

**Yunnan Provincial Government**

**PPIAF/World Bank**

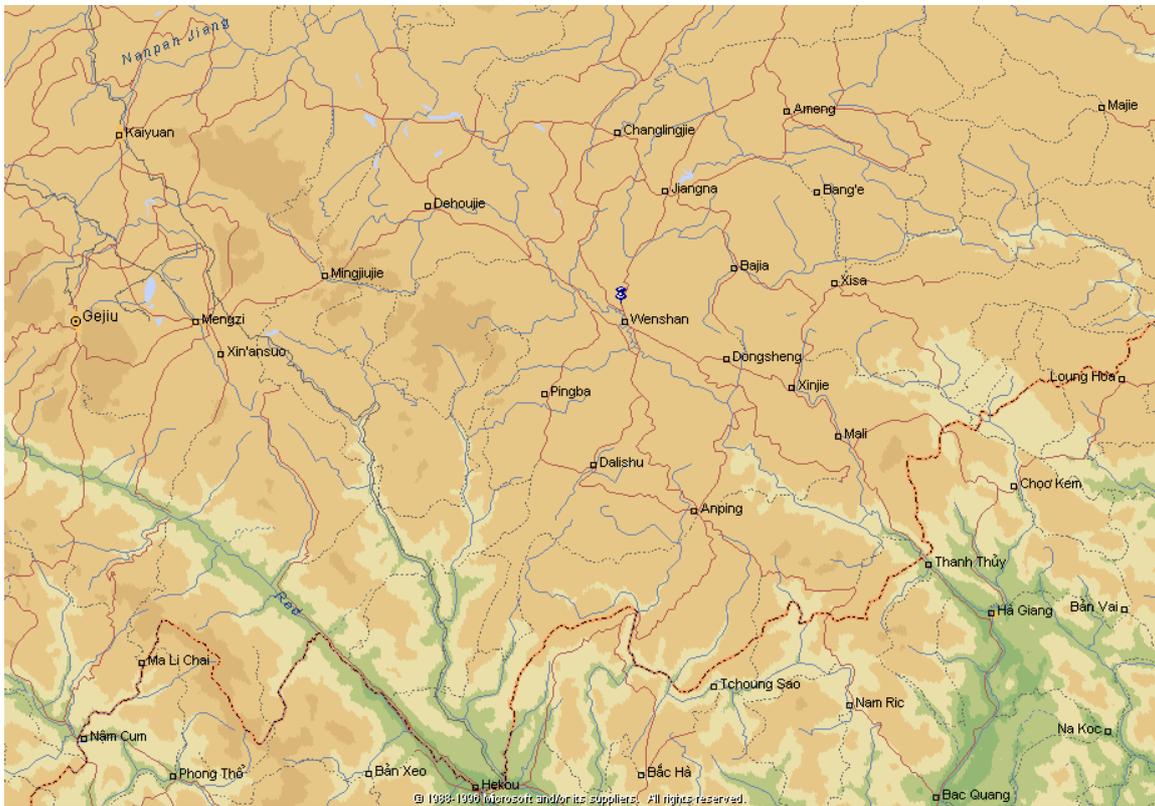
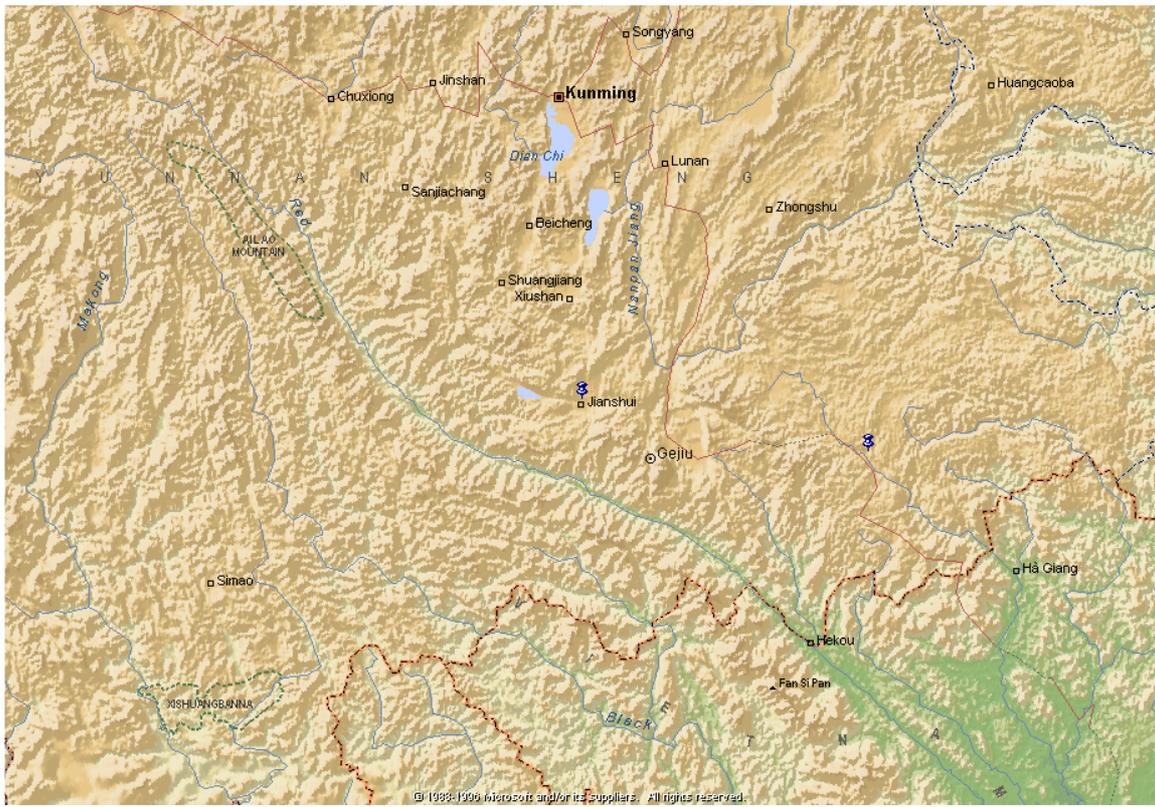
**Private Investments in Small Hydropower in Yunnan**  
**Review of Framework and Recommendations**

January 2005  
Report  
by  
Li Zhiwu and Wolfgang Mostert

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## Abbreviations

CFB	County Finance Bureau
MFB	Municipal Finance Bureau
MoU	Memorandum of Understanding
MWR -	Ministry of Water Resources
PPA	Power Purchase Agreement
PPIAF	(World Bank's) Public Private Infrastructure Advisory Facility
PPP	Private Public Partnership
SDPC -	State Development and Planning Commission
SHP	Small Hydro Power
SPC -	State Power Corporation
YPPDC -	Yunnan Provincial Planning and Development Commission
YPFB -	Yunnan Provincial Finance Bureau

## Definitions :

Small Hydropower	< 50 MW
Medium Hydropower	50-250 MW
Large-scale Hydropower	> 250 MW

Exchange rate : 1 US\$ = 8.26RMB (Yuan)

# 1 Introduction

A Workshop for Promotion of Private Participation in Infrastructure Development in Yunnan supported by PPIAF/World Bank and arranged by Yunnan Provincial Government (Yunnan Research and Development Commission) was held on November 17-18, 2003. The workshop demonstrated the great potential for private participation in the development of the rich medium and small sized hydropower resources in Yunnan and identified five key barriers to private participation, which were:

1. policy and legal framework/gaps in developing projects;
2. regulatory framework;
3. power tariff policy;
4. optimal risk allocation among key stakeholders;
5. governmental approval procedures and how to streamline.

At the conclusion of the Workshop, PPIAF proposed a follow-up study with PPIAF funding to further clarify existing status in five aspects regarding premonition of private participation in hydropower development in Yunnan, and the provincial government expressed full support to the study.

Mr. Li Zhiwu from the Hydropower Research Center and Mr. Wolfgang Mostert were contracted by the World Bank to carry out the follow-up study on aspects related to private investments in small hydropower. At the World Bank/PPIAF, the team reported to Mr. Mats Andersson. The team carried out a field visit to Yunnan from July 20 to 27, 2005. Starting in Kunming, the team visited the counties of Wenshan and Jianshui.

The team would like to thank for the excellent assistance rendered by the Provincial authorities in Kunming and in the visited cities in preparing the program of visits and interviews for the team. Particular thanks to Mr. who accompanied the team from beginning to end and provided many useful observations.

Last but not least, Mr. Wolfgang Mostert would like to apologize for the delay in preparing and presenting the report, which originally was scheduled to be finished by end-August. The workplan was smashed by a malaria-attack and follow-up infection diseases.

Everything occurs at a larger scale in China. The definition of small hydropower is no exception: it refers to hydropower plants in sizes from 5 MW to 60-80 MW installed generating capacity.

## 2 Regulatory and Financial Framework for Small Hydro

### 2.1 Demand for Investments in Power Generation

The exceptional growth in power demand in China provides a fertile ground for power investments in general, including private investments in small hydropower. The country's annual additions in generating capacity are the largest in the world. Power demand is fuelled by fast economic growth and low per capita consumption: electricity output per capita in 2003 was 1,278 kWh compared to South Korea's 7,068 kWh. In a context of fast demand growth if overinvestment takes place, as in the mid-1990s, overcapacity vanishes quickly. In 1998 and 1999, there was a glut of supply, in 2004 there were power outages in 21 of China's 31 provinces.

Hydropower competes with coal-fired plants for base load and for peak load: due to abnormally high local natural gas costs<sup>1</sup> coal-fired plants instead of gas-fired plants are used as peaking units.<sup>2</sup> The competitive position of new hydropower plants is likely to improve further in the future, because coal-fired plants face rising costs: pollutant discharge fees<sup>3</sup>, coal prices<sup>4</sup> and equipment prices<sup>5</sup> are gradually increasing.<sup>6</sup>

The position of hydropower plants in Yunnan, in particular, is improved by the completion of the West-to-East transmission scheme in 2005, which allows Guangdong to import cheap hydropower from Yunnan. Wholesale tariffs for power from Yunnan to Guangdong would be RMB0.32/kWh, inclusive of transmission fees, versus a year 2004 average on-grid tariff of power plants in Guangdong of RMB0.38-0.40/kWh.

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<sup>1</sup> Weak oversight or lack of central policy with regards to regulating the gas industry has led to many players along the "pipeline" taking a cut out of the gas business – a fact evidenced by the plenitude of local governmental taxes, surcharges, processing fees, pipeline transportation tariffs, etc. While the cost of coal is also increased by the imposition of some local taxes (which is as high as about 30% in Shanxi alone), there can be up to 16 different kinds of taxes payable for Sichuan gas.

<sup>2</sup> The total costs per MWh for a coal-fired plant and a gas-fired plant with similar generation output in China is US\$30.60 and US\$43.80 respectively

<sup>3</sup> Guangdong announced that all power plants with an installed capacity above 300 MW are to install desulphurization equipment. Smaller power plants in these provinces will soon be required to retrofit scrubbers as well.

<sup>4</sup> Since 2002, China's coal mining sector has been increasing production at 20% a year- which, given the limited ability to open new mines and increase productivity, does not seem sustainable. Much of the current coal supply comes from small, unsafe township-run mines with poor safety records. A major reason for the coal shortage in 2003 was a sudden government decision to shut down many small mines under popular pressure following an excess of fatal accidents. Although 70% of these closed mines resumed operation towards the end of 2003, mass mine closures could recur and tighten supply. In any case, governmental efforts to improve the safety feature of Chinese coal-mines will imply higher capital expenditures, and thus higher production costs and coal prices.

<sup>5</sup> Equipment costs in general may be on the rise, given that production capacity for power generation equipment is close to 100% utilized and that the current low profitability of equipment manufacturers is unlikely to be sustainable. According to Goldman Sachs research, capital equipment costs rose 15% to 20% during 2004. Escalating steel prices aggravate the situation.

<sup>6</sup> However, small hydropower is also affected by price increases, Capital investment for an SHP project has increased to 6,000-8,000 Yuan/kW at present versus 3,000-5,000 Yuan/kW in the early 1980s, probably in part because the more difficult sites are being developed now.

Under these circumstances, and in view of the dynamic entrepreneurial talent of Chinese businessmen and their risk willingness, it is not surprising that private companies from rich coastal provinces such as Guangdong and Zhejiang move west- and southward to develop hydropower projects. To hasten their market entry, private investors purchase also completed small hydropower station from state-owned and local-Government owned power companies.

## **2.2 Policy and Regulatory Framework**

### **2.2.1 Administrative system in China**

The Chinese administrative system is divided into “*Government*” consisting of the four levels of (i) centralized government, (ii) province, (iii) prefecture/municipality and (iv) county and “*local Government*” comprising the governments of townships (formerly communes) and villages (formerly brigades).

### **2.2.2 Power sector reform: restructuring the power industry**

The traditional government owned power systems<sup>7</sup> were provided by a centralized government department with operating units at province and prefecture levels. Because not all rural electricity supply areas are connected to the Provincial grids, local systems also grew up at county level and even at local government levels (township and village).

The provincial power companies form the core of the current system. They own and operate the main transmission grids, act as single buyers in the purchase of power from generators (*except for "embedded" generation* – generators that are connected directly to distribution grids and sell their power to these). Also, although the government has mandated the separation of generation from transmission and distribution, the provincial power companies continue to have substantial interest in generation and distribution. The single buyer structure is expected to be a transitional mode of operation as the Government intends to introduce retail competition within the next 5 to 10 years.

The power sector reform is not yet defined in its final details, but some elements are in place.

The generation assets owned by the State Power Corporation (SPC) are being restructured into independent generation enterprises such that the capacity share of a power company in a market should not exceed 20 percent. Most of the new hydropower capacity is undertaken by the five big power groups set up in 2004. The five big groups strive to win contracts for investment with the local governments and scout the country for hydropower sites to invest in. This is creating a situation of unprecedented competition for new power generation.

The Government will establish one national grid company and six regional grid companies. The latter will have provincial grid companies as subsidiaries with responsibility for local transmission and distribution.

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<sup>7</sup> Until the early 1980s, there were no private investor owned power plants in China

The reform will establish power trading centers, where generators will bid for dispatch. Within the jurisdiction of each regional grid company, one or more dispatch centers will be established depending on local conditions, all managed by the regional grid companies with free trading between dispatch centers.

A rational wholesale power pricing mechanism shall be developed. The electricity prices will be divided into generation, transmission, distribution price and consumer supply.<sup>8</sup>

### **2.2.3 Interim character of the regulatory framework for power sector**

Because power sector reform is changing the industry and ownership structure of the power sector, the present legal and regulatory framework for private investment in the power sector has interim character. The system resulted from ad-hoc decisions taken in response to practical issues that arose from the change of a purely state owned power system to a mix of state-owned and private power companies. The speed of economic change and in the demand for power, gaps in North-South and East-West transmission capacity, the geographic size of China and differences in the speed of development between the super-successful coastal and the slower in-land Provinces all made ad-hoc solutions necessary. In the Eastern Provinces, for example, electricity markets quickly reached a size, that called for more sophisticated regulatory responses.

The interim regulatory structure has three layers of intervening authorities: central government, provincial government and local government with some overlapping functions. The system will in a very near future be overhauled by a coherent reform package for the power sector which the Chinese Government is in the final stages of preparing. A State Power Regulatory Agency is expected to be established under the State Council. It will perform the regulatory duties and functions authorized by the State Council. The regulatory agency will have branch offices in areas with regional power grid companies and trading centers.

### **2.2.4 Promotion Policy for SHP with Focus on Local Power Supply**

In the Government's strategy for the power sector, investments in SHP have primarily been a means to accelerate rural electrification. The rural electrification policy emphasises the use of generation from SHP in a way that ensures self-sufficiency in local power supply. The emphasis on covering local needs is also reflected in the objective of involving local governments and local people in the construction and operation of hydropower stations to a maximum extent.

Local farmers took great interest in SHP construction, and it was common to convert the labour contributed by the farmers into funds. Some counties adopted the regulation that every farmer had the duty to make a contribution in developing hydropower and communal facilities, contributing say, no less than 8-10 working days each year. During the construction of hydropower stations and

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<sup>8</sup> There have been rumours that the generation price will consist of a government determined fixed capacity price and a competitive-market determined energy price. But that still has to be seen, a single price (without separation of energy and capacity component) power market scheme is also a possibility, where capacity is paid only for stand-by units.

power grids in some counties, the work contributed by the farmers could be converted into investment in kind in the form of shares.

As electricity generated by the SHP station is intended mainly to cover local demand, each SHP under the “self-supply” policy is required to have its own supply area, a unified SHP market of electricity generation, supply and consumption is to be established. SHP is almost exclusively “embedded generation”, meaning a power generator connected directly to the local distribution grid through a purpose-build transmission line. In case of connection to the Provincial power grid and integration into the Provincial power market, the original SHP property rights, ownership affiliation and financial arrangements are not to be changed.

Under the system of “self-supply”, electricity exchange between grids operates as either “mutual supply” or as “bulk sale”:

- If power generating capacity of SHP was greater than the load in the small local grid for more than half a year in any one year and was able to provide net-supply to the large grid, then it was to be regarded as “*mutual supply*”. In that case, the small grid could enjoy the same sales and purchasing prices as the large grid.
- Otherwise, the large grid is not expected to directly develop load for direct supply to the area of the small grid. The local distribution company is expected to remain responsible for ensuring supply to the end-users. a “*bulk sale*” price would be implemented on a quarterly or monthly mutual balance basis.

As China is expanding its interconnected grid across the country, the concept of “local self-supply” is losing its meaning.<sup>9</sup> In the “local supply” policy, the market rules for SHPs connected to local grids are different from the market conditions for large hydropower plants selling to the national grid. Once a local grid is connected to the Provincial grid, SHPs connected to the local grid come under the general operating rules of the Provincial grid system. They lose their previous “monopoly supply” area and must like all generators follow the policy of separating ownership of generation from ownership of the distribution grid. Their daily generation is subject to the orders of the dispatcher and sub-optimal dispatching policies of grid operators prevent SHPs from producing electricity even there is plenty of water, thereby under-mining their financial position. Yet, due to antiquated rules, “local SHPs” with surplus power generating capacity either cannot sell power into the Provincial grid, or can do so only at a very low selling price. A proper integration of SHPs into the market systems operated under the Provincial grid requires legislative changes that establish normal and efficient market rules and conditions for SHPs.

Steps towards this are being taken. On 17 Oct 2003, *Document No 138 was issued by the People’s Government of Yunnan Province* to speed up the medium and small hydro power exploitation. The key element of the regulations established by the document is the abolishment of the “self-supply” policy: the sector monopoly and local protection is to be broken and connection of isolated grids to the interconnected grid of the province is to be accelerated. The intention is to work towards a market-oriented system, which is planned in a unified way, and where generators compete fairly and openly on the bulk market for power.

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<sup>9</sup> The advantages of reduced losses in transmission and lower need for investments in transmission capacity are obtained from embedded power generation also without that policy.

## 2.2.5 Approval process for SHPs: intervening institutions

Compared with other countries, the approval process for a new SHP-project from the start of the application till final approval of the construction of a project seems to take much less time than in most other countries. To standardize SHP development, rationally exploit hydropower resources and fully play the role of SHP in socioeconomic progress, each provincial government formulates its administrative guidelines so as to protect and promote the development of SHP industry.

For a new hydropower project or a project to be rehabilitated locally, the contractor must submit a project proposal, a feasibility study report with the design documents attached to the provincial planning, water conservancy and electric power administrative sectors for examination and approval.

The hydropower resources of each basin and tributary in a province are to be exploited in accordance with the approved hydropower development planning on rivers and the electric power programming. A development proposal shall therefore be examined and verified by the provincial administrations in the areas of planning, water conservancy and electric power. They are to check that the proposed project is in accordance with the hydropower resources, integral basin planning and other water-conservancy regulations. When there is no plan for the development of hydropower resources or an existing development plan needs to be technically revised, a qualified investigation & design institute shall be contracted to formulate a hydropower resources plan for the river. The plan can be applied after unanimous approval by the provincial planning, water conservancy and electric power administrative sectors.

The approval right in Yunnan for projects below 10 MW belongs to the county, for projects with a capacity of 10 MW – 25 MW to the prefecture, whereas projects over 25 MW must be submitted to the development and reform commission of Yunnan province for approval.

The *Economic and Trade Commission* discusses with the local and provincial power company how much new capacity is needed.

Within the framework of the laws regulating the multiple uses of water, the *Bureau of Rural Hydropower and Electrification Development* in the Ministry of Water Resources, MWR, checks, ratifies and demarcates the power supply areas for the local grids that are served by SHPs. In the context of the “self-supply policy” the Ministry supervises and checks issues related to power supply or consumption.

In China hydropower companies do not get separate licenses for water use and for power generation. They are given a single license issued by the *Water Sector Department*<sup>10</sup> - the *Prefecture Water Sector Department* for projects decided at prefecture-level and the *County Water Sector Department* for projects decided at county-level. The concession is for 70 years, but needs re-registering every year. During re-registering, it is confirmed how many tons of water were consumed and how much will be consumed.

The Provincial *Land Resources Department*, *Forest Bureau* and *Environmental Department* have to accept the land use and environmental aspects of a SHP-project. Whereas water rights have to be

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<sup>10</sup> The Water Sector Department used to be owner of local hydropower companies.

approved at Provincial Government level, land rights are decided at county and prefecture level unless it involved agricultural land of more than 100 mu.

The right of final approval of a SHP-project belongs to the provincial and prefecture levels' *Development and Reform Commission*.

The company for operating a local SHP must be registered with the *Investment Bureau*.

The power purchase contract is signed between the SHP and the *Transmission Company*.

The *Provincial Planning Commission* approves the tariffs of individual plants, and in case of difficulties in the negotiations, appeal can be made to the Planning Commission and to the Economic and Trade Commission for mediation.

## 2.2.6 Tenders

Tenders for *bidding for individual project sites* are organised only when there is more than one interested party in the project, which is rarely the case. The belief in the value of organising tenders for project sites asking private investors to bid for these is not great: officials seem to think that there are too many hydro resources in the Province and that tenders would make potential investors to seek other projects instead.

For construction, however, regulations stipulate that *procurement has to be by public tenders*.

## 2.2.7 Evaluation of environment and social impacts

In some countries, *environmental assessment and approval procedures* have become formidable blocking stones to the development of hydropower projects. In China, the authorities when giving the approval for a project are supposed to have verified the environmental aspects of the project. The appraisal is done as part of the integrated resource plan for the exploitation of water resources.<sup>11</sup> But rapidly growing local demand for power and the subsequent desire for a rapid expansion of power capacity in many instances seem to have overruled the environmental assessment process, reducing its quality.

The *regulations for land acquisition* establish that a sum of 16,000 Yuan per mu is paid for land without use; while for farming land a sum of 20,000 Yuan/mu is paid.

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<sup>11</sup> A hydropower project to be built on the main stream and the first-grade tributary of Yellow River or Yangtze, national and provincial water & soil conservation areas, wildwood regions or natural reserves etc., must meet the requirements for eco-system and water resources protection regardless of its scale, and it shall be submitted to the responsible authority for registration after approval by the provincial planning commission and the provincial department of water resources. If this project is categorized as the one for hydropower-based rural electrification, it shall be approved by the provincial department of water resources, and then submitted to concerned sector for registration.

The *procedures for resettlement* are well-defined. Resettled families are entitled to a compensation of 20,000 RMB per person and to assigned land.<sup>12</sup> Local government plays an important role in resettlement, both in identifying and allocating new land to resettled people and to ensure that supplementary investments are carried out, such as in schooling, for example. In some areas, investments can be as high as 100,000 Yuan just for the school building.

## 2.2.8 Dispatching and billing

Many SHPs encounter problems after the commissioning of a plant with bill settlement and with grid dispatching by the Provincial transmission company.

## 2.2.9 Issues in the project approval process

In the official project approval and monitoring process three major problems have emerged:

1. In many cases the *official procedures are not followed*. The multi-management of the approval process with duties that often seem unclear to involved institutions causes disorder in the local administration of applications for approval. This allows investors eager to speed up the construction of a SHP-plant to sidestep the process. In order to get projects approved at local, instead of at prefecture level, for example, interconnected project sites are registered as individual projects, each having a capacity within the threshold limit for local approval. Some investors start construction first and then submit the project for approval. Some investors get a project registered with the investment bureau of the county in their own, personal name, and get the approval signed in their individual name, instead of in the name of a local company as required.
2. According to Chinese consultants, the supervising authorities are frequently doing a superficial job in the *supervision of compliance with civil and electrical standards for project, quality control of construction is poor*. Whereas the Development & Reform Commission has a clear responsibility for the initial project approval and the approval of the completed project<sup>13</sup>, the supervision during the construction falls into a responsibility vacuum, making quality control during construction more difficult. Quite a large number of hydropower plants, therefore, have problems of safety.
3. *The right to develop projects at specific sites is snatched up by speculators who do not proceed immediately with the preparation and implementation of the project*. Some are conducting basin planning and some designing. But many are just occupying the project, without developing it. Apparently they are waiting for a chance to make a profit out of selling the right to develop the resource.

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<sup>12</sup> China is moving towards a policy of giving the affected people a single lump-sum payment.

<sup>13</sup> The site of the SHP-plant and the installed capacity of a new hydropower plan, shall be strictly in line with the details specified in the project proposal. The actual installed capacity shall be no less than 90% of the proposed, and the cascade development of a river shall not negatively impact the construction of cascade stations at upper and lower reaches. Any modification shall be subject to an approval.

The inefficiencies in the approval and supervision process lead to the problem of an increasing number of power stations with the “four withouts”, as the situation is called in China: Hydropower plants that are without either (i) proper project approval, (ii) design that fulfils the norms, (iii) final official acceptance after construction or (iv) professional management. It is estimated that there are more than 3,000 such hydropower plants in China; in Sichuan there are hundreds of such stations and in Yunnan there are 21. About 30% of generating capacity installed during the last ten years may be illegal. Provincial regulations define sanction for breach of regulations: A hydropower project built without approval from the provincial planning, water resources and electric power administrative sectors, and not conforming to the planned and approved development is not allowed to be connected to the grid and the sale of electricity. But presumably the need for power locally overrides compliance with these rules also.

## **2.3 Financial Framework for Investments in SHP-Plants**

### **2.3.1 Power Tariffs**

Tariff setting in China is an extremely complex and sensitive matter involving several governmental agencies and stakeholders with conflicting interests.<sup>14</sup> In 2000, SDPC adopted a tariff setting method for power generators establishing the following:

- Tariff set at the time of commissioning will be designed to yield a financial internal rate of return (FIRR) on equity of four percent higher than interest rates for long term loans, over an operating period approximating the design life of the project; for hydropower this is 30 years.
- Assumed loan terms are 20 year maturity (for hydro) current long term interest rate (local loans), actual interest rate foreign loans.
- Assumed operating costs are equal to the average operating costs of plants of similar type and size operating in the same grid.
- During the operating period, if cost fluctuation due to changes in fuel prices, interest rate or exchange rates exceeds five percent, tariff may be adjusted.
- Tariff structure reflecting time of day and season will be introduced.

Yet, investors and consultants criticize that the fixing of SHP electricity prices lacks standardized policies and regulations.<sup>15</sup> The price setting methodology is said to lack a sound basis, inter alia

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<sup>14</sup> Since 1983 when China introduced its "new power new price policy" the tariff to be charged by new power plants has been calculated in accordance with a debt repayment formula with the tariff subject to approval by the provincial Pricing commissions and ultimately SDPC. Under this procedure, projected tariff is calculated at feasibility stage and the approval to proceed with the project based on the competitiveness of the projected tariff. The actual tariff is not calculated until the completion of the project taking into account current conditions including actual cost and debt servicing projections at the time of Commissioning. If after initial approval of tariffs cost factors (operating cost, inflation, foreign exchange rate adjustment) change significantly, then the power plant can apply for a tariff adjustment.

<sup>15</sup> Lack of internal coherence in tariff setting and regulation is a problem, not just for SHP-plants, but for power plants in general. Coal-fired power plants, for example, face the following problem. The coal industry in China has been deregulated and subject to open market competition since 1993. But whereas the price of coal is allowed to escalate freely, tariffs of coal fired power plants are highly regulated, creating a ceiling on revenues. Adjustments in tariffs

because of the evident mismatch between the length of loan maturity foreseen on the formula and the maturity of loans actually available on the market. The negotiations on electricity price by the local authorities are usually made based on work experience, status of the enterprise and the decision maker's understanding of the future trends of national policies.

Under the "local self-supply scheme", the tariff for the purchase price of electricity from the Provincial to a local grid is a fixed, non-negotiable price, which is the same all over the province. In 2004, the price in Yunnan was 0.316 Yuan/kWh.

The SHPs cannot sell their power to other Provinces; exports of power to other provinces are undertaken by the Provincial transmission company.

The power tariff for power sold to the provincial grid owned and operated by the State owned Yunnan Provincial Power Company will be initially approved by the Yunnan Province Pricing Bureau in accordance with principles established by SDPC. Over time it is expected that such pricing arrangements will transition towards more market oriented arrangements. The tariffs for sales of power from the local to the Provincial grid are much lower than the tariffs for purchase of power from the Provincial and depend on the season. In 2004, the tariffs in Wenshan county were

- 0.10 Yuan per kWh during rainy season
- 0.12 Yuans per kWh during normal season
- 0.20 Yuan per kWh during dry season

For reference purposes, the table below summarises the retail power tariffs in Jianshui County and some of the cost components.

Price paid for bulk power coming from SHP	0.292 Yuan/kWh
Line losses in distribution:	13%
Average retail price:	0.45 Yuan/kWh
Price for industries	0.38 Yuan/kWh
For irrigation use:	0.22 Yuan/kWh
Household	0.432 Yuan/kWh
Commercial:	0.73 Yuan/kWh

The price to connect to network is : 0.05-0.1 yuan/kWh

Traditionally, worldwide, hydropower plants have been established on the basis of a "guaranteed market" either formally through a long-term PPA with an off-taker for all or the majority of the output or de facto, as a distribution company would invest in a hydropower plant. In countries that operate competitive power pools, hydropower plants sell their output through a mixture of long-term contracts and by bidding directly into the day-to-day or hour-to-hour pool. Whereas large-scale power plants tend to be very price competitive on the pool market in both the short and the

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occur but with delay. The National Development and Reform Commission (NDRC)'s decided in December 2003 to raise tariffs by around 2% to pass through an approximate increase of 7% rise in coal prices. To counteract the tendency of rising coal prices, the Chinese government is planning to consolidate the coal industry to build 10 mining conglomerates, each capable of producing more than 50 million tons of coal annually, in search of economies of scale and lower costs.

long term,<sup>16</sup> SHPs on average have higher costs of production than larger power plants and need higher tariffs to break even. Many countries, therefore, have promotion policies for SHPs that give these access to guaranteed preferential tariffs. The standard PPA-tariffs for SHPs are normally based on the avoided cost pricing principle, which is applied in different ways in national schemes. Variations concern:

1. whether the tariff is divided into seasonal variations during the year: kwh-tariff paid is higher during peak season than during off-peak season;
2. whether the tariff is differentiated according to the time of power supply (avoided cost of thermal power depends on the time of day);
3. whether it is split into a capacity payment (kW-tariff) and an energy payment (kWh-tariff); (avoided cost in the short term refers to savings in variable cost – mainly cost of fuel; in the long term it includes savings in thermal capacity),
4. whether the tariff is adjusted annually or multi-annually during the years of the length of contract and how the adjustment is linked to specific indexes; (avoided costs change during the years due to changes in the price of fuel, general inflation, exchange rate)

The Rural Hydropower and Electrification Bureau in the Ministry of Water Resources has submitted a proposal for the introduction of a standard PPA-tariff for SHP-plants for approval by the central government. The Bureau justifies the need for a standard “SHP-PPA” with reference to the upcoming introduction of a competitive pool. The Bureau assumes investments in SHP for selling power to the Provincial grid will be larger if SHPs do not have to compete directly with conventional power plants. In addition, the Bureau proposes the standard-PPA as part of a policy package that also combines incentives and restraints.

The proposal is to offer a fixed selling price for newly built run-of-the-river hydropower plants of 0.25 Yuan per kWh, 0.18 Yuan per kWh for renovated hydropower stations, and of 0.27 Yuan kWh. SHPs with storage capacity sufficient to provide power for over 15 days.

In the absence of a nationwide policy as proposed by the Bureau, provinces are implementing widely different tariff regimes, making pay-back periods of otherwise similar SHP-projects vary strongly according to the province’s tariff policy. Zhejiang province in eastern China, the average electricity selling price to the grids for SHP stations with regulating reservoirs exceeds 0.45 Yuan per kWh. In Zheijiang, therefore, the pay-back period of a SHP-project, comprising the whole period from planning, registering and construction is usually around 10 years; in Western provinces, the pay-back period is usually around 20 years.<sup>17</sup> The Provincial Congress of Guangdong province

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<sup>16</sup> Hydropower plants will always be able to sell all their output to power pools, because their variable costs of production are lower than the variable costs of thermal power production. Due to their short-term price competitiveness, they are first in the merit order of power scheduling. The clearing price in the pool is, therefore, always set by the marginal thermal power plant.

<sup>17</sup> In their competition to attract SHP-projects, many local governments tend to promise orally the high electricity price during the initial period of project preparation. For instance, in Hubei, Sichuan and Guizhou provinces, the electricity selling price promised to developers was about 0.38 Yuan per kWh. But the actual selling price of electricity in these provinces is 0.15-0.22 Yuan per kWh, while the seasonally adjusted average sales price of power to the Provincial grid is 0.28 Yuan per kWh. On Wenshang prefecture’s internet of political affairs, the two hydropower stations of Kana and Xiaolongtan are still inviting the investment. The predicted financial benefit is the annual power generation 148 mil

in 1996 adopted an act entitled “Decision on Acceleration of Rural SHP Development”, a local regulation with the force of law. It defines the priority of development, of integration into the grid and of purchasing electricity from SHP, streamlines the administrative approval process and improves the procedures for fixing the power tariffs and financial subsidies. After execution of the “Decision”, the selling price of rural hydropower for the whole province reached 0.3 Yuan/kWh or more, compared with 0.176 Yuan/kWh before the “Decision”.<sup>18</sup>

### 2.3.2 Project Finance

Equity investors in SHP-projects were typically generation and financing companies owned by provincial governments, with limited participation by municipal and county owned partners.<sup>19</sup> For the very large projects national development financing companies such as the State Development Investment Company are involved. Debt financing for these developments is now generally provided by syndicated loans from Chinese commercial banks, for the very large projects China Development Bank financing may be involved. During later years, SHP-projects have increasingly been taken up by private investors.

The cost of investment in a SHP-plant is typically in the range of 5000-6000 Yuan/kW. Spread over the lifetime of a hydropower plant, the amortization of the cost of investment represents over 80 percent of the cost of production per kWh. Hydropower projects, therefore, depend totally on adequate financing terms to be competitive with thermal power generation.

In China, the financing conditions are very good.

Project developers are required to come up with *equity finance equal to 30%* of the project investment. Normal practice for SHP-developers is to put the equity finance together through direct contacts with partners and acquaintances. Due to the large number of investment opportunities in China that offer high rates of return, the *rate-of-return-on-equity* demands of potential investors are, however, at least 20-25 percent.

It is relatively easy for SHP-developers to get access to 5-10 year loans from either the *Construction Bank* and/or from the *Agricultural Development Bank* of China. The rate of interest is 5.75%. For middle-sized SPHs it is easy to get a bank loan because of short payback times.

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kWh, sale revenue 50 mil Yuan and profit 30 mil Yuan. The revenue that the government lists is divided by the annual power generation, the price for per kWh is on average 0.34 Yuan. These tariffs would result in a 4 years pay-back period. However, the purchase price of Wenshan Power Corp is 0.12 Yuan per kWh during the rainy season and 0.18 Yuan per kWh during the dry period, which is from December to April. After commissioning, the total power generation of Xiaolongtan is 140 mil kWh, 110 mil kWh during the rainy season and 30 mil kWh during the dry period. This yields a gross theoretical income of Xiaolongtan hydropower station of around 18 mil Yuan, with the averaged electricity price 0.13 Yuan kWh, and a pay-back period of at least 10 years.

<sup>18</sup> The act also provided for incentives for construction of SHP from social forces; leading to investments in 1,200 MW of rural hydropower installations during the 5 years from 1996-2001.

<sup>19</sup> The prefecture and county owned companies are able to contribute appropriate amounts of equity from existing hydropower revenues, the main impediments to development of projects in the size range of those proposed under the project are project development institutional capacity and lack of creditworthiness with local commercial banks.

Government economic policy interventions to control over-heating of the economy, can, however, block the granting of loans. In early 2004, for example, the Government ordered the banks not to give loans to SHPs below 5 MW as part of its measures to stop inflated economic expansion.

When a local county level bank is approached for finance, a potential problem is that the size of the required loan may be higher than the legal exposure level of the bank to a single project. Another problem is that local banks do not give “project finance”, but require collateral outside the project itself for security. What complicates the matter of collateral even further is that the regulations of the bank may not allow it to use an investor’s assets in another province as mortgage.

Central government and local governments grant *low-interest loans* for SHP construction for which the repayment period is around ten years. If the SHP-plant-project is classified as a project, which *reduces local poverty*, it is eligible for loans with an *interest rate of 2,4%*. These loans need approval by Provincial Government as the Provincial Bureau gives the interest rate subsidy.

The Bureau of Rural Hydropower and Electrification Development, Ministry of Water Resources, its affiliated economic entities, and the related provincial (regional, municipal) hydropower groups or companies are authorized, in coordination with the State Development and Reform Commission, Ministry of Finance and banks, to be in charge of the supervision, management and operation of the low-interest loans, and their rolling utilization.

Although it is customary for investors to take contact with a local bank for finance early in the project investigation stage, investors may also go ahead with the construction of a project making use of their equity finance, and then start negotiating with banks to get loans for rest-finance. An investor may, for example, use his own equity to finance the first cascade of a project and then seek a bank loan to finance the next.

### 2.3.3 Incentive policies for hydropower

In China, the definition of small hydropower comprises plants up to a plant size of 50 MW. The incentive schemes for small hydropower comprise an array of *fixed incentives* provided by the state and the Province and *plant-specific incentives* that are negotiated with the prefecture, country and local governments. Despite claims about increasing competition for hydropower projects, it seems that the negotiating position of investors for getting access to local incentives is quite strong. Local Governments in Yunnan seem to have the perception that investors can choose between many alternative projects in Yunnan and other provinces, and that they therefore risk losing out to projects in other communities.

The present portfolio of subsidy instruments is strongly dominated by support schemes that are financed by the public budget, very little use is made of cross-subsidies within the power system, see the overview in the chart below.

*Subsidy Instruments for Small Hydropower Plants: Sources of Finance and Subsidized Items*

Sources of Finance	Subsidized Items		
	Cost of investment	Price of output	Operating Costs
Public Budget Finance Instruments	<ul style="list-style-type: none"> <li>Soft loans to investments</li> <li>Import duty reduction</li> </ul>	<ul style="list-style-type: none"> <li>VAT on output 6% instead of 17%</li> </ul>	<ul style="list-style-type: none"> <li>Reduced tax payments during</li> </ul>

	<ul style="list-style-type: none"> <li>• Government guarantee for foreign soft loans</li> <li>• Reinvested profits free of taxes</li> </ul>		initial years
<b>Electricity Invoice financed Instruments</b>	<ul style="list-style-type: none"> <li>• Transmission line financed by regional power company</li> <li>• Very shallow connection costs</li> <li>• Financial support to SHP-investments from Provincial grid company</li> </ul>	<ul style="list-style-type: none"> <li>• Premium tariffs for electricity generated by small hydropower</li> <li>• 0.02 Yuan levy per kWh-consumption for Rural Hydropower Funds</li> </ul>	<ul style="list-style-type: none"> <li>• Incremental balancing costs of seasonal variations in power supply are not charged</li> </ul>
<b>Greenhouse gas payments</b>		<ul style="list-style-type: none"> <li>• CER revenue/kWh?</li> </ul>	

The central government grants a number of incentives to SHP as part of its policy to encourage investments in rural electrification. Since 1994, the policy of 6% value-added tax was levied for SHP, versus that of 17% for large hydropower and large grids. Company profits, including those from power generation, are in principle subject to an income tax of 33%. Hydropower plants in Eastern Provinces pay 33% in company income tax, SHPs in Western Provinces, however, are charged 15% only, and, furthermore, enjoy a tax holiday during the first three years of operation and a rate of 7.5% during years 4 and 5. Under the “Electricity supports electricity” policy, all profits from SHP stations and local power grids that were reinvested in SHPs are exempted from company tax. In the year 1996 alone, profits from the stations used for further developing SHP nationwide reached 480 million Yuan.

In addition, central Government provides special loans for developing SHP and rural electrification. With financial support from local governments, Rural Hydropower Development Funds were established. In rural areas with power supply from SHP, a levy of 0.02 Yuan per kWh was levied on power consumption to raise money for these Funds.

The tilt towards “taxpayer paid subsidy instruments” reflects the absence until now of a coherent national regulatory framework for power. As a more coherent system is now emerging, the balance is likely to shift towards “electricity invoice paid” financing instruments. The Rural Hydropower and Electrification Bureau level in the Ministry of Water Resources of the central government is currently developing a new conceptual strategy for incentive policies for SHP.

### 2.3.4 Fees and taxes to pay

The land compensation fees, resettlement fees, land cultivation fee, occupation fee, income tax, VAT are to be fixed in a favorable manner according to the related laws and regulations.

The conditions related to the payment of company income tax are described in section 2.3.3. The Construction tax of 5.5% paid to the local Government.

Upon commissioning, the developer must pay a quality control fee for acceptance by the authority of the quality of the plant.

The fees for water rights are fixed in Document of Yunnan Government 71.2004, which beginning July charges the following fees for water use by run-of-the-river hydropower plants<sup>20</sup>:

<sup>20</sup> When a lake is used as water reservoir, the fees are 0.1, 1.1 and 1.5 Yuan/kWh.

- SHPs (<50 MW) 0.4 Yuancents/kWh
- Medium hydropower plants (50-250 MW) 0.7 Yuancents/kWh
- Large-scale hydropower plants (>250 MW) 1.0 Yuancents/kWh

50% of the revenue from the water resource fee accrues to the Provincial Government's Water Resource Bureau, 20% to Prefecture Government and 30% to County Government.

## **2.4 Issues related to Financial Framework**

Except for the absence of access to 15 or 20 years loans, the terms of project finance are satisfactory for SHP-investments. The mismatch between debt maturities and asset life is onerous for hydropower because new SPDC tariff policies assume loan maturity approaching asset life (18-25 years) whereas maturities for bank loans are 10 years.

The absence of well-defined rules for tariff setting gives some uncertainty to the initial investment. Yet, overall, the issue is not that investors in SHPs are not offered a good deal, the real issue is rather that the economic incentives for investment due to the absence of any bidding for either the tariff or the water use/land right favourable project finance, subsidies to investments and to operation, low fees for water use and in some cases generous tariffs do not provide a good balance between the private investor interest and the local community/Province.

The balance is tilted in favour of the investor.

## **3 Impressions from Field Visit**

### ***3.1 Scope for hydropower projects in Yunnan***

Yunnan shares a western border with Myanmar, and a southern border with Laos and Vietnam, and covers an area of 394,000 square kilometers.

The theoretical hydro power potential of Yunnan province is 106 mil kW and exploitable resource 96 mil kW, representing 1/4 of the national exploitable potential. The medium and small exploitable resource amounts to 17.4 mil kW which represents 1/5 of the national medium and small exploitable resource. By the end of 2003, 1568 medium and small hydro power stations have been built with the total installed capacity of 3.52 mil kW.

Most of the medium and small exploitable resource has not been tapped yet so far in Yunnan province. And around 3 mil population is still under poverty and nearly 5 mil population is just out of poverty but still in the situation of being economically unstable. Some 3 mil people face difficulty in having water and 2.70 mil people do not have access to electricity. The Province is slow in developing the medium and small exploitable resource and the development level is low. The electricity consumption per capita is less than 75% of the national average level. The electricity consumption in the minority, frontier and poverty-stricken areas in the province is around 35% of the provincial average level.

Yunnan province has worked out the developing plan for exploiting the medium and small exploitable resource: between 2003 and 2010, 3 mil kW will be constructed for medium and small hydro power development; Before 2020, medium and small hydro power installed capacity will exceed 10 mil kW, forming the pilot grids of 110 KV at the county level, basically forming the network structure in prefecture and urban areas and pushing forward the grid connection at the province level. The trans-province and trans-country grid connection is encouraged in the frontier areas so as to realize the optimization resources.

The big and huge hydro power projects in the initial stage in Yunnan province include: Xilodu hydropower station with installed capacity of 12.6 mil kW, Xiangjiaba hydro power station with installed capacity of 6 mil kW and Jin'anqiao hydro power station with installed capacity of 2.5 mil kW at Jinsha River, Jinghong hydro power station with installed capacity of 1.5 mil kW at Lanchang River and Nuozadu hydro power station with installed capacity of 5.85 mil kW at Lanchang River. Hundred billion RMB Yuan has input in the hydro power development in Yunnan province for "West Electricity for the East China", the boom never experienced in the past.

However, after the completion of the numerous big and huge hydro power projects, while the hydro power stations compete for entering the grids, those medium and small hydro power stations are in a weaker position. So, the medium and small hydro power stations should at least put into operation two or three years before the completion of the big and huge hydro power project so that there is a period of time for returning the investment to alleviate economy pressure.

At present, over 20 medium and small hydro power stations with installed capacity of over 2.3 mil kW have started construction and hydro power projects of over 6 mil kW are now under preparation. Over 10 big investors from Beijing, Shanghai, Zhejiang, Hunan, Guangdong and Fujian provinces are asking for investment in the medium and small hydro power projects.

By June 2004, 18 institutions in and out of Yunnan province had signed agreements with related prefectures and counties and planned to invest 2.35 bil Yuan to develop 27 medium and small hydro power projects. At Import & Export Commodity Fair of Kunming in 6-10 June 2004, 8 bil Yuan fund was attracted by agreements for investing in medium and small hydro power projects, with the installed capacity over 1.2 mil kW.

### **3.2 Wenshan County**

Wenshan City Prefecture consists of 8 counties with a territory of 31,456 km<sup>2</sup> and a population of 3.32 million. Wenshan city itself, founded around 1990 has a population of 400,000 and is very fastly growing. The prefecture has a very dynamic Government, which gives very positive treatment, incentives, information assistance and other administrative support to investors.

Five of the counties are connected by an isolated prefecture grid, the other three are connected to the Provincial grid.

Wenshan county has a territory of 2.972 km<sup>2</sup> and a population of 435,000 of which 314,000 are rural. Average income, in particular of the rural population is substantially below the national average. The county has an electrification rate of 92%, will reach 99% by end-of five year plan. Average consumption per capita of 400 kWh/year - for farmers 300 kWh – is expected to increase to 500 kWh by end of the present five year plan.

Wenshan county has first class hydro-resources being part of the red river and Huonkong river region. Thanks to annual rainfall of 1196 mm rain, the county has on average 1,348 billion M<sup>3</sup> of water per year. The county has 93 kms of 110 kV transmission lines and 140 kms of 35 kV distribution lines. The potential hydropower sites in the country permit the development of 10 GW of hydropower capacity. Installed hydropower capacity early 2004 was 230 MW increasing to 300 by year-end. All are run-of-the river plants. During the dry season the installed hydropower capacity results in power shortage, as the plants produce at 1/3 of their design capacity, whereas there is water overrun during the rainy season. Only 11 SHP with a capacity of 55.15 MW have been established so far. These are state-owned, but private investors are encouraged. Electricity production in 2003 was 244 million kWh.

Low local demand for power and weak infrastructure for transport of power to the provincial grid limit the possibilities for large scale development of local hydropower capacity.

### **3.2.1 Incentive policies for private investment in SHPs**

The prefecture and the county have introduced a “one stop service” for assisting investors with the project approval process, and a social watchdog system to supervise the work.

For hydropower investments, the county offers for each 100 yuan of investment, 5 yuan in support.

The formula used to calculate the tariff of the PPAs with SHPs is claimed to use a sound methodology for calculating the repayment period of the project.

### **3.2.2 Experience with PPPs**

A water reservoir for increased water supply to the city is being built upstream of Panong River. The water reservoir will have a capacity of 57 million m<sup>3</sup> and require an investment of 220 million Yuan. Half of the construction was finished in July 2004. The reservoir itself is a public investment financed by a mixture of local and provincial loans. The transport pipeline of water to the city, connecting the reservoir with the municipal water supply system is financed by a private investor under a public-private-partnership (PPP) scheme.

The reservoir will have a 5MW hydropower plant attached.

## **3.3 Jianshui County**

### **3.3.1 Basic background**

Jianshui County, located 220 km from Kunming, has a population of 510,000 people.

The county has 22 rivers with 333 km length. Annual rainfall of 907 mm provides 743 million m<sup>3</sup> water volume on average. Theoretical hydropower potential in the county amounts to 570 MW, of which 270 MW can be developed. Peak demand at prefecture level is 280 MW. The local distribution company in 2003 got 330 million kWh from the Provincial grid, 400 million kWh from private SHP and generated 200 mill kWh from self-owned plants.

The county has several SHPs, some of whom have their own grid. The county owns a system of 6 MW of power stations organised as shareholding company. It generated 12.58 GWh in 2003.

The planners expect that new investment in SHPs by the year 2010 extent will increase the share of supply coming from SHPs to about 40%.

### **3.3.2 Tariffs for hydropower**

The tariff for supply from the Provincial grid is 33 cents. The tariffs paid to SHPs during the rainy season (June-October) is 10 cents, 15 cents in the middle season (November-December), and 20 cents during the dry season (January-May).

### **3.3.3 Hydropower projects**

The biggest existing privately owned SHP station is 800 kW, and in operation since 1999. The rate of return on the investment was calculated at 12%. The SHP, which uses a simple technology, has operated non-stop at full output except for maintenance periods. Water head is 20 meter. The distribution line is 10 kV.

An investor, a JSC from Guandong Province has established a small company locally to invest in a 130 MW hydropower plant. In July 2004, the investor was doing the feasibility study for the project.

Five other new SHP-projects are in the pipeline, the first three by local investors, the fourth by a big manufacturing company and the last by a Kunming-based investor:

- A hydropower plant of 12.9 MW consisting of three stations
- A 1.4 MW power station
- A 320 kW power station
- 40.2 MW cascade by private investor. Prefeasibility study done by private investor. In negotiation. 520 m Yuan. Big mineral manufacturer requires 3 m kWh and invests in the power station.
- A Kunming investor has a 1 MW hydropower plant ins the prestudy stage.

### **3.3.4 Incentive policies**

As a general principle, the Government will not invest in SHP. The first priority for the local government is to get local companies to investment in the plants. When local investors are incapable of it, they attract bigger companies from the outside.

The go vernment does not use tenders to attract the attention of investors. Investors take the initiative themselves to come and discuss possible investment opportunities with the local Government.

## **3.4 Conclusions from Site Visit**

The local administrations give strong support to private investors interested in investing in the region, including in SHPs.

The administration is open-minded to experiment with PPPs in different constellations.

## 4 Recommendations

### 4.1 Relevant Benchmarks for Evaluation of Framework

There are three key benchmarks, against which the performance of a proposed scheme for private investments in small hydropower can be judged.

1. The *administrative system for approvals* must *minimize the costs of transaction*, one element of which is the average number of months that pass from the pre-feasibility stage to the commissioning of the finalized hydropower plant.
2. The regulatory and incentive framework must adequately *balance the interests of the private sector and the public sector*. A balanced approach secures public and private support for hydropower projects, reducing tensions that risk creating a stop-go development.
3. The contracts must *maximize the power system benefits* from the specific characteristics of hydropower.

For a *private investor*, the ideal framework for investments in hydropower has six key elements:

1. The capital market can provide long-term and low-cost project finance to investments in hydropower.
2. There exist published and clear policy guidelines that coordinate project approval process of involved authorities, and advise these on how to proceed.
3. There are transparent bidding process for hydro-sites and/or for PPAs
4. A long-term PPA with standard features is signed with a creditworthy purchaser
5. There are clear rules for dispatching by system operator
6. The policy environment observes the rule of law: political respect of contracts

The ideal framework seen from the *public's perspective* satisfies six conditions:

1. The PPA reduces the cost of regional power supply
2. The payment scheme and operating conditions for hydropower do not distort the general market rules for the buying and selling of bulk power
3. The output of hydropower stabilises prices on the power market
4. Local communities near the project site get long-term benefits from the project
5. The operation of the hydropower plant follows efficient dispatching
6. Any environmental damage from the hydropower plant is acceptable and minimized by adequate mitigation measures

## **4.2 Recommendations for Regulatory Framework**

### **4.2.1 Further streamlining of project approval process**

The one-shop organisation structure practised by Wenshan County for processing applications for from investors for SHP-projects has merits to be a standard feature in counties with potential hydropower resources. The one-shop organisation can be called the SHP development group and is established by the county committee and county government.

The local Government has the comparative advantage in dealing with the resettlement issues, including finding new land for the population that is resettled. It is recommended, therefore, that the Government takes over the process and charges the full cost of resettlement, including all administrative expenses to the project developer.

### **4.2.2 Avoiding occupation of project sites by speculators**

The problem of occupation of project sites by speculators who are not genuinely interested in developing the project themselves can be avoided, or at least greatly reduced, by three measures.

The first is to fix qualification requirements (eligibility criteria) for accepting to grant developers a license for the development of a site.

The second is to ask developers to pose a performance bond, which is triggered if the investor by a certain date has not submitted a feasibility study of acceptable quality to the Planning Commission and to the Water Bureau.

The third is to replace the single SHP-license by the issue of three different licenses, one for each project phase:

- a time limited project preparation license for a given site;
- a time-limited project development license for the period from the start of construction till commissioning;
- an operating license for the SHP upon commissioning of the site.

What must be prohibited through the adoption of a Provincial regulation is the signing of so-called Memorandum of Understanding, MoUs between developers and local communities and/or prefectures for the development of a site into a SHP-project. A MoU blocks development by other developers of the site without imposing any de facto legal obligations on the developer.

### 4.2.3 How to achieve a better balance between private and public interests

An approach to achieve a better balance between private and public economic interests in SHP projects comprises three elements:

1. Standardising basic terms for SHS-projects across Yunnan Province to avoid a race between counties and prefectures in terms of offering extra-favourable economic incentives to investors
2. Implementing institutional procedures to increase competition between projects
3. Introducing a variable resource rent fee to shift a maximum of the economic surplus of a SHP to the public sector

### 4.2.4 Introducing standard economic terms for SHP-projects

Once the proposal of the Rural Hydropower and Electrification Bureau in the Ministry of Water Resources for the introduction of a standard PPA-tariff for SHP-plants has been implemented, investors in SHP-plants will face a number of fixed economic parameters:

- The PPA-tariff is fixed and paid for by the transmission company, which is the off-taker for all power coming from the SHP; alternatively, if local demand is sufficiently high, the local distribution company could also be the off-taker under the new rules.
- The water resource fee is fixed
- The rates for local and government taxes are fixed
- The administrative fees are fixed as well

That provides a good transparent framework, which eliminates the real and psychological pressure on local governments to offer investor better terms in order not to risk that they seek out another SHP-project instead.

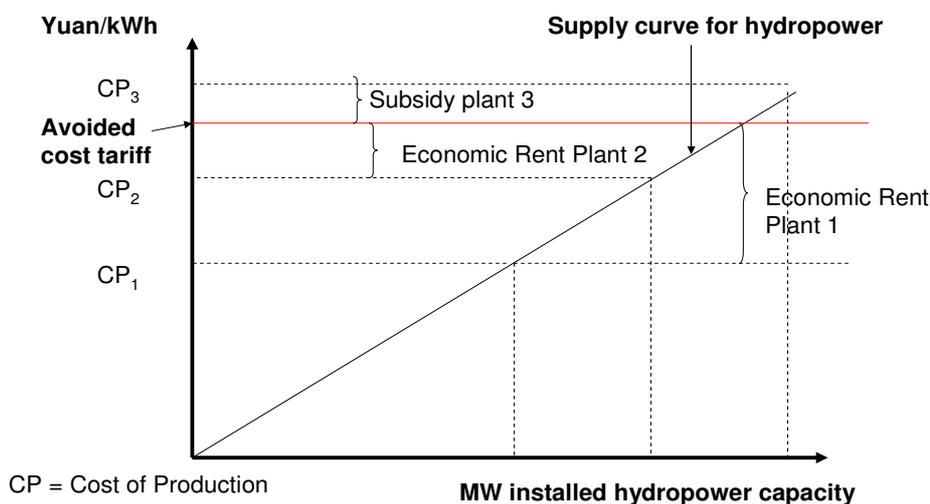
In order to avoid as little distortion on the power market as possible, it is strongly recommended that the PPA-tariffs are differentiated not just by season (rainy season, dry season, and possibly a third “normal season”) but also by time-of-day (peak and off-peak). This tariff-system has the advantage of contributing to long-term price stability on the market (part of the supply on the market has a pre-determined fixed price), yet it reduces price distortions (difference between free spot market price and fixed PPA-tariff) to a minimum and offers investors a clear economic signal about the rate-of-return on the size of water storage, which the design of the SHP should be aim for.

### 4.2.5 Economic rent in SHP-projects under a standard PPA

With fixed rates for tariff, fees and taxes and site-dependent costs of production per kWh, some SHP-plants under these terms will break-even, some will make a super-profit, and some will not be financially viable investors, although they may represent the least cost solution for power supply to the local grid. A super-profit is a profit, which is higher than needed to motivate investors to invest in a project and produce a product. When caused by differences in resource endowments, it is called “economic rent”. In the chart below, the SHPs 1 and 2 have costs of production  $CP_1$  and  $CP_2$

that are below the PPA-tariff (“avoided cost tariff”), whereas the cost of production  $CP_3$  of plant 3 is higher than the PPA-tariff.

## Economic Rent in Hydropower



SHPs 1 and 2 generate a substantial “economic rent”, meaning that the remuneration for the power output results in a *project a rate of return*<sup>21</sup> and a *rate of return in invested equity capital* that are higher than normal rates of return in the power industry. The size of the economic rent that accrues to the owners of SHPs 1 and 2 can be reduced by imposing a resource rent payment on the projects with SHP1 paying a higher resource rent than SHP2. Ideally, the resource rent is determined by asking competing investors to bid for the right to develop the two projects. When there is not competition, the resource rents will be determined by the outcome of bilateral negotiations between the private investors and the local authority authorizing the project.

The resource fee can be charged in the form of a *single upfront payment* (a concession fee for the site) or as an *ongoing resource rent fee per sold kWh*. The public interest is best served by a per kWh fee. Private investors ask for higher rates of return than public investors. Whereas a private investor looks for a 15-25% rate of return on his equity investment, a public authority is satisfied with a 10-12% rate of return on public investments. The NPV of a resource fee per kWh paid during future years – using the public discount rate – will therefore be lower than the upfront payment, which the investor would have been willing to pay. Due to higher discounting, a private investor values later payments less than public investors: the upfront payment offered by the private investor would be equal to the per kWh resource fee discounted with his high discount rate.<sup>22</sup>

The SHP3 plant, on the other hand needs to get access to subsidies to break even. For this China already has subsidy instruments such as low-interest rate loans for poverty reduction projects.

<sup>21</sup> Financial Internal Rate of Return, FIRR.

<sup>22</sup> It is the same mechanism of differences between private and public sector rates of discount that explains the popularity of incentive schemes where the public sector offers investors in capital intensive projects a tax holiday of 2-7 years (no company income tax).

## 4.2.6 Increasing the level of competition for development of SHP-projects

Public investment in information on available water resources and in initial cost-of-investment estimates for promising SHP-sites and making this information publicly available by putting it on a website for propagating local development opportunities, is an efficient way of attracting more private sector interest and increase competition.

The county or prefecture government can use funds from the public budget or take a loan from a bank to contract a qualified institute by way of bidding to provide information on the amount of the exploitable hydropower potential and initial cost estimates. The cost of that can be recuperated by later charging the cost of the contract to the investor who gets the concession for the project as part of the project administration fees.

The local authorities can use the project information to organise a tender for the project, with the winning bid being decided on the basis of the highest resource fee per kWh that is offered. When no tender is organised, the information will still serve as a basis for determining the direct bilateral negotiations about the size of the resource rent to pay for getting the concession for the project.

The revenue from the resource fee would be shared between the local community, prefecture and Provincial government according to a fixed formula, as is the case for the water use fee.

## 4.2.7 Setting up a interest organisation for investors in SHPs

In the new market economy for the power sector, the economic situation of SHPs will be influenced by the rules that are adopted for the operation of the spot market for power, including fees charged for grid connection, transmission, cost of balancing power, bill settlement, etc. To defend their economic interests, it is a direct advantage for SHP-owners - and indirectly also for communities housing sites for SHPs<sup>23</sup> - that an interest organisation is set up to represent their voices in discussions and negotiations on new market rules and fees. The association will provide legal assistance in tariff disputes, give technology information and other services to members.<sup>24</sup>

## 4.2.8 Improving the quality of supervision

Governments at each level should seriously follow the procedures outlined in the document "Announcement on strengthening the Quality Management of Infrastructure" by the General Office of the State Council (1999 No 16) so as to ensure the quality of the engineering and that rules on tendering are followed. The water and power sector authorities must strengthen the inspection and supervision of projects during construction and operation.

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<sup>23</sup> The lower the costs are for the participation of SHPs in the market, the higher is the tax revenue and the resource fee.

<sup>24</sup> The experience from Zhejiang province shows that the work by the SHP association has become a necessary element in the management of the hydropower sector. The status and the role of the association are being recognized gradually by the people. In Lin-an county, 74 SHP enterprises united and used the law as weapons to resolve the VAT 11% issue. In Tiantai county, SHP enterprise association tried every way to resolve the energy billing issue. In Yongjia county, SHP enterprise association, on behalf of the station owner, settled the feed-back policy of the substation.

## **4.2.9 Local ownership**

The local population gains from the investment in a locally located SHP through employment opportunities during construction and operation (very modest) and through the increase in local taxes and fees from the revenue of the SHP. Further local benefits can be gained by making it compulsory for SHP-investors to offer the local population to purchase a certain percentage of the equity shares in the company, against paying the market price. The very low risk of shares in a SHP-plant with a fixed PPA-tariff and guaranteed off-take of its power, makes shares in these an ideal investment for households.

## **4.3 Project Finance**

### **4.3.1 Cofinancing of investments by transmission companies**

As the state owned transmission companies are likely to get loans at longer maturities and lower interest rates than the private investors in SHPs, it is possible to reduce the cost of production (and thereby increase the state income from revenues coming from the resource fee) by letting the transmission company undertake most of the cost of investment in connecting a SHP with the nearest transmission line. The transmission company would recuperate the annualised cost of the investment through an annual connection fee charged to the SHP.

### **4.3.2 Longer-term loans**

The fixed PPA-tariff to be offered to SHPs can be reduced by making loans with maturities longer than 10 years available to SHP-projects – 15 year or 20 year loans. Yunnan Provincial Government can take the initiative and discuss with banks operating in the Province the possibility to offer such loans to SHP-investments and to let participating banks “securitize” new loans given during a year through a 15-20 year bond issue backed by the revenue of these loans.

## **4.4 Improving the Grid System**

### **4.4.1 Grid planning**

The implementation of the planned standard-tariff for sales of output from SHPs to the grid calls for reforms and investments in the grid system for transmission and distribution if it is to function efficiently. The intention of the scheme is to give output from SHPs priority in daily power generation scheduling. Bottlenecks in transmission capacity prevent SHPs from generating at full capacity during the rainy season, a situation that leads to spillage of water to prevent current

overflow. This requires the development and implementation of a rational plan for the expansion and reinforcement of transmission grid to allow ongoing and foreseen investments in medium and small hydropower plants in Yunnan province to feed their full potential power output into the grid also during the rainy season when all hydropower plants are producing at peak capacity.

#### **4.4.2 Consolidation of small grid companies**

The State's power sector calls for the separation of the ownership of power generators and ownership of the grids they are connected to. As currently, many SHPs still have their own small grid system, it is recommended to assist the consolidation of small county level distribution grids into regional distribution companies jointly owned by the affected county governments. This step can accelerate the integration of these with investments in the expansion of the provincial transmission grid.

#### **4.4.3 Dispatching and rules for selling output from SHPs**

Market rules for system operators/dispatchers obliging these to give preference to generation from SHPs are a logical component of a standard-tariff scheme for SHPs. One can therefore expect that the system operators will be required to operate the system in a way that allows SHPs to operate and sell at full load during the rainy season.

In view of the scattered location of SHPs in rural, mountainous areas, it would be rational to expect that the local distribution company is off-taker of all power from SHPs up to the limit of the demand in its area of demand, while surplus power is purchased and on-sold by the transmission company.

## **Annex I: Terms of Reference**

Study on Medium and Small Hydropower Resource Development in Yunnan, China  
*Task Team Leader: Mats Andersson, EASUR*

### **OBJECTIVES:**

Review the status of the key aspects with regard to facilitating public private partnership for promotion of small and medium hydropower resources in Yunnan Province, China, and make recommendations for improvement..

### **BACKGROUND:**

A Workshop for Promotion of Private Participation In Infrastructure Development in Yunnan supported by PPIAF and Yunnan Provincial Government was held on November 17-18, 2003. The workshop had demonstrated that there was great potential for private participation in the development of the rich medium and small sized hydropower resources in Yunnan and identified five key aspects that had barriers to private participation, which were:

6. policy and legal framework/gaps in developing projects;
7. regulatory framework;
8. power tariff policy;
9. optimal risk allocation among key stakeholders;
10. governmental approval procedures and how to streamline.

At the conclusion of the Workshop, PPIAF proposed a follow-up study with PPIAF funding to further clarify existing status in five aspects regarding premonition of private participation in hydropower development in Yunnan, and the provincial government expressed full support to the study.

### **SCOPE AND TIMING OF REQUIRED SERVICES:**

The assignment includes review for the Bank of the status of the five aspects stated above, with particular attention to barriers to private participation, and make recommendations regarding strategies and appropriate actions for improvements in these five aspects to facilitate private participation. The assignment will mostly be carried out during July 2004. (A separate contract with a local consultant is being arranged through the Bank's China office.)

### **SPECIFIC OUTPUTS EXPECTED FROM CONSULTANT:**

Reporting as follows:

- (a) Draft report: one week after the mission to Yunnan scheduled for July, 2004
- (b) Final report: mid August 2003.

The consultant will report to the Bank's TTL, Mr. Mats Andersson.

### **SPECIFIC INPUTS TO BE PROVIDED BY THE BANK:**

The TTL will make arrangements for the consultant to meet with the relevant entities, as required.

**REFERENCE TO PREVIOUS STUDIES:**

Before or at the start of the mission to Yunnan, the Consultant will receive papers and presentations delivered at the Workshop on Attracting Private and Public Sector Participation in Infrastructure, jointly hosted on November 17 to 18, 2003 by PPIAF and Yunnan Provincial Government in Kunming, Yunnan Province.

Yunnan provincial government authorities will brief the consultants on previous studies that may be of relevance or have an impact of the proposed study and will provide relevant documentation.

Yunnan Provincial Government Authorities will arrange and facilitate meetings, upon request by the consultants, with relevant government bodies or companies for detailed discussion on previous studies or other relevant issues.

**BUDGET**

10 days