点实验室, 北京 100101;

3 中国科学院大学, 北京 100049;

4 山东理工大学, 淄博 255012

**摘要:** 西南地区是我国水电资源最富集和贫困人口最集中的地区, 加快水电资源开发是促进西南贫困地区发展和农户生计资产改善的重要途径之一。本文以云南省怒江傈僳族自治州为案例, 通过华电云南分公司访谈和政府部门座谈等方法, 提出建立水电开发的效益共享机制并论证了其必要性和可行性。研究表明, 企业税负重、补偿标准低、电价不合理、发展条件薄弱是水电开发不能同时带动地方经济发展和农户生计资产改善的主要制约因素。基于特定要素模型和持久性收入理论, 提出了移民参与水电开发效益共享的长效补偿机制, 构建了理论分析模型并分析了移民搬迁前、后对理论模型的影响。在此基础上, 提出了政策建议。

**关键词:** 怒江傈僳族自治州; 水电开发; 库区移民; 效益共享