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Transformation of Ownership Pattern of SHP in China and its Approaches of Benefitting Farmers

Cheng Xialei Yu Huimin

Abstract: *Since the end of 1990s, a diversified pattern of investment for China's small hydropower (SHP) stations has been formed with considerable changes in the ownership structure. With the new ownership structure, approaches to benefit the farmers have been constantly under innovation. Therefore, farmers have various ways of income. Research for establishment of a continuous and stable assurance mechanism could effectively give full play of SHP in strengthening and benefitting farmers.*

Key Words: *SHP Ownership Benefitting farmers*

I The Transformation of China's SHP Ownership Pattern

Before 1990s, developed mainly for rural power consumption and rural electrification, China's SHP was supported by special funds from the central government and local authority with state and collective ownerships as the main form of ownership. According to the statistics of 1996, the ownership structure of China's SHP then was: 17.3% state-owned, 80.8% collective and 1.9% others.

Since the end of 1990s, the diversified pattern for investment sources has gradually been formed along with the initiation of national investment system reform and the deepening of power system reform. Remarkable changes of the SHP station's ownership structure have taken place with the old state-owned stations being transformed into share-holding system or private ownership through property rights reform. According to the statistics of 2009, 9% of the SHP stations were owned by public institutes, 8% was solely state-owned and 4% state-held, 1% state-shared, 11% collective and 67% belonged to other ownerships which includes share holding or partnership, private ownership, foreign investment, etc. Take Lishui City of Zhejiang Province as an example, renowned as the Most Developed City for SHP in China, the government has promulgated favorable policies to actively guide non-public ownership in the development and management of hydropower. Up to the end of 2007, 4.1% of the SHP stations was community-owned, 24.6% state-owned and 71.3% share-holding. In Jingning County of this city, over 10,000 among its population of 170,000 were shareholders of SHP stations; more than 50% of all the county's population has directly or indirectly participated in the development of SHP. Almost every household holds shares of SHP station and the directly benefitted population has surpassed 70,000.

II Approaches of Benefitting Farmers through Various Ownership of SHP

Within the new ownership structure, approaches benefitting farmers have been constantly under innovation so that farmers have various ways of income.

As an important source of income for rural community economy, SHP stations of state and collective ownership have enhanced the development of community economy and improved the welfare for the villagers. For example, Diaojiaowan Village of Changle County, Shengzhou City, Zhejiang Province, is located in rural areas with a weak village-level economy. With the help from local water resources authorities, a collectively owned hydropower station with an installed capacity of 450kW

and an annual power generation of 1.2 million kWh was built in 1994, which has greatly revitalized the previously exhausted village economy and invigorated the village community economy thus enhancing the welfare of the villagers. After over 10 years' operation, the station has generated profits which have been used to repay the loan, and apart from this, 300,000 yuan was invested to install tap water for 200 households of 610 people of the village and more than 400,000 yuan was invested for the tractor road construction and the street lamp installation. Besides, those who have been admitted by universities, colleges or technical schools are awarded 2,000 yuan per person; 50 yuan is allotted to every villager on Spring Festival and 100 yuan to the senior citizens on Mid-autumn Day; the senior citizens over 60 years old could receive an annual pension of 250-400 yuan in correspondence with their ages.

Share-holding stations, through drawing local villagers collectively or individually into share-holders, have directly benefitted farmers, given access to cheap electricity for villagers or have enabled the development of public services as water supply, transportation, health care, education and others. Luoshui Village of Ruyuan County in Guangdong Province owns an SHP station with a small unit of 900kW; 49% of its shares is held by the individual villagers: each of 213 households holds one share of 2,200 yuan which generates 300-500 yuan of dividend annually. The rest 51% of the shares is owned by the village community and the profits it generates are used in collective welfare: rural cooperative medical service is undertaken by the

village committee; villagers amending their houses will have a subsidy of 10,000 yuan; other public services such as hardening of village track base, cable TV and subsidies to village cadres, etc are all borne out of the profits. Culong First Cascade Station in Jingning County of Lishui City, Zhejiang Province is owned by more than 200 share-holders of three adjacent administrative villages. The villagers enjoy favorable terms provided by the station, i.e. every household is given an annual quota of 300 kWh enjoying a low tarrif of 0.15 yuan/kWh. Besides, the station pays 50,000 yuan to the village committee as management fee.

Some privately-owned or solely-invested hydropower stations sign contracts with local authorities, or provide some of the energy at a lower price or for free, others draw a portion of fund for the compensation of the local villagers. A village in east rural area of Guangdong Province is inhabited by 23 households with a population of over 130. Its villagers had led an impoverished life because of locked transportation, undeveloped communication industry and limited farming land. A private enterprise-owner, after knowing that the hydropower resources in this village could be exploited, decided to make an investment of more than1.3 million yuan to build an SHP station with a capacity of 300 kW. After discussion and negotiation with local government, water resources authority and the villagers, an agreement was reached that the station hand over a certain amount of managerial fee and tax and build a low-cost road (for the traffic of small cars) with a length of 1.5 km, and provide electricity to the villagers at a low price and compensate the villagers for the land acquisition. The farmers were employed during construction of the station and paid for their labor; after the commissioning of the station, two youngsters in the village were employed to be in charge of attendance of water sources, the pipe culvert and the station, thus providing job opportunities for the villagers.

An indirect way for the SHP station to benefit the farmers is to increase local revenue. In counties with rich water resources, profits and tax turnovers take up a large proportion in the overall culvert revenue of the county; in many counties, more than half of the financial income is generated from SHP. The development of the overall economy of the county has spurred on the advancement of infrastructure

construction, public welfare and cultural industry, the achievements of which are commonly enjoyed by the local villagers. Wuhua County of Guangdong Province has 260 SHP stations which turn over a revenue of more than 20 million yuan to county and town governments which constitutes the main sources of income for the local governments. In Shengzhou City of Zhejiang Province, there are a total of 123 stations up to April, 2010 with a total installed capacity of 54,725 kW and average annual power generation of more than 100 GWh. The annual income from power tarrif exceeds 40 million yuan with a tax turnover of more than three million yuan.

III To Establish A Long-term Mechanism for SHP Stations to Benefit and Enrich Farmers

SHP stations are important rural infrastructure which has exerted a significant role in rural electrification enhancement, greenhouse gas emission reduction, emergent power supply, ecological environmental protection, rural living and production conditions improvement and poverty relieve and rural prosperity, etc. Till now, there are 45,000 SHP stations in China with a total installed capacity of over 55 GW and an annual power generation approximating 160 TWh. Due to limited technological and economic conditions as well as aging from years of operation, about 10,000 SHP stations which were built before 1995 are now quite low in unit efficiency with large amount of water resources abandoned, many potential safety risks and little economic return. If not being refurbished in time, most of them will have to be discarded, which will not only result in a loss of huge clean renewable energy, but also comprehensive functions such as flood control, drought resisting, irrigation and water supply, etc. Chinese government is right now carrying on refurbishing these aging stations in a planned manner.

The fund for technical rehabilitation of the stations should be collected by means of subsidies from central government, support from local government and funds raised by the owner of the stations. To ensure that the portion invested by the government could practically benefit the farmers, a constant and stable mechanism needs to be established; different mechanisms need to be created and applied for stations of different ownerships.

① For collectively owned power stations, beneficial right from state-invested part is still given to the village collectives;

② For hydropower stations with shares simultaneously held by collectives and individuals, the state-invested part may be taken as incremental capital of collective shares;

③ For private or sociaty solely invested hydropower stations, revenue may be re-distributed according to their input renovation for efficiency improvement and capacity extension under unchanged managing mode to ensure the rural collective economic organization and farmers in the project location being benefitted from the stated-invested part;

④ For old power stations with ownership already transformed, state sponsored capital could enjoy the revenue through buying into the station by township or village collectives on the basis of evaluation of residual assets;

⑤ It is suggested that the fund shortage for station renovation be settled as far as possible by absorbing investment from villagers or village collectives in the benefitted area to buy into the station for collecting capital used in station renovation for efficiency improvement and capacity expansion. Other modes such as contract energy management, financing and leasing for collecting social funds may also be attempted;

⑥ Establishment of insurance

mechanism. Firstly, regulations of construction management and special fund of financial subsidy should be set up to provide system insurance for project implementation. Secondly, legal person of the project should be designated, whose duty, right, and benefit together with obligation be clarified. Thirdly, investment representation of state-asset should be clarified to assure safety of financial fund and maintainance and application of state assets value. The property right of state-asset created by central and local governments' co-ordinated funds belongs to state-asset investor entrusted by local government to ensure its benefit serving the local farmers, village and agriculture. Fourthly, the orientation of benefit sharing, benefited results, etc. should have involvement of the sociaty for monitoring management.

To sum up, after technical refurbishment, the earnings brought by the efficiency improvement and capacity enlargement should be allotted to the investors; the benefit right of the state investment part mainly benefit local farmers, or develop public welfares such as rural infrastructure, and health care, education, cultural affairs, etc. Local government could entrust related authorities to act as the representatives of state assets and through the establishment of a benefit allocation mechanism to allocate income legally so as to benefit the farmers to the full.

IV Conclusion

Since 1990s, the diversified investment pattern for China's SHP

stations has been formed gradually. Although great changes have taken place to the structure of ownerships, the characteristics of SHP benefitting the agriculture, the farmer and the village remains; it has always been serving the rural economic and social development and benefitting rural farmers in hilly areas by various means.

As a project of public welfare aiming at efficiency improvement, energy saving and emission reduction as well as public security protection and farmer benefitting and enriching, technical rehabilitation of SHP stations should be financially supported by the central and local governments; the investment by the government could further enhance the scope and intensity of benefit for the farmers. The mechanism innovation could really ensure that governmental investment could benefit the village community and the farmers of project areas.

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About the authors:

Xialei, Cheng(1958-) : Director of Hangzhou Regional (Asia-Pacific) Center for Small Hydropower(HRC), Professor and Chief Editor of the journal Small Hydropower and SHP News. Address: 122#, Xueyuan Road (310012). Contact 0571-56729103(E-mail)xlcheng@hrcshp.org

Huimin Yu (1988-): Hangzhou Regional (Asia-Pacific) Center for Small Hydropower (HRC), Program Manager ■

Renovating for Small Hydropower in China

ZHAO Jianda WU Hao KANG Peng

In order to improve the efficiency of utilization for water resources, many renovation projects for old small hydropower stations have been carried out across China in recent years.

I Introduction

Small hydropower (SHP) is internationally well known clean renewable energy, and quite rich in China. China already had a history of 100 years in SHP development. Especially since the founding of new China in 1949, over 60 years of development, China has totally 45,000 SHP stations, with installed capacity of 59,000 MW, and annual output of 200 billion kWh, both accounting for about 30% of China's hydropower installed capacity and annual output. SHP has played a very important role in electrification in rural area without power, promoting social and economic development in rural area, protecting ecological environment, promoting energy-saving and emission reduction, guaranteeing the emergency power supply, known as the "luminous pearl" and "little sun" to rural area and won a good name among rural people. SHP installed capacity increased from about 100 MW in 1949 to 59,000 MW in 2010, with average annual growth of 29.6% (compared with China's power industry installed capacity annual growth of 11% on average).

II The Development of SHP Promotes Technical Innovation

At the initial stage of SHP development, electrical and mechanical equipment were non-standard production, so the technical key and applied research is to combine local actual situation, for example, to obtain raw material locally to build earth dam, rockfill dam, concrete penstock. In 1970s, focused on the standardization of equipment production and design in order to adapt to the needs of the development of SHP in scale. In 1980s, combined with the rural primary electrification construction, the focus was on new technologies, new materials, new equipment application and technical management. In 1990s, focused on SHP optimal dispatching, renewal and transformation, local power grid energy conservation. In beginning 10 years of 21st century, combined with a series of project implementation including the hydropower-based rural electrification construction and “SHP replacing fuel” project, study focused on computer application, automation, to meet the personalized needs of high efficient runner and mechanical and electrical equipment, and began to pay attention to the impacts of SHP development on ecological environment. Through SHP technology innovation, China has become the world's SHP technology exporter and pilot, and effectively promotes international exchange and cooperation in SHP development.

III SHP Development Dilemma Currently in China

With the reform of national finance system, electric power system reform, that the protection of the ecological environment and scientific development becomes the increasingly high demand, there are still problems to be solved in process of SHP development. One of key problems is that the development of diversion type hydropower stations is carried out without considering the ecological water flow, which leads to water reducing or dehydration of local rivers in the dry season; The second problem

is that some station owners don't consider the farmers' profits in the process of water resources utilization particularly in the resettlement and compensation issues. The third one is that development and construction process is against construction procedure, for example, some projects were built without permit and a large number of old power stations had low energy efficiency, and equipment were aged and full of hidden safety problems. These problems were not born problems of SHP, but problems occurred in the process of development. More attention should be paid to the problems and try to find solutions in the historical perspective and with the objective attitude.

According to statistics, there are about 5,700 SHP stations at present in China that were established before 1995 or reaching scrapping condition, with a total capacity of 8,000 MW. Because of the restriction in technical level and economic condition by early time, some disadvantages existed in the initial construction of rural hydropower plants such as aging of electromechanical device and energy efficiency decreasing year by year, which not only waste a lot of water resources, but also influence the ecological environment of rivers and bring many safety problems. If the renovation projects can be implemented to these old hydropower stations, the efficiency of utilization for water resources may improve, meanwhile, promote energy saving and emission reduction, protect the ecological environment of rivers, eliminate potential public safety hazard as well as make benefits for local farmers. The old hydropower station is responsible for public benefit task of flood control and irrigation but with a low feed-in tariff, for which reason the old rural hydropower stations can't renovate depending on its own accumulation but need special support by the government. The low feed-in tariff is one of the main dilemmas of China's current SHP development, and to some extent it is a disincentive for promoting the renewable energy development in China.

In 2010, the Water and Power Department, Ministry of Water Resources of China, carried out a sample survey on 833 SHP stations in 24 provinces, with a result that half are unprofitable. Table 1 shows that the average payback rate is only 1.3%~1.8%.

Table 1: A survey on SHP stations

Items	Constructed before 1995	Constructed after 1995
Number of SHP station surveied	619	214
Total investment (million yuan)	7,768.26	8,141.84
Total installed capacity (MW)	1,970.189	1,070.74
Design annual generation (ten thousand kWh)	757,384	406,549
Annual power sales (ten thousand kWh)	589,990	327,320
Total income of power sales (million yuan)	1,522.98	901.74
Total cost of power sales (million yuan)	1,290.39	745.93
Total income of profitable enterprises (million yuan)	268.18	178.25
Total loss of unprofitable enterprises (million yuan)	131.37	72.75
Annual income of power sales per kWh (yuan)	773	842
Average payback rate	1.8%	1.3%

IV Way of Improving the Utilization Efficiency of Water Energy Resources

Based on statistics analysis, the early constructed old SHP stations have low comprehensive energy efficiency of less than 65%, far less than comprehensive energy efficiency level of 85% for the current small turbine unit in China. That means waste of valuable water energy resources and loss of integrated benefit. It is needed to change the development mode and accelerating the renovating for old power plant to improve resource utilization efficiency.

In order to improve the utilization efficiency of water resources as well as safeguard China's rural electricity needs and promote the sustainable and orderly development of SHP,

Fig 1: An old SHP powerhouse and its generation equipment need to rehabilitate

Fig 2: Runner refurbishment

in August 2011, the central finance arranged capital from renewable energy special funds to support renovation projects. With the purpose of strengthening the financial fund management, enhancing funds usage efficiency and standardizing the projects management, the Ministry of Finance and the Ministry of Water Resources jointly issued a management measure of ***Provisional Measures on the Management of the Refurbishment Projects of Zhejiang Rural Hydropower Stations*** (No.[2011]504), which specifies Zhejiang Province and Chongqing City as comprehensive pilot projects of renovation projects for rural hydropower that will be firstly supported by the central government subsidy funds from 2011 to 2012, part pilot will be established in Hubei, Hunan, Guangxi and Shaanxi Province.

Presently, the Ministry of Finance and the Ministry of Water Resources give a joint reply to ***Implementation Plans for Pilot Renovation Projects for Rural Hydropower*** made by Zhejiang, Hubei, Hunan, Guangxi, Chongqing and Shaanxi province (city). On the basis of the reply, the six provinces (cities) will establish pilot renovation projects for rural hydropower with the total amount of 620 projects. Before the renovation of the projects, the installed capacity is 881MW, and annual output in the beginning 3 years is 2.75 billion kWh, after renovation the total installed capacity will reach 1,102 MW with annual output of 3.91 billion kWh, the installed capacity and annual output increase by 25.1% and 42.2% respectively.

According to the Provisional Measures (No.[2011]504), the central government finance will give fixed subsidies to renovated installed capacity with 700 yuan per kW for eastern area, 1,000 yuan per kW and 1,300 yuan per kW for middle and western area respectively after the renovation projects. The financial subsidy by central government will not exceed half the total investment for single project. The Provisional Measures (No.[2011]504) also provide clear regulations of selection conditions of projects, management of declaring and using funds,

project management, examination and acceptance, supervision and inspection, establishment of provincial implementation plan.

The renovation projects aim at improving the overall energy efficiency and safety performance, promoting the comprehensive utilization of water resources and maintaining the river health. Based on no increase in the quantity of existing units, the mechanical and electrical equipments as well as supporting facilities of the old rural hydropower stations will be renovated, among which the renovation of mechanical and electrical equipments are key point. The water retaining, draining, diversion works and powerhouse, metal structure and power transmission works will also be renovated if they have impacts on power generation benefits, projects safety, river-way ecological protection and hydropower station operation environment.

V Case Study: Zhejiang Province

Zhejiang, a eastern province in China is rich in hydropower resources with many rivers and creeks flowing through mountainous area, there are so many valleys that have a large water drop. The exploitable installed hydropower capacity in Zhejiang is 8,625MW, among which the SHP is 4,625MW. Zhejiang's SHP resources ranks the 16th in all provinces in China, the developed installed hydropower capacity ranks 6th as well as the rate of exploitation ranks 4th in China. By the end of 2010, Zhejiang has totally 3,175 SHP stations with the total installed capacity of 3,700MW, and annual output of 10.93 billion kWh, the rate of exploitation has already reached 80%. In addition, in the construction of new projects, at the same time, Zhejiang pays more attention to the renovation projects of old power stations and strengthening the industry management. According to statistics in 2006, there are 1413 SHP stations with total installed capacity of 660 MW put into operation before 1990, among which, 1000 stations still need to renovate.

Ever since 2003, there are 40 hydropower stations with installed capacity of 30MW are abandoned every year for the reasons that most are running over age, can't meet the safety operation and the owners are unable to carry out technical renovation or the renovation is uneconomical.

Most of these stations with ownership of collective or state-owned. In order to maintain the power generation of the hydropower stations put into operation in the early years and realize the full utilization of the water energy resources, during the eleventh Five-year Plan (2006-2010), Zhejiang Province shows comprehensive consideration of safety and benefitting farmers, gradually strengthens the work dynamics of the renovation projects of old hydropower stations. To inspire the owner's enthusiasm for the renovation projects and express the guiding role of financial fund, from 2006, Zhejiang shows a clear attitude that the provincial financial fund supporting the development of rural hydropower are mainly used for the renovation projects of old hydropower stations. Moreover, Zhejiang also actively implement the rural hydropower and electrification project, China Renewable Energy Scale-up Program (CRESP) loan project for SHP cooperatively launched by Chinese government, World Bank and Global Environment Facility, and focus on promoting the renovation projects of old stations. During the eleventh Five-year Plan, Zhejiang has completed 300 renovation projects of old stations with the installed capacity after renovation reaching 250MW.

In accordance with the implementation plans replied by the Ministry of Water Resources and the Ministry of Finance, Zhejiang has 115 projects taken into the pilot plan and will get 100.69 million yuan supported by the central government financial fund, the Zhejiang provincial financial fund will also give appropriate support. The scale and financial input of renovation projects of old hydropower stations will have unprecedented expansion.

It has been found that, by the renovation of old facilities, Zhejiang Province can effectively eliminate hidden dangers in stations, greatly increase the efficiency of hydraulic turbine generator unit and enormously improve the utilization efficiency of water resources. The overall increase of installed capacity can reach 30%~40%, the unit efficiency improves by 10%~15%. At the same time, Zhejiang also expands wide application of new technology, material and equipment, greatly improves technical level and safety production management level, in order to speed up the rural hydropower modernization in Zhejiang Province. In addition, the new "unattended and few-people on duty" management mode can further reduce the operation cost for power stations.

Fig 3: Laoshikan SHP station, located in Anji county, Zhejiang province, firstly commissioned in 1968 with total installed capacity1,860 kW (1,360 kW+500 kW) and annual generation in design 5×10^6 kWh. After two technical renovation in 1986 and 2005, presently its installed capacity reaches to 3,500 kW (2,500 kW+1,000 kW) and annual generation in design is 13×10^6 kWh. Safety, reliability and generation efficiency are well improved after application of computer monitor and control technology.

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About the authors

Professor and executive chief editor ZHAO Jianda is the Head of Small Hydropower and SHP News published by HRC. WU Hao and KANG Peng, editor with the two journals. Contact: jdzhao@hrcshp.org

President and Ambassador of Zambia Attended the Completion Ceremony of Shiwang'andu Station

On December 5, 2012, the completion ceremony of Shiwang'andu SHP station was held in Muchinga Province of Zambia. Current president Sata and the first president Kaunda of Zambia appeared in person. Besides, over 1000 people including the Ambassador of China to Zambia, the Minister of Mines, Energy and Water Development, senior representative of UNIDO and other important representatives from many organizations attended the ceremony.

Shiwang'andu SHP station is located in Muchinga Province, the northeast of Zambia, 800 km away from the capital. Since the independence of Zambia in 1964, this area had been without electricity but relying on diesel oil or other mineral energy. With the support of UNIDO, the Zambian government will construct renewable energy generation projects based on independent grid, in order to deal with climate change and reduce the carbon emission. Shiwang'andu station is one of the successful completed projects. It is also a part of the "Lighting up Rural Africa" project carried out by ICSHP and UNIDO.

Mr. Satta, Zambia's president was highly complimentary about the impact of this project. The station not only supplies electricity to local schools, clinics and farms, but also promotes rural electrification and reduces the dependence on firewood. It plays an important role in promoting tourism, increasing employment and attracting investment. Mr. Satta indicated that the Zambian government would rapidly develop SHP in order to improve the national power supply situation. The representative of UNIDO also gave a speech to praise the Zambian government to positively develop the renewable energy. He also said that Shiwang'andu station would be a sample for other developing countries to carry out south-south cooperation.

Shiwang'andu station is co-funded by Global Environment Facility (GEF) and Zambia Power corporation, supported by UNIDO and constructed by ICSHP. The total installed capacity is 1MW with two 500 kW units. Its construction started in April 2011 and was completed on December 5, 2012. Zambia national television, news and websites all reported this spectacular event.

(Source:ICSHP) ■

Introducing New Financing Model for Hydropower Plants

Case Study — Crna River Cascade

Disclaimer

This paper was prepared by Mr. Igor Nikolov. The findings, interpretation, and conclusions expressed in this paper are entirely those of the author. They do not necessary represent the view of the JSC ELEM, its Executive directors or the view of any legal representatives of R. Macedonia. They should in no way be taken to represent the official view of any institution with which the author is associated.

I Introduction

In this paper short analyze was made, for the Crna River Project financed under the PPP model (Public Private Partnership), with description of all advantages and hurdles that come along when putting working together Public and Private Company.

The last decade there has generally been a marked downturn in new-start hydro in many of South East European countries; this was the case in Macedonia too. There were many reasons leading to this slow down, but the main problem has been the difficulty of raising finance. After the unbundling (three years ago) of the functions of the state-owned utility ESM into separate generation, transmission and distribution companies, the problem with the financing has become more acute and we have entered in moratorium period in the financing of new generating plants.

Against this background the past two years there have been a lot of efforts of the Government to introduce the Public-Private Partnerships as being the best model of attracting finance for hydropower projects. But as this concept is new for Macedonia, we now need to think more about what it really means. There are undoubtedly many possible models for the sharing of the responsibilities, risks and revenues between the public and private sectors but we are still only at the early stages of exploring them. As mentioned, the power sector in Macedonia has been unbundled; and shortly after unbundling the distribution company passed from state ownership to total private ownership, while now the power generation is considered as responsibility of the state owned company (Macedonian Power Plants –ELEM), and as a matter of fact ELEM could not meet the growing demand for Power and Energy in the country.

So, new financing models are necessary if we expect of the hydro potential to satisfy the urgent needs for Power and Energy in Macedonia. This is a particularly serious problem because the large hydro projects are inevitably heavily dependent on foreign funding. Quite apart from the reluctance of the private sector to lend into countries that are financially weak, there are particular problems that arise when trying to finance infrastructure with hard currency loans, as we shall see later.

Lately there has been good news that private investors are interested for building new small hydro power stations through the DBOT (Design Build Operate Transfer) model. Under this model a **"special-purpose"** project company is created to Design, Build, and Operate the power station

before Transferring it back to state ownership at the end of the 20 years concession period. It has been proved that this model can suite well for SHPP but when it comes to large hydropower it seems that this model is not the most applicable.

The practice in the today's most developed countries shows that the optimum model for attracting financing in big hydropower lays between the total privet owned and totally state owned companies.

II Current Trends in Financing of Private Hydropower Projects

In 2000 the World Bank published study for the Financing of Private Hydropower Projects and, about the roles of the host government, the utility and the international financing agencies. The subject projects ranged in cost from US$100 mio to US$1,200 mio, and their financing arrangements varied considerably to reflect both this size variation and the stage of development of the host countries. The WB (World Bank) study shows that on global level only 4%, by capacity, of new private power projects signed from 1994-2000 were hydro projects. Amongst the many issues that emerged from the above study, the following are the most significant, and relative to CRP (Crna River Project):

1. The private sector finds it difficult to finance hydro projects due to their **high risk profile** and the fact that the relatively low import content (traditionally financed by export credits) leaves large sums to be funded by commercial loans, which are expensive and difficult to arrange. As a result most "private" projects depend heavily on public sector support in terms of financing, guarantees and risk sharing.

2. It is important to distinguish between **financial and economic viability** when selecting a project for private development. Financial viability is a measure of a project's ability to repay debt and dividends, and is essentially the viewpoint of the project company over a relatively short time horizon. Economic ranking represents the long-term national viewpoint, and may not always prioritize the same project.

3. Hydropower sites are unique national assets, and the award of a concession to a private (often foreign owned) company can raise sensitive issues. The complexity and cost of formulating a private hydro proposal makes it very difficult to award such contracts through international competitive bidding, so most concessions are directly negotiated. This makes it hard to **demonstrate transparency** what is essential issue. There are few precedents for arriving at a formula for the sharing of risks and benefits between the public and private sectors.

4. There is a **shortage of credible sponsors** with the strength and experience – and appetite - for promoting large hydro projects. There are many "would-be" investors but a lot of them melt away as the difficulties become apparent. This unresponsiveness of the private sector is often matched by unrealistic expectations on the part of host governments. The public sector sometimes fails to understand the central role it has to play in structuring private projects, or the commercial constraints under which private companies are forced to operate.

III Public-private Ownership Model

Multipurpose projects present the possibility of dividing the ownership between the public and private sectors. This was the case on the Crna River project (energy and irrigation) in Macedonia, where the project was too expensive for the public sector, and not sufficiently attractive in its entirety for the private sector. The project provides 642 MW of hydropower and sufficient water for 40,000ha (Demir Hisar) and 19,890 ha (for Upper Pelagonia), plus other benefits. At the end it was decided to finance it by dividing the scope into two, where each party would finance the part which is most suitable for that party (as described below). Regardless of the split shares and scopes in the CRPC (Crna River Project Company) the whole project is built under single EPC contract (Engineer, Procure, Commission) to avoid interface problems.

An absolute pre-requisite for the private sector participation in project financing, is a positive enabling environment. The basic principles that were put in place include the following:

• A legal regime that allows for an enforceable contract backed by provisions for the speedy resolution of disputes in an impartial environment and international arbitration.

• Established government policies

that encourage local and foreign private investment, with clearly defined framework of tax laws, import duties and incentives for private investors, as well as incentives for reinvestment of the profit.

• Clearly defined procedures for interfacing with government, (still not "one stop shop" facility but the ELEM participation in the JV eases the interfacing) with respect to all matters relating to approvals, permits, clearances and the like.

• An established Regulator acting independently of government, together with a record of adequate financial performance of the public elements of the power sector, and access to the open market.

IV Crna River Project Description

Crna River Cascade comprises the following hydro power plants:

• HPP Cebren, capacity of 332,84MW / 347,34 MW(Turbine Mode/Pump Mode), reversible

• HPP Galiste, capacity of 193,50 MW, conventional

• HPP Tikves (existing) capacity of 116 MW, conventional

Total capacity of the Crna River Cascade 642.34 MW

The Crna River Project is of great importance for the Macedonian economy as it will provide approximately 2,000 jobs during construction, and according to the economists it will increase the GDP for about 1%. More over it is important for providing higher level of independence of import of electricity, as peak power plants the Crna River Plants will provide very valuable peak energy in Macedonia and the region. More over the CRP will improve the hydrological conditions and provide water for irrigation.

Water economy issues: Special attention should be paid to the arrangement of the water economy conditions i.e. the utilisation of the waters of the Crna River, which is one of the largest rivers in the country, and which can provide the required water quantities for the basic water economy activities in any region of the country. The parametric analysis carried out in the study shown that if the available average quantity of water is considerably lower than the anticipated in the study, the investment becomes much less attractive. It should be noted that other alternatives of lower cost (e.g. smaller dams) do not present advantages from economic point of view.

Land use issues: The expropriation is also an essential issue (in the scope of ELEM), which was defined before the public invitation for the tender for concession. For the purposes of construction of the structures, it is required to perform expropriation of part of the land, which is in private ownership, and also there are certain measures to be performed, and certain construction works, in order to change location of structures and arrangement of the reservoir areas. The awarded concession includes also the right for using the land, and guarantees to the concessionaire the right to access and operate the land, these activities and the related financial issues are to be arranged in advance.

V Main Concerns of Private Investor Point of View

Speaking about raising finance, in EU or wider there is no fundamental shortage of private money or lack enthusiasm to invest in hydropower – but only under the specific conditions - the main issue being the risk. This is demonstrated by the fact that commercial banks compete vigorously for export credit mandates when it comes, for example, to the supply of turbines or generators because it is essentially risk-free business. The message is very simple: **if we can remove risk than you have found the financing**. Making

Figure 1: Total investments for completion of the new plants (Cebren and Galiste)

Investment	Interest During Construction			Total Investment	
	Equity	Loan	IDC	k €	€/kW
538,623	107,725	430,898	63,502	602,125	1,160

Figure 2: Total output of the new plants (Cebren and Galiste)

Capacity	Annual Production (GWh)			Utilisation	Pumping
MW	Primary	Secondary	Net	hr/year	GWh
526	938	165	1037	1998	786

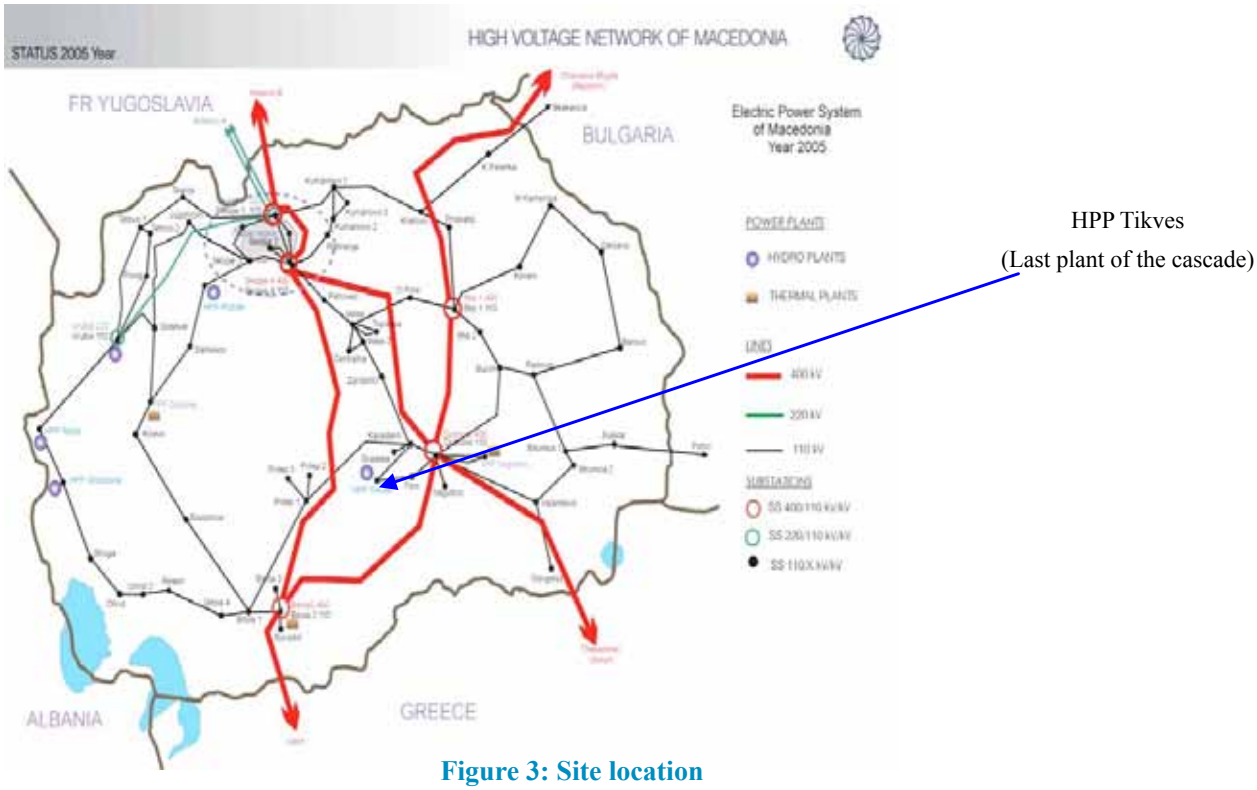


Figure 3: Site location

Main milestones:

Ø – April 2008	Bid submission and Evaluation of bids
Ø – Sep/Oct 2008	Joint Venture agreement, CRPC establishment, Concession Agreement
Ø – Oct 2016	Final date for completion and start of commercial operation
Ø – Depending of the bid	Transfer to Government of Macedonia

private funding more accessible and less expensive was imperative for the Government in the strategy for developing the CRP financing model.

Many governments attempt to place virtually all the risks onto the private sector. This attempt always fails because commercial companies simply reject the proposition, or the end-price was simply too high. Although the governments were following what appeared to be a perfectly logical line of reasoning, it is incorrect. On reflection there appears to be a good case for arguing that it is in the public sector's interest to assume more risks - not less - because in the end it is likely to result in a cheaper projects over which the utility retains more control. The reasons for this are explained below. When schemes have been developed under the BOOT (Build Own Operate Transfer) formula, risk has traditionally been handled by pushing it down the project structure away from the government and its utility, towards the project company and its contractors. To the maximum extent possible each party in the long contractual chain tries to pass the risk to those below him, but he also retains some contingency in case things go badly wrong. The result of this "ring fencing" is that the project cost is greatly increased as each party makes its own provision for the worst-case scenario. The layering of contingency upon contingency burdens the project with the cost a lot of eventualities that may never happen. Further, many governments often deny or oppose **international arbitration**, or are not able to shorten **strong bureaucracy** while the investor is collecting different permits.

Also, very often huge problem is that **refinancing** (or taking credits pledging the HPP's) of the project once completed is not possible, which simply locks huge capital for further new developments. It is much easier to refinance an existing hydropower

project that is fully operational, than a Greenfield project because many of the risks that deter financiers occur at the construction stage. Once a project is built and has a secure revenue stream it becomes an attractive investment suitable for the long-term investments, such as bonds.

VI Main Concerns of Public Point of View (ELEM)

As it was mentioned above the execution of the Crna River Project solitary by ELEM (the public element) is either not possible or very difficult and not on economy basses. Here are mentioned the main obstacles that ELEM would face if it was decided to go alone in this project:

1. Access to financing, currency mismatch, high cost of financing, enhanced by high proportion of capital cost in overall cost

For financing of CRP ELEM could raise finance only from credits from foreign banks, because, banking institutions in Macedonia do not have the capacity to finance implementation of large-scale projects. The available financing per project is usually limited to 2 million euros, much less than the investment required for the Project (602 mil. euros). A working paper by IMF describes in details the inability of the banking system of Macedonia to finance large hydro projects due to its fragility, lack of reforms in the banking sector and the large share of non-performing assets hold by large Macedonian banks. In this environment ELEM will have to look for borrowing opportunities from international investors or lending institutions. For such borrowing agreement, ELEM would need sovereign guarantees, voted by the parliament, and the parliament is often reluctant to accord such guaranties.

Although ELEM is the national power company of Macedonia, it has been making only a small operating profit and often there are years when it sustained a loss. In addition, most of ELEM's revenue is denominated in local currency (denar), thus exposing the company to exchange rate fluctuations in case of foreign currency borrowing.

Under combination of these conditions, successful repayment of a foreign currency denominated loan is deemed infeasible for ELEM.

2. ELEM's cost of kWh to end-consumer must be affordable, leading to unfeasibly long pay-back time, lack of electricity market sophistication

As ELEM is the national power company of Macedonia, it has been making only a small operating profit, which is benchmarked from the Energy Regulatory Commission. So, the company is not operating on market bases, but cares that the Cost of the kWh to the end costumer is affordable.

While this constraint of holding down the price of electricity, ELEM could not develop such project but only to operate and maintain the existing facilities. On the other hand Government of Republic of Macedonia had signed the Athens Memorandum, and engages to implement the EU directives in the Energy Market, which is not possible at the current level of the market sophistication. As a consequence, if we suppose that somehow CRP is completed, even than under current market conditions for ELEM there would be no value of the provided peak power from CRP thus leading to infeasible pay back time of the project.

VII The CRP Structure

Below is given schema of CRP project structure by the model of PP financing model:

The Role of the private investor in the Joint Venture will be to insure (strong sides of privet investors):

- Efficient project development
- Efficient construction management
- Optimizing and respect of the budget
- Respect of the timetable
- Secure funding (including guaranties)
- Efficient operation and maintenance

• Commercial expertise
• Bring best management practice
• Bring up-to-date technical expertise
• Bring commercial and free market expertise

However the Public partner should insure that the privet investor will also:
• Commit to minimal and acceptable environmental impact
• Commit to fair treatment of displaced population
• Commit to fair social treatment of the employees

The Role of the public partner (as public component) in the Joint Venture will be to insure (strong sides of public investors):
• Strong EPC contract
• Secure timely granting of licenses and permits
• Make available existing historical data
• Facilitate expropriation procedures
• That the preset rules(water management) for use of water are respected
• Set fair and balanced access to market
• Enforce rule of law
• Limit unjustified actions by NGO's
• Favor development of domestic investment funds

It is useful to mention that in spite of facilitating the execution of project ELEM has accepted to do the land expropriation for the both sites and storages, HPP Cebren and HPP Galiste, and further to build the access roads for HPP Cebren, one at the crest level at the right side of the river and one at the level of the power house at the left side of the river.

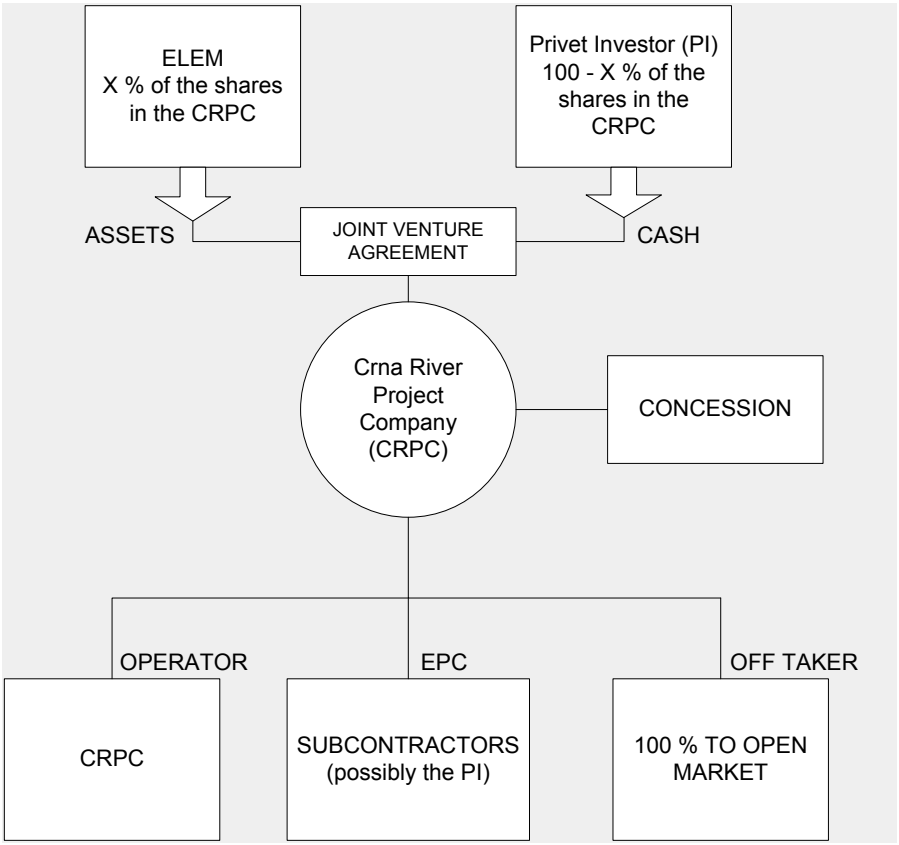


Figure 4: Crna River project structure

VIII Conclusions

• For larger hydropower facilities we may be witnessing a swing away from privately funded projects, towards a mix of public and private investment which essentially under right condition is proven method of financing.

• In order to stimulate private lending, projects will have to be structured with an underlying presumption that the lender is insulated from all or from the mayor risks. This will require guarantee structure for all the undertakings, not only from the privet investor, but as well as from the Government side.

• All the power for removing or decreasing the risks lay in the hands of the governments and its agencies, but as the water is sensitive issue it is not always easy to grant water concessions without opposition of NGO or others (which often can be non-justified). Maximum transparency and media promotion of benefits from the project can help in these situations.

• A lot of attention should be given to the issue of structuring Public-Private Partnerships, with particular reference to solicitation procedures and the relative responsibilities of the parties in terms of risk assumption and revenue sharing. It is essential that the structuring of the relative

responsibilities in the project comply with the project partners capacities.

About the authors:

Igor Nikolov *obtained his Electrical Engineering degree at the Sts. Cyril and Methodius University, Skopje in 2004. In 2006 he obtained Master degree at the Federal Institute of Technology in Lausanne, Switzerland. He began his professional career in 2004 in MHyLab – Mini hydraulics laboratory of Montcherand, Switzerland where he participated in the development program of the Kaplan turbines in the low-head area (H < 30 m) and Design & dimensioning of small turbines and worked on engineering projects in the small hydro domain. In 2007 he joined Macedonian Power Plants, the largest Macedonian electricity producing company, where he works on the company's renewable energy strategy as responsible engineer for renewable energy. Also he works on environmental (CDM) and strategic issues as part of the Development and Investments sector staff.* ■

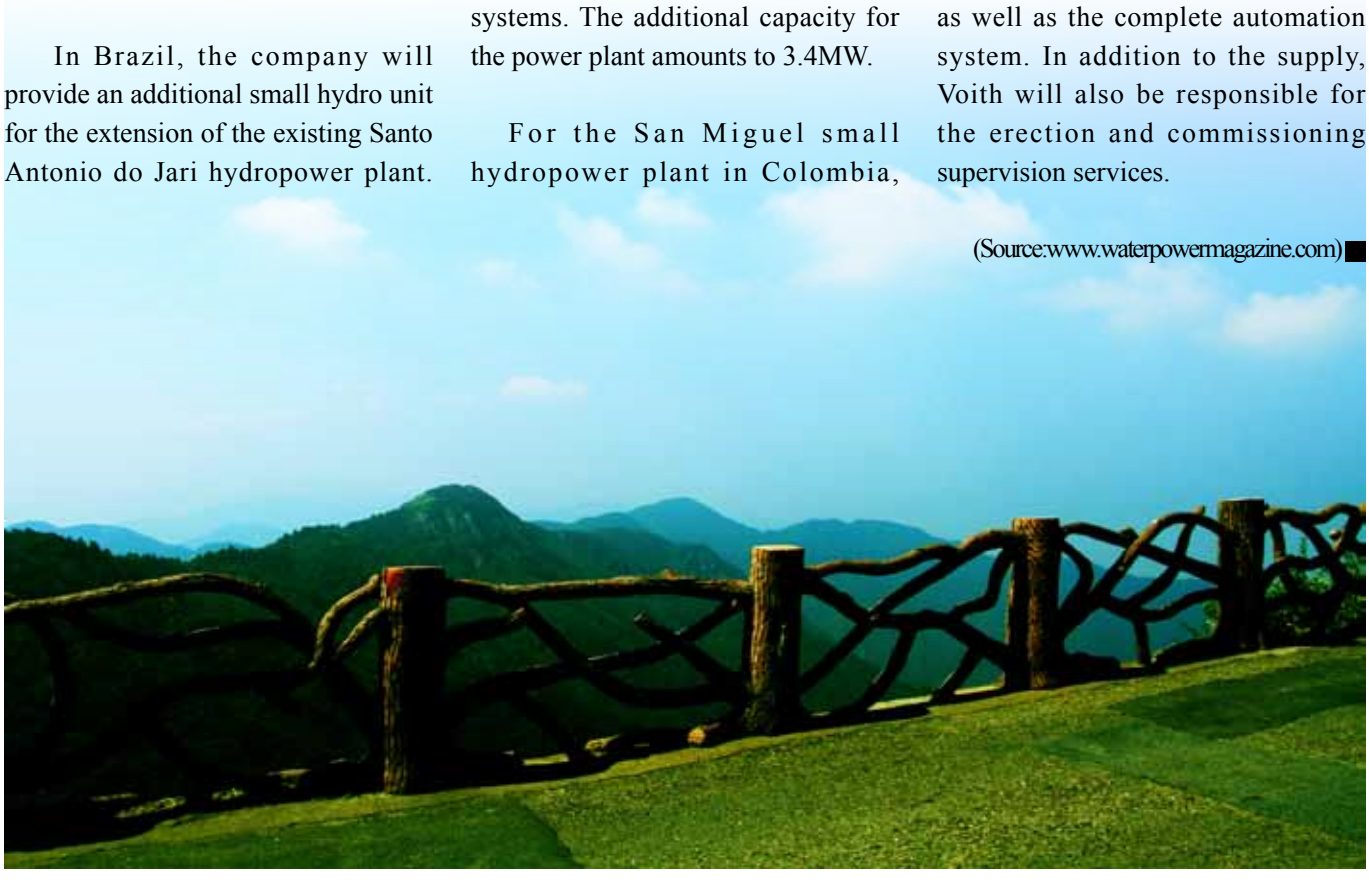
Voith Works on South American Small Hydro

Voith has announced it is to supply turbines and related equipment for two small hydro plants in Brazil and Colombia.

In Brazil, the company will provide an additional small hydro unit for the extension of the existing Santo Antonio do Jari hydropower plant. The scope of supply includes the Kaplan-S turbine, the generator, the automation as well as the electrical and mechanical balance-of-plant-systems. The additional capacity for the power plant amounts to 3.4MW.

For the San Miguel small hydropower plant in Colombia, Voith will supply two turbines with a combined capacity of 45.8MW, the generators, protection valves, speed governors and voltage regulators, as well as the complete automation system. In addition to the supply, Voith will also be responsible for the erection and commissioning supervision services.

(Source:www.waterpowermagazine.com) ■

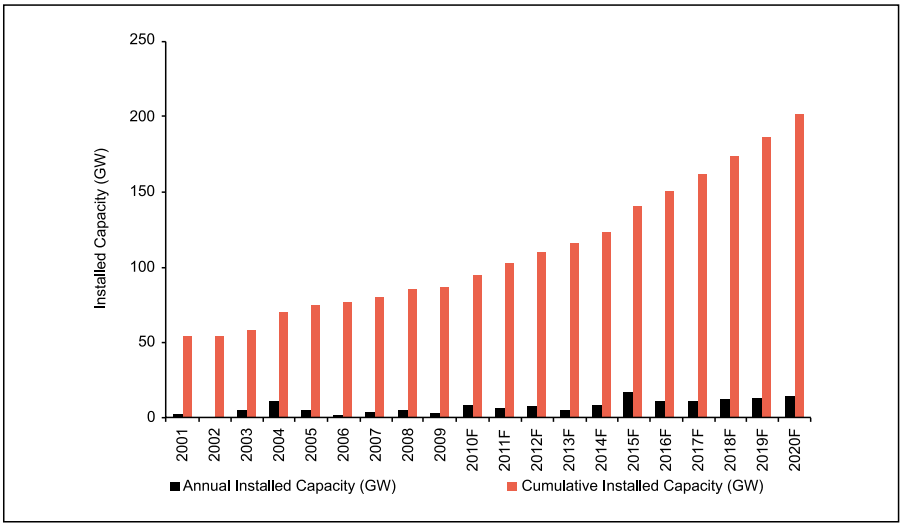


Global SHP Market Analysis to 2020

— *Installed Capacity, Generation, Investment Trends*

I Hydropower is the Most Popular Source of Electricity Generation Across the World

Even though fossil fuels dominate electricity generation across the world, more than 60 countries use hydropower for meeting more than half of their electricity needs. The technology is the most popular renewable source of electricity generation as for various reasons, which include its ability to instantaneously respond to changing electricity demand, water management and flood control.



▲ **Global Small Hydropower Market, Historical and Forecast Annual and Cumulative Installed Capacity (MW),2001-2020**

II SHP Generation is Gaining Importance Due to its Social and Financial Benefits over Large Hydropower

Small and mini hydropower generation plants have shorter gestation period. Large hydropower plants usually have a gestation period of about seven years, whereas it is about two to five years for smaller plants. Additionally, small and mini hydro gives a higher return on investment due to the low capital investment and operational and maintenance costs. Small and mini hydropower plants are easier to construct and commission due to simpler designs, thus keeping the costs down. Small and mini hydro facilitates community participation and capitalizes on local skills for plant construction. Large hydropower plants require rigorous surveys, investigations and designs, which are not necessary for constructing a small and mini hydro plant. In addition to the above, construction of a SHP plant does not disturb the local habitat as is the case with large hydropower plants. SHP installation does not involve the building of large dams and reservoirs and thus does not lead to the problems of deforestation, submergence and rehabilitation. Furthermore, it does not require a large land area and thus can be constructed in areas with small streams of water and small to medium rivers.

III Global SHP Cumulative Installations Grew at a CAGR of 6%

Annual installed capacity surged during 2004 mainly due to rise in new installations in China. Given the

advantages of generating electricity from SHP coupled with rising interest in the sector has led to increased government support policies which will derive installations in many countries in the years to come. Cumulative installed capacity of SHP is expected to reach 140GW in 2015 and 201GW in 2020.Hydropower is the most popular source of electricity generation across the world

IV Need for Energy and Environmental Security is Promoting SHP Development

Global energy demand is rising fast, especially in developing countries, due to an increase in populations and industrialization. In order to meet this demand, it has become necessary to explore renewable energy sources, as conventional sources have become expensive due to the depleting supply. Small hydro provides an excellent and abundant source for power generation and does not have any fuel costs as it uses water; it emerges as one of the most promising solutions for ensuring a reliable and affordable energy supply in the long term.

V Administrative Bottlenecks are Restricting the Growth of SHP Market

Administrative hurdles leading to a delay in permits and plant approvals are major challenges for the development of small hydro. Many countries currently have very long authorization procedures. Complicated and time-consuming licensing procedures coupled with red-tape in many countries have been major stumbling blocks in the development of SHP installations across the globe.

VI China is the Largest SHP Market

The SHP market in China is driven by rural electrification programs of the Chinese government. At present, more than 30% of the China's counties depend on small hydro to meet their electricity requirements. This percentage is rising continuously. In 2009, the country had a cumulative installed capacity of 51GW of SHP, making China the largest hydropower market in the world in terms of installed capacity.

VII Non Operating Existing Dams Represent Huge Potential the US Has for SHP Development

The US has tremendous potential to add capacity to existing non powered dams as 97% of about 79,000 dams in the US are not generating any power. Furthermore, since most of the environmental damage associated with the construction and operation of dams has already taken place, energizing these dams will not have a high impact on the environment. These dams, if energized, have the potential to supply an additional 7.3GW of capacity by 2025.

(Source: AltEnergyMag) ■

SHP Bill Back for Consideration

Bill Would Make Approval Process Faster for Small Hydroelectric Projects

By Collin McRann
Staff reporter

Small hydroelectric power plants played a large role during the development of Colorado's natural resources and if some proposed legislation passes, they could make a comeback.

The legislation comes in the form of a bill called the Hydropower Regulatory Efficiency Act. It was reintroduced to the U.S. House of Representatives Jan. 15 by lawmakers from Colorado and Washington state. Though an identical bill was shot down in the Senate late last year, it did pass the House in July by a unanimous vote. The bill's main focus is to clear much of the red tape associated with permitting small hydroelectric power projects, mainly those generating less than 5-megawatts of electricity.

Both U.S. Rep. Diana DeGette (D-CO) and U.S. Rep. Cathy McMorris Rodgers (R-WA) co-sponsored the bill, and one of its major supporters is the Colorado Small Hydro Association. Ophir's Kurt Johnson is president of the association, and in the past he has promoted the benefits of small hydroelectric projects.

"Rep. DeGette's efforts have resulted in legislation that will lead to development of new, clean energy generation and create new jobs — particularly in rural areas," Johnson said in a release. "Hopefully this non-controversial, long-overdue, common-sense, bipartisan hydro reform legislation will quickly complete the legislative process and be signed into law."

Regulations currently in place require most hydroelectric projects to go through an application process and review with the Federal Energy Regulatory Commission (FERC). The FERC process can be lengthy and expensive, which can create a burden to small projects.

If the new bill is passed into law, the regulatory process could be streamlined for certain small hydro projects. The bill, as written, provides periods of public comment and directs FERC to examine the feasibility of a two-year licensing process for certain low-impact hydropower projects. Some of the low-impact projects could include the conversion of existing non-powered dams into power-generating ones.

According to the association, the current permitting process has been a barrier to small projects for decades. As a result the association claims much of Colorado's, and the country's hydroelectric resources are under utilized.

Historically, western Colorado has had a number of small hydroelectric projects, including the Bridal Veil hydroelectric power station above Telluride. Bridal Veil along with the Ouray Hydroelectric Power Plant in Ouray are two of the oldest AC power plants in the country.

Another organization called the National Hydropower Association claims an estimated 5.3 jobs are created per megawatt of new hydro construction. The association also estimates that in Colorado alone, around 200-megawatts of new, potential hydroelectric development is possible. Some of the new developments would mean constructing new hydroelectric facilities, but most would center on adding generating equipment to existing dams.

The bill states a significant amount of new hydroelectric generation could come from maximizing existing infrastructure, particularly non-powered dams. It states that only about 3 percent of the nation's 80,000 dams currently generate hydropower.

(Source: www.telluridenews.com) ■

Youngs Creek SHP Project

Snohomish Public Utility District in the US has recently opened Youngs Creek SHP project, the first new hydro scheme in Washington State for almost 20 Years. Neil Neroutsos reports.

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Despite the recent economic slowdown, Snohomish County Public Utility District (PUD) in Washington State, US, expects rapid growth in its customer base over the next 20 years. In addition its elected board of commissioners has made a commitment, as part of its climate change policy, to meet additional load growth through aggressive energy conservation and renewable energy sources. As a result SHP projects are set to become key components of the utility's energy mix.

"We want to develop these resources to the extent possible within our own service territory," says PUD General Manager Steve Klein. "By doing so, we can better determine and guide our own destiny, providing economic development and jobs within our community."

In October 2011, the utility opened the first new hydroelectric project in Washington State for nearly 20 years. The project demonstrates that new SHP sites can be developed to be cost effective and meet high environmental standards.

The Youngs Creek facility, located about 6.4km south of the city of Sultan, has a generating capacity of 7.5MW -enough power for more than 2000 homes. The project will output the highest levels of energy during the winter months, the highest demand period. In drier summer months, it will operate in limited capacity or be shut down temporarily for maintenance.

I Moving Forward

The utility purchased the land for its Youngs Creek project in 2008. The site had an existing licence from the Federal Energy Regulatory Commission (FERC), which was originally issued to Puget Sound Energy. The previous owner had developed some initial designs but never moved forward on the project. PUD officials worked with FERC to assume the licence with the condition that the hydropower project would be built by the end of 2011. This short FERC project deadline put the PUD on the fast track, but the utility was able to tap existing staff and assemble a project team to meet multiple construction deadlines.

The Youngs Creek site offered several benefits. Like other PUD SHP projects, it's located outside of sensitive areas, such as designated wilderness lands. The powerhouse and intake are above a natural barrier, a waterfall, so there are no issues related to migrating fish.

The project is also located close to two other PUD hydropower projects - Woods Creek and the Jackson project - so it can be easily operated and maintained by existing staff.

"We also see SHP as a resource that's competitively priced or cheaper than other green energy sources,' says PUD Manager of Generation Engineering Scott Spahr. "These projects give us greater flexibility with our power supply as they're locally generated, reliable resources that provide energy at times of the year when it's needed the most."

The utility engaged with multiple stakeholders during its planning process, including local tribes, environmental groups and regulatory agencies. It worked closely with the Washington Department of Fish and Wildlife and other state and federal agencies to ensure that the project was designed to provide adequate levels of river flow and fish protection.

Extremely wet conditions in fall 2010 also created challenges in the

timing of some construction. The community of Sultan, about 6km from the project site, received an economic boost during the construction phase, as contractors' crews coming through the area increased revenues for local hotels, restaurants and various retailers.

II SHP Potential

Snohomish PUD is assessing several additional SHP sites for potential development in the next five to 10 years. The projects' generating potential ranges anywhere from 2-25MW. If fully developed, the collective energy output could serve tens of thousands of PUD customers.

As with the Youngs Creek site, the PUD has been proactive in engaging community members and regulatory agencies as it considers new projects. In many cases it can bring improvements to the community as it develops projects. For example, a project on the Skykomish River in Western Washington, now in the study phase, could include improvements to a state-operated fish trap and haul facility. The state programme uses trucks to transport fish 6.4km upstream around a set of waterfalls, providing more than 161km of additional spawning habitat for fish. The state, strapped for funding to upgrade the facility, could get critical support from the PUD for the fish operation if the hydropower project is completed.

"In assessing potential sites, we're especially mindful of anadromous fish populations, hydrology, geology, environmental issues and access to existing roads and transmission lines, " comments PUD Assistant General Manager of Water, Generation and Corporate Services Kim Moore. "We want to balance energy generation with the need to protect river flows, water quality and cultural resources."

The PUD SHP facilities are designed as run-of- river projects. Given rainfall patterns in the region, the generating output is naturally maximised during times of high energy demand. These facilities also complement other intermittent energy sources, such as wind and solar.

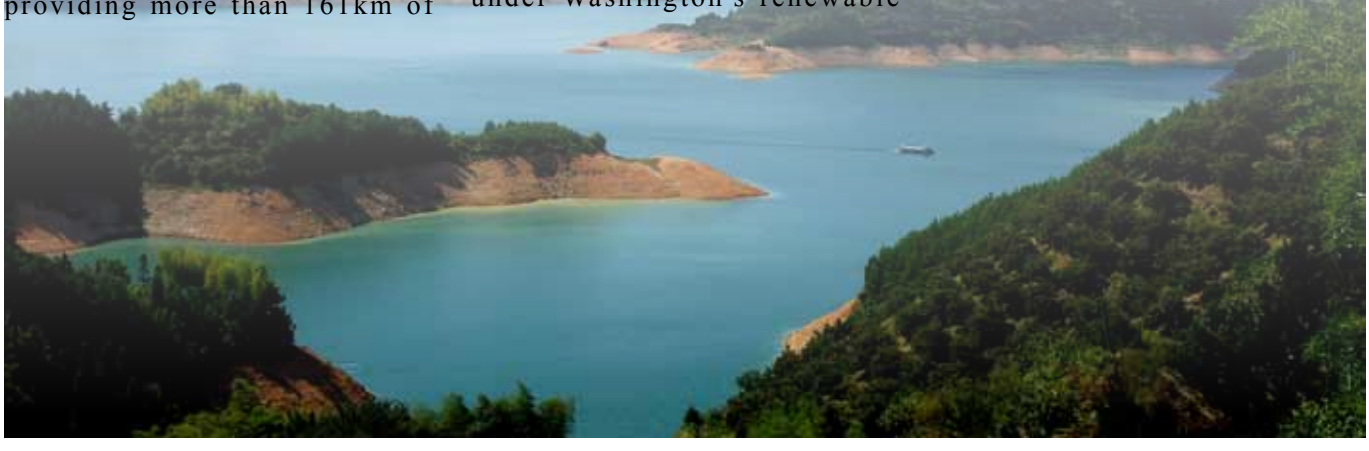
New SHP sites require approval by the Federal Energy Regulatory Commission. For its planning purposes, the utility expects each project will take five to seven years from the application stage to completion of construction. Small hydro facilities currently don't qualify under Washington's renewable portfolio standard (RPS). Although a recently proposed state bill sought to include new hydro projects of an average of 5MW or less, it didn't pass. The PUD and other utilities have supported such legislation.

III An Essential Source

For decades, the bulk of the PUD's energy has come from hydroelectric power. Most of this is purchased from Bonneville Power Administration (BPA), which markets wholesale power generated in the Columbia river basin in Washington. In addition to Youngs Creek, the PUD operates two other hydropower plants in Snohomish County. The 112MW Jackson hydroelectric project was built in 1984 and the 650kW Woods Creek project was purchased from a private party and upgraded in 2008. Along with BPA energy, about 80% of the PUD's energy portfolio now comes from hydropower.

(Neil Neroutsos is the media liaison for Snohomish County Public Utility District, north of Seattle, Washington, US.)

(Source:www.waterpowermagazine.com)



HRC's Annual Report on Foreign Affairs in 2012 and Work Plan for 2013

Hangzhou Regional Center (Asia-Pacific) for Small Hydropower (HRC)
National Research Institute for Rural Electrification (NRIRE)

In 2012, led and supported by Ministry of Commerce, Ministry of Water Resources and Nanjing Hydraulic Research Institute, HRC carried out and implemented the decisions and arrangement of the Central Committee of CPC on speeding up the reform of national water conservancy. Staff members of HRC earnestly studied the documents of 18th Conference of CPC, with high responsibility and meticulous attitude, in the practical style of seeking truth, worked very hard, united and pioneering. Foreign-aid training projects were actively undertaken and extensive international exchanges conducted, striving to develop international market, successfully implemented bilateral cooperative projects, promoting SHP equipment export and creating social & economic benefit.

In 2012, leaders at a higher level attached great importance to the foreign affairs of HRC. Mr Hu Siyi, Vice Minister of Water Resources, Mr Gao Bo, Director-General of the Department of International Cooperation, Science and Technology of MWR, leaders of Bureau of Rural Hydropower and Electrification Development, MWR, and Department of Commerce of Zhejiang Province respectively paid inspection visits to HRC and met with the international participants of HRC, showing deep concern and support.

I Foreign-aid Training General Situation

In order to strengthen foreign-aid human resources development, deepen south-south cooperation, popularize Chinese SHP technology and equipment, and promote exchange and cooperation among developing countries, HRC, under the guidance of MOFCOM and MWR, successfully organized 3 foreign-aid training workshops (seminar) in 2012, with totally 83 participants (officials) from 41 countries, achieving remarkable results.

The year 2012 saw continuous improvement of the foreign aid training. The completion of detailed training scheme, strict management regulation for the lecturers, strengthening of lecturers' capacity, arrangement of visit to the villagers and etc all increased the satisfaction rate of the training.

1. Training Workshop on Small Hydropower Technology for Developing Countries

From 23 May to 6 July, the "Training Workshop on Small Hydropower Technology for Developing Countries", which is the 61th international training workshop by HRC, was held in HRC successfully, with 24 officials and technicians working in the hydropower sector from 17 countries i.e.. Vanuatu, Nepal, Fiji, Kyrgyzstan, Cambodia, Nigeria, Zimbabwe, Kenya, Ethiopia, Sudan, Syria, Sierra Leone, Jamaica, Pakistan, Guinea-Bissau, Dominica and Sri Lanka.

During the execution of this training, HRC attached great importance to the continuous improvement of international training. Based on several years' accumulated experience in training, we worked out the <Scheme of International Training>. This scheme, which is divided into eight parts with totally

hundreds of entries, covers the whole training process, including the preparatory work, reception, opening ceremony, training work, logistics, closing ceremony, send-off, and summary. It specifies certain tasks, the precautions, the handling personnel, the re-check and assistant members, finishing time, and the person who takes the relevant responsibility. The scheme effectively guarantees the diminution of the work negligence, the improvement of quality and the execution of the training.

In order to improve the presentation quality, we established a strict management system for our teaching staff. The participants would evaluate the courses of each lecturer, and make scores. The feedback of the scores and evaluation results would be given back to the lecturers, and the lecturers could continuously improve their future lectures based on the recommendations of the participants and improve the quality of foreign aid training.

Mr. Zhang Jianyun, Academician of Chinese Academy of Engineering and President of Nanjing Hydraulic Research Institute and Director of Dam Safety Center of MWR gave a special lecture "Water Resource vs Impacts of Climate Change in China" to the international participants of Training Workshop on SHP Technology for Developing Countries. The participants broadened their horizon after having Mr. Zhang's illuminating lecture complete with excellent texts and graphics in PPT, which explained the profundity in simple terms.

In addition, a visit to a village scored good result, appreciated by Ministry of Commerce. The participants were arranged to visit Diaojiaowan SHP Station at a village in Changle town where participants were divided into groups to have dialogues with local villagers. The visit enabled the participants to see the great changes after the construction of SHP plants in Chinese social, economic and living aspects. Participants praised the visit as an unforgettable trip to the countryside.

At the closing ceremony, Nepalese participant Mr Ramesh, monitor of the class commented:"We made some friends here. We expressed a lot through our eyes to eyes and smiles to smiles. We are emotionally and psychologically closer with Chinese people. During this training period we shared, learnt and saw many of your experiences and technical know-how in SHP and other fields. With the knowledge you imparted to us we are sure that we will be able to contribute in the development of SHP and water management in our countries. Besides your technology of small hydropower, we are taking with us your tea and silk and Tai Chi to our homes never to forget. We sincerely thank all of you for the useful lectures, study tours to SHP plants, industries, university, villages, sightseeing and shopping. This training will help strengthen friendship between China and our countries. When we go back to our countries we will make every effort to be connected with you for further cooperation. The world is looking forward to you for every cooperation. We need you. We would like to see China become mightier. Many of your developments in the fields of flood control, irrigation and small hydropower are visionary, inspiring and enlightening to all of us and to those who will understand your spirits through us in our home countries."

The statistics from the questionnaire shows that participants were satisfied with all the items of the training, especially with "Management capability",

"Organizational skills of the Chinese staff" and "Reception attitude" 100% satisfaction. Over 90% participants expressed they were very satisfied with the "training content", "Course degree of difficulty" and "Lecturers". Over 80% participants felt satisfied with "Suitability of course quantity" and "Correlation between study tours and the program theme". All the participants commented the training beneficial or very beneficial on "Role of the program in promoting cooperation between China and your country in the relevant fields".

2. Seminar on Rural Electrification for Developing Countries

The Seminar was held from 30 Aug to 26 Sept 2012 and working language was English, which was attended by 24 officials in energy sector from Antigua and Barbuda, Cambodia, DPR Korea, Fiji, Ghana,

Guyana, Kenya, Laos, Liberia, Malawi, Nepal, Papua New Guinea, Uganda, Tanzania and Zimbabwe.

During the implementation of the seminar, officials were arranged to visit the well-known Three Gorges project and were left deep impression. They expressed it was their greatest honor to visit this grand project, a glorious milestone in the exploitation

of hydropower resources.

On the SHP Forum during the seminar, we invited our old participant Mr Igor from Macedonia to introduce SHP development of Macedonia and bilateral cooperation with HRC on SHP. After going back from the SHP training in 2007, he took part in the implementation of several SHP or other renewable energy projects. Currently, he is secretary general of Macedonian generation enterprises association. Based on actual examples, his vivid introduction touched everyone present. An official from Malawi expressed with excitement: The introduction

consolidated the confidence of us working in the hydropower sector from African countries. Our brother has set us a good example, worthy of our study. We should think it over. What he has scored, I believe we can also make it. From now on, we should act quickly. Let's take substantial efforts to light Africa and to realize rural electrification in our rural areas.

To enrich the life of the participants at spared time, HRC organized an international boat-rowing match, participated by officials from 4 continents. The arrangement was well planned and atmosphere friendly. Officials expressed that the match was unforgettable, which, together with the friendship of HRC and the Chinese people, will rest in their heart for ever.

The monitor and the participant from Zimbabwe Ms Shorai expressed her gratitude to Ministry of Commerce, HRC, all the lecturers and

the training team on behalf of all the participants. She said: "During this training period I have no doubt that all participants learnt from China's experiences and technical know-how in SHP, Solar power and Wind power development and their important role in Rural Electrification and overall socio-economic development. With the knowledge HRC imparted to us, we will certainly contribute in the development of SHP & renewable energy to boost Rural Electrification Programs in our respective countries. This seminar has strengthened friendship between China and our countries. As we go back to our countries, we will make every effort to be connected with you for further cooperation. I strongly encourage my fellow participants to exploit this cooperation seriously. You are so caring. You worked tirelessly to make sure that our schedule never had a dull moment. We will never forget memorial events like boat rolling competition at the West Lake and having a chance to eat in Chinese and Korean restaurants where we had an opportunity to cook for ourselves."

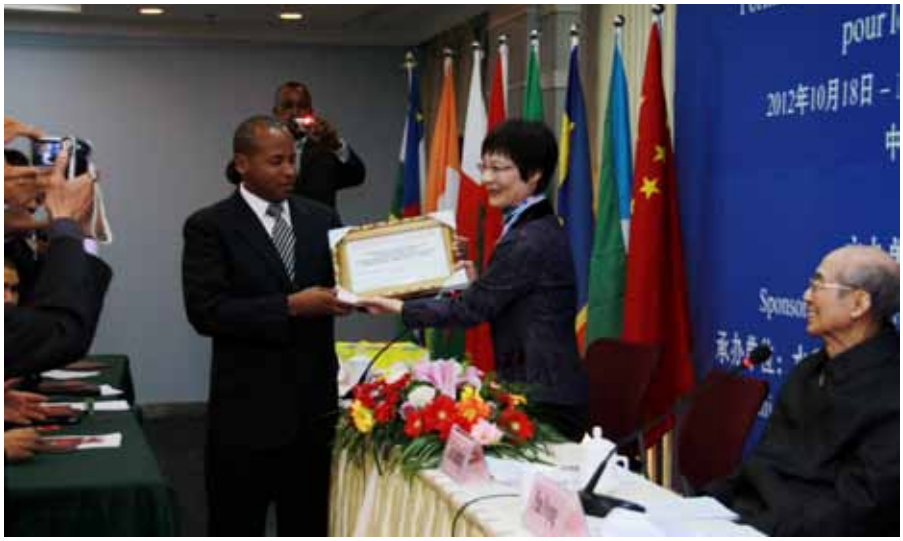
The statistics from the questionnaire shows that officials were very satisfied with the seminar, expressing 100% satisfaction with "Training content", "Course degree of difficulty", "Accommodation", "Transportation arrangement", "Management capability", "Organizational skills of the Chinese staff" and "Reception attitude". The positive evaluation of the officials is not only the affirmation to the training programs, but also is the motivation and direction for our future work.

3. Training Workshop on SHP Technology for Francophone African Countries

The "Training Workshop on SHP Technology for Francophone African Countries ", a 42-day foreign-aid training program was conducted by HRC at Hangzhou from 18 Oct to 28 Nov 2012. 35 participants from Benin, Central Africa, Comoros, Cote d'Ivoire, Djibouti, Guinea, Equatorial Guinea, Congo (Kinshasa), Madagascar, Niger, Morocco, Mali, Togo and Tunisia attended it. The working language is French.

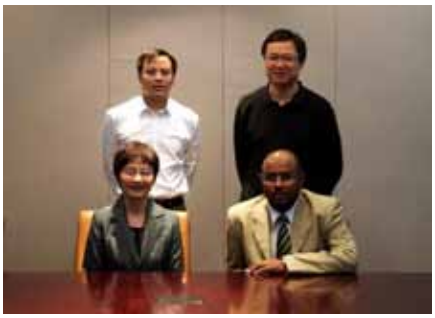
During the implementation of the training, Mr Gao Bo, Director-General of the Department of International Cooperation, Science and Technology of MWR, Mr Chen Dayong, Deputy Director-General of Bureau of Rural Hydropower and Electrification Development, MWR, and other leaders paid working inspection to HRC, met with the international participants of HRC, took photos, showing deep concern and support, ensuring the full success of the foreign aid training programs. The trial textbook on SHP in French was used during the training. The translation from the English version took 4 years and around 20 French specialists took part in the translation or revision. The completion of the textbook on SHP in French laid a good foundation for the future training workshops for francophone. Throughout China, there are not many such training institutions which could hold technical training of foreign aid in French, which is one of HRC's features.

During the training, we arranged a study tour and discussion for the participants in Zhejiang Jinlun Electromechanical Co., Ltd, the first ranking company of top ten enterprises of China's small hydropower equipment, and the participants combined the technical experience and practice with acquired professional theoretical knowledge perfectly. And we also fully showed them the development level of small hydropower in Zhejiang and even in China, furthermore, the wisdom



and diligence of Chinese people. The participants studied the features and advantages of China's small hydropower equipment during the site visit. This visit has promoted the Sino-African cooperation for small hydropower projects, and the Chinese products further toward the African market. In the course of an in-depth discussion with the participants, Jinlun Company has found by surprise that the participant of the Central Africa, Mr. ZANGBE, was precisely the one in charge of the hydropower project in Central Africa, which was about to be executed by Jinlun Company. During the visit, the two sides held several in-depth discussions about project-related issues that were commonly concerned, it was very helpful to this bilateral small hydropower cooperation which was about to launch.

At the closing ceremony, on behalf of all the participants, the monitor Mr. Luc, Chief of Inter-regional Water Section, Ministry of Water Resources of Madagascar, delivered a speech: "The training workshop covers all the important aspects in SHP development. Based on the training, we are well informed of all the technical details concerned. During the 42 days, we are deeply impressed by the new technology and advanced experience of Chinese SHP, and our capacity of application are greatly enlarged. The unique and successful mode of China is suitable for our developing countries. It is well known that the social and economic development in Africa is restrained by many factors, and the implementation of the training workshop embodies the friendship and the assistance from Chinese Government, which is very beneficial to the promotion of development in Africa. At present, we face many difficulties, including the shortage of funds and other problems, however, a friend in need is a friend



indeed, we find the most faithful friend of us --- China. We believe that China is the friend of African countries forever, and we trust China. Meanwhile, we would like to repay with the most sincere friendship. We hope that based on the platform of training, the Sino-African friendship will be continuously strengthened with good results. We will bear China in mind forever. Thank you, China, the good friend of Africa! Long live the Sino-African Cooperation! Long live HRC!"

The statistical analysis of the participants' questionnaires, indicate that more than 90% of the participants were satisfied with the "Organizational management", "Reception attitude", "Transportation arrangement", "Management ability" and "Meals"; 74.3% of participants were satisfied with the "Translation effect", which is a relatively big improvement compared to that in the year 2011. At the end of the training, HRC was awarded an honorary

certificate prepared by the 35 participants: “HRC, the best training institution”, representing their definite affirmation of HRC’s training work.

II International Communication

1. Reception of Foreign Guests

In 2012, HRC totally received 13 foreign delegations of 45 foreign guests (as per appendix 1), respectively from Kenya, Turkey, Albania, Venezuela, Nepal, Czech, Chile and UNESCO. The visiting of new and old friends enhances the communication and understanding, improves the friendship and trust, thus reaching cooperative purpose for many projects. The important visits include:

(1) Official of UNESCO Visited HRC

On October 23, 2012, Mr. Hassan, official of UNESCO, visited HRC, and had a discussion on the financing of Sudan SHP cooperation project. Mr. Hassan had visited HRC twice before, and he have contributed to the conduction of UNESCO “Framework Research of Arabic Renewable Energy”. HRC undertook the development consultation for two small hydropower projects in Sudan.

(2) Officials of Venezuelan Ministry of Science and Technology Visited HRC

On November 1, 2012, Mr. Francisco Karthus, Director of

National Center of Research Authentication for Housing and Urban Development, Ministry of Science and Technology, the Bolivarian Republic of Venezuela, the inspectors Mr. Francisco Hernandez and Mr. Juan David Keira, accompanied by staff member of the Embassy of the Bolivarian Republic of Venezuela in China, paid a visit to HRC for communication. The delegation was assigned by Venezuelan Ministry of Science and Technology for enhancing the cooperation in the new field, especially in SHP technology and energy field between Venezuela and China, and seeking for Chinese partner. During the meeting, Venezuelan delegation learned in detail about SHP development in China, especially the project situation and relevant policies of rural electrification, ecological protection project of substituting SHP for fuel, efficiency improvement and capacity enlargement of rural hydropower, and they took great interest in containerized SHP, rubber dam technology, hydraulic automatic shutter gate technology, complementary technology of wind power, solar power and hydraulic power. Mr. Karthus, head of the delegation, said:“before visiting, we already had a preliminary understanding that HRC is very capable in SHP field in China. Through this visit, we had a further understanding about HRC, and the scientific research achievements and talent team left us a deep impression. The development process of HRC showed us the achievements and a prosperous future of China after reform and opening up. We will arrange and report the achievements of this visit to government authorities, and strive for the cooperation with China under the agreement of governmental science and technology cooperation framework. Hereafter, we hope HRC could send technical delegation to Venezuela for further communication and cooperation opportunities”.

(3) Distinguished Delegation from Chile Visited HRC

On 16 November, accompanied by Ms. Dai Aiping, Division Chief, Department of Foreign Affairs of Zhejiang Province, the 10-member delegation from Chile headed by Ms. Felisa Ojeda V., Governor of Aysén Province, paid a visit to HRC. During the friendly bilateral meeting, Director Cheng and Governor Felisa addressed respectively. Director Cheng said:"HRC is a national research institute specializing in small hydropower and we also serve as a world-wide window for international small hydropower cooperation. Small hydropower is a renewable energy which has been universally recognized by the international society and embraces the obvious advantages of rich resources, proven technology, economic cost, flexible electric dispatching and high energy return rate. The SHP development in orderly manner and its sustainable utilization have played a very important role in reducing the greenhouse gases emission, protecting the forest and the vegetation, improving production and living conditions for rural population and contributing considerably to the rural economic and social development …… As we know, Chile is a beautiful country with comparatively large potential of hydropower development. Since Chinese small hydropower has its unique characteristics in terms of development and utilization, our center HRC would like to make contribution to the promotion of hydropower development in Chile. We hope that your honored visiting can deepen the mutual understanding and promote the bilateral cooperation in the field of small hydropower". According to the speech of Governor Felisa, Chile is rich in water resources and the government also attaches

an importance to hydropower development. In Aysén Province, there are many rivers and lakes; however, due to lack of the experience concerned, they hope to be informed of the achievements and experience of hydropower development in China. The delegation members took great interests in listening "HRC Briefing" and "SHP Development in China", and asked questions respectively. An in-depth discussion was held and the guests from Chile suggested that a MOU would be signed with HRC and the concrete cooperative projects were expected to be carried out in near future.

2. Outbound missions

In 2012, HRC has applied for 21 oversea visiting delegations of 36 people to Ministry of Water Resources (as per appendix 2). HRC dispatched delegates respectively to France, Macedonia, Turkey, the Philippines, Vietnam, Pakistan and other countries to attend international conferences, implement science and technology cooperation between governments, carry out the tasks of the installation of hydraulic equipments, technical consultation, contract negotiation of the equipments export and so on. The important visits include:

(1) HRC delegates attended the 6th World Water Forum.

During March 12-17, 2012, the 6th World Water Forum was held in Marseille. HRC Director Ms. Cheng Xialei, as a member of Nanjing Hydraulic Research Institute Delegation, delivered a speech at Session 1.4.3: "Social policies for disaster risk reduction and resilience" and took part in the spot discussion as an invited guest and answered questions.

(2) HRC delegate attended Energy Sector Coordination Committee Meeting of Central Asia Regional Economic Cooperation

During May 21-22, 2012, Energy Sector Coordination Committee Meeting of Central Asia Regional Economic Cooperation was held in Philippines. 40 representatives from 11 countries attended the meeting and they commented on the implementation of Energy Action Plan and Energy Work Plan 2013-2015 of Central Asia Regional Economic Cooperation. Mr. Lin Ning, Director Assistant of HRC, attended the meeting, and discussed the follow-up project cooperation with the participants who had taken part

in the SHP International Workshops undertaken by HRC.

(3) HRC Delegation Visited Vietnam for the Cooperation Project between Vietnamese Governments

During July 7-15, 2012, at the invitation of Vietnam Institute of Hydraulic and Renewable Energy (IHR), headed by HRC Deputy Director Mr. Xu JIncai, a 4-people delegation visited Vietnam to carry out the cooperation project between Chinese Government and Vietnamese Government---"Research on the Emergency Guarantee Technology for Rural Hydropower under the Disaster Condition Caused by Climate Variability". HRC signed a Memorandum with IHR on black-start technology of hydropower station and other potential cooperation projects.

(4) HRC Delegate Attended 2nd EAS Energy Efficiency Conference

From July 30 to Aug. 2, 2012, 2nd East Asia Summit (EAS) Energy Efficiency Conference was held in Phnom Penh, Cambodia. 200 people from ASEAN include senior officials, experts and company manages. Professor-level senior engineer Li Zhiwu made a report titled "China's small hydropower in rural energy development" to introduce China small hydropower policy, technology, development obstacle and other aspects. During the meeting, Mr. Li paid a visit to Mr. HENG SOKKUNG, Under Secretary of State, Ministry of Industry, Mines and Energy, Cambodia, who had attended the Ministerial Seminar on Water Resources and Small Hydropower, and paid a return view to some participants who had taken part in international training course for small hydropower held in HRC.

(5) HRC Delegate Attended International Off-grid Renewable Energy Meeting

During November 1-2, 2012, International Off-grid Renewable Energy Meeting was held in Ghana. HRC assigned Mr. Cui Zhenhua to attend the meeting. At the meeting, Mr. Cui gave a report entitled "Rural Electrification through Small Hydropower in China".

(6)HRC Carried Out Cooperation in Renewable Energy in Pakistan

During December 10-16, 2012, 4-people delegation including Mr. Xu Jincai, Deputy Director of HRC, Mr. Lin Ning, Director Assistant of HRC, and other two relevant persons in charge paid a visit to Pakistan to carry out cooperation in the field of renewable energy such as hydropower, solar power and so on. During their stay in Pakistan, HRC delegation visited Renewable Energy Technology

Committee, Ministry of Science and Technology and several related departments, as well as the Minister for Affairs of Kashmir and Northern Area, the Federal Government of Pakistan, and the Economic and

Commercial Counselor's Office of the Chinese Embassy in Pakistan. The Delegation received warm reception by local government, scientific research institutions and power developers, and signed memorandum of cooperation with Punjabi Bureau of Energy and Habib Rafiq (Pvt.) Limited on the broad cooperation of technical training, cooperative R&D, and project demonstration in the field of small hydropower and other renewable energy.

(7) International Seminar on SHP Cooperation between India and China

On October 23, 2012, sponsored by National Development and Reform Committee of China, National Energy Administration of China and Ministry of New and Renewable Energy of India, "International Seminar on SHP Cooperation between India and China" was held in Beijing. Professor-level senior engineer Mr. Zhao Jianda of HRC attended the meeting and made a keynote speech entitled "Development Situation of Chinese Small Hydropower and Relevant Policies".

3. Information Exchange

In 2012, HRC has finished the translation drafts of Operation and Maintenance of Small Hydropower Station Technical Specification, Technical Code for Construction of Small Hydropower Station, The Acceptance Code for Construction of Small Hydropower Station, and completed the English translation draft for examination of Guidelines on Electromechanical Equipment

guide for Hydroelectric Installations. The formulation and publication of the above English version standards have a great practical significance in promoting the development of international hydropower market and increasing the international business of design of SHP projects and equipments export and so on.

HRC has edited and published the "SHP News" of 2012, colleting huge number of articles concerning SHP technology and development, as well as the cutting-edge news in the field of SHP of many countries. The influence of the website of HRC has been enhanced. This year, it released 24 pieces of English news, collected and edited some global SHP and SHP industry information. In 2012, 28 papers from HRC staff members were published (as per appendix 3).

III Export of hydropower equipments

In 2012, HRC's subordinate equipment completing company carried out the after-sale service for 5 power stations of AKFEN project; completed the on-site installation and commissioning of Murat cascade power station and put it into operation; finished the on-site service of Kartalkaya project, carried out the on-side service of Osman, Kale and Sena project. Osman and Kale projects are expected to be completed in January, 2013 and Sena project will finish installation in April, 2013; started on-site service for containerized units in Kosovo; Otluca project has finished the shipment and is about to conduct the on-site installation service; organized the equipments manufacture for project in Angola; carried out the after-sale service for Pinar project; launched the development of SHP markets in Turkey, Kosovo, Serbia, Togo, Macedonia, Ivory Coast, Pakistan and so on.

The company has newly undertaken 3 foreign projects: equipment completing of GIKIRA (2×200 kW) in Kenya, feasibility report for the construction of DOBRUSHA power station in Kosovo, equipment completing of Gangelas project(1×1,004 kW+1×250 kW)in Angola.

IV Design for overseas engineering

In 2012, in addition to carrying out bilateral cooperation projects such as the design of PAKKAT power station in Indonesia, project design for RUHUII, construction drawing design for LUBUK hydropower station and AIR PUTIH hydropower station in Indonesia, construction drawing design for UPPER BAIUNE in Pupa New Guinea, feasibility research for THUAN HOA hydropower station in Vietnam, engineering consultation for Naltar-V hydropower in Pakistan, HRC's subordinate Planning and Design Institute for M/S Hydro also undertook the design for some new cooperative projects, such as RENUN hydropower station in Indonesia, THUAN HOA hydropower station (30MW) in Vietnam, SIBUNDONG hydropower station in Indonesia, DEBELAT hydropower station in Indonesia, AIR PUTIH hydropower station in Indonesia, etc.

V Work Plan for 2013

Based on the fruitful achievements concerning foreign affairs work in 2012, HRC will make unremitting efforts to continuously enhance international cooperation on SHP, vigorously undertake international exchange and foreign-aid training, conscientiously implement the strategy of "Go Global", actively explore overseas markets, and further promote SHP equipment export. Details of the work plan for 2013 are set out below.

1. To earnestly conduct the three foreign-aid projects (Seminar on Rural Electrification for Developing Countries, Formation sur la Technologie de Petite Centrale Hydroélectrique pour les Pays d'Afrique francophone and Training Workshop on Small Hydropower Technology for English-speaking African Countries) entrusted by the Ministry of Commerce; plan to revise the English version of the training materials "Small Hydropower"; to publish the French version of the training materials "Small Hydropower" based on the suggestions and comments from the participants of the training workshops who had read the trial edition; to make persistent efforts to ensure the excellent fulfillment of the foreign-aid training projects sponsored by MOFCOM; to earnestly conduct the training workshop on SHP for ASEAN countries.

2. To pay a visit to 1-2 countries which have dispatched participants to HRC for attending the foreign-aid training projects, aiming at collecting suggestions for sustainable improvement; to further strengthen the in-depth exchange with the foreign colleagues and governmental sectors in the field of SHP, to enhance friendship and promote cooperation.

3. To fully play the role of an important "window" for international exchange and cooperation on SHP, to strengthen the development of "the two magazines and the website" of HRC, and plan to build a section of French version of the website, to undertake extensive information exchange with the international organizations, the oversea SHP institutions and the colleagues at home and abroad.

4. To actively explore the overseas markets; to maintain the market in Turkey and undertake the overhaul and supply the spare parts for the projects built in Turkey; to further explore the African markets based on the projects in Angola and Kenya; to build the demonstration project on the containerized SHP units in Macedonia, to further explore the markets in East Europe, such as Kosovo, Albania and Serbia, etc.; based on the demonstration project on the containerized SHP units for "Black Start-up", to further explore the markets in south-east Asia, such as Thailand, Myanmar and Indonesia, etc.; to explore the market in Pakistan by strengthening the communication with the old training participants and the cooperation with the construction companies and installation companies.

5. Plan to dispatch the delegate(s) to Nepal for attending the Energy Summit.

Appendix 1

Foreign Guests Hosted by HRC in 2012

No.	Time	Country/Organization/Delegate(s)	Objectives & Achievements
1	1/9-1/10	The owner of a SHP station in Kenya	The visit paid by the owner signified the formal startup of the cooperative project focusing on equipment supply and technology export, playing a role of demonstration for opening up African market, and providing experience for the further market development in Africa.
2	1/9-1/12	5 delegates from the Turkish company	The foreign guests visited the equipment manufacturer and inspected the test of hydropower equipment to be supplied.
3	3/18-3/20	5 delegates from the Turkish company	The foreign guests visited HRC, holding a discussion on hydropower projects and wind power development.
4	4/2-4/4	2 delegates from Albania	The foreign guests visited HRC, holding a discussion on the pre-feasibility study on local hydropower development.
5	7/2-7/6	5 delegates from the Turkish company	The foreign guests visited the equipment manufacturer and inspected the test of hydropower equipment to be supplied.
6	9/22-9/23	2 delegates from the Turkish company	The foreign guests visited the equipment manufacturer and held a primary technical discussion on the new project.
7	10/23	Mr. Hassan, Official from UNESCO	The foreign guest visited HRC and held a discussion with HRC leaders on financing for the cooperative SHP project in Sudan.
8	10/31-11/11	4-member delegation led by Mr. Francisco Garcés, Director of National Research and Certification Center for Housing and Urban Development, Ministry of Technology, Venezuela	The foreign guests had a meeting with HRC leaders and learnt the general survey on SHP development in China and the related policies and new technologies, aiming at promoting the exchange in the field of science, technology and renovation, as well as the cooperation in the field of SHP and other renewable energies.
9	10/29-10/31	The manager from a Nepalese company	The foreign guest visited the equipment manufacturer and confirmed the intention to have a long-term cooperation with HRC.
10	11/4-11/6	3 delegates from Czech Republic	The foreign guests visited the equipment manufacturer and had a meeting with HRC representatives, hoping that the cooperative project would be well promoted.
11	11/16	10-member delegation led by Ms. Felisa Ojeda V., Governor of Aysén Province, Chile	The foreign guests held a friendly meeting and made in-depth exchange with HRC leaders and experts, and were well informed of the achievements and experience of hydropower development in China. It aimed to promote bilateral cooperation in the field of SHP.
12	11/19-11/23	3 delegates from a Turkish company	The foreign guests visited the equipment manufacturer, and checked and made an acceptance of the equipment to be supplied for the project. A summary on the cooperative project has been made between the two sides.
13	11/20-11-23	3 delegates from the Kenyan company	The foreign guests held a meeting with HRC experts, discussing the issues of production quality and packing quality, and reaching an agreement on the next step action plan for the cooperative project.

Appendix 2

HRC's Outbound Missions in 2012

No.	Time	Delegate(s)	Country	Mission & Achievements
1	2/24-3/29	2	Macedonia	To hold discussion on the cooperative hydropower project in Macedonia.
2	3/12-3/17	2	France	To attend the 6th World Water Forum in France.
3	3/26-6/21	1	Turkey	To give instructions on the installation of turbine-generating units in Turkey.
4	4/18-7/14	1	Turkey & Macedonia	To give installation instructions for the hydropower projects in Turkey and Macedonia.
5	4/16-4/27	2	Turkey & Macedonia	To hold discussion on the cooperative hydropower projects in Turkey and Macedonia.
6	5/20-5/23	1	The Philippines	To attend the Energy Sector Coordination Committee Meeting of Central Asia Regional Economic Cooperation in the Philippines.
7	6/22-9/18	1	Turkey & Macedonia	To give installation instructions for the hydropower projects in Turkey and Macedonia.
8	7/8-7/15	4	Vietnam	To implement one of the scientific and technical cooperative projects between Chinese Government and Vietnamese Government.
9	7/4-8/5	1	Turkey	To give instructions on the installation of turbine-generating units in Turkey.
10	7/16-7/21	1	Turkey	To give instructions on the installation and debugging of the hydropower project in Turkey.
11	7/18-8/6	2	Turkey & Macedonia	To hold discussion on the cooperative hydropower projects in Turkey and Macedonia.
12	8./6-11/3	1	Turkey	To give instructions on the installation of the turbine-generating units in Turkey.
13	9/2-9/20	4	Turkey	To hold discussion on the cooperative hydropower project in Turkey.
14	9/3-9/30	1	Turkey	To give instructions on the installation and debugging of the electro-mechanical equipment for the hydropower project in Turkey.
15	9/24-10/3	1	Turkey	To give instructions on the installation and debugging of the hydropower project in Turkey.
16	10/30-11/25	3	Pakistan	To give instructions on the installation of the turbine-generating units in Pakistan.
17	11/21-	1	Turkey	To give instructions on the installation and debugging of the hydropower project in Turkey.
18	12/10-12/16	4	Pakistan	To hold discussion on the cooperative hydropower project in Pakistan.

No.	Time	Delegate(s)	Country	Mission & Achievements
19	12/4-	1	Macedonia	To give instructions on the installation and debugging of the electro-mechanical equipment for the hydropower project in Macedonia.
20	12/4-	1	Turkey & Macedonia	To give instructions on the installation and debugging of the electro-mechanical equipment for the hydropower project in Turkey and Macedonia.
21	12/17-	1	Turkey	To give instructions on the installation and debugging of the hydropower project in Turkey.

Appendix 3

Papers of HRC Staff Published in 2012

No.	Title of Academic Papers	Magazine/ Conference	Serial No.	Category	Author
1	An Analysis on Installation and Operation of Rural Earth Leakage Protector	China Rural Water and Hydropower	ISSN 1007-2284	Chinese Core Journal	Cheng Xialei, Zhu Mingjuan, Guo Xinggan
2	Research on the Water Resources Regionalization Model Based on Extension Conducting Effect	Journal of Hydroelectric Engineering	CN 11-2241/TV ISSN 1003-1243	Chinese Core Journal (collected by EI)	Zhang Rengong, Cheng Xialei
3	Design on Management System of Water Resources Regionalization in China	Water Resources and Power	ISSN 1000-7709 CN 42-1231/TK	Chinese Core Journal	Zhang Rengong, Cheng Xialei
4	Social Policies for Drought and Flood Risk Reduction in China	Session 1.4.3, the 6th World Water Forum, --Marseille, France, March 14, 2012		Invited presentation	Cheng Xialei
5	IVDF-ANN Prediction Model for Monitoring Data of Landslide Deformation	Journal of Yangtze River Scientific Research Institute	ISSN 1001-5485	Chinese Core Journal	Qin Peng, Zhang Zheyu, Qin Zhihai, Wang Weihan
6	An Analysis on Implementation Strategy of Green Hydropower Certificate in China	China Waterpower & Electrification	ISSN 1673-8241	Chinese Ordinary Journal	Cui Zhenhua, Chen Xing
7	An Analysis on Establishment of Carbon Accounting System for Small Hydropower Project	China Waterpower & Electrification	ISSN 1673-8241	Chinese Ordinary Journal	Chen Xing, Cui Zhenhua
8	Some Issues on Electrical Design of Hydro Power Station	Journal of Beijing Electric Power College	CN 11-4081/N ISSN 1009-0118	Chinese Ordinary Journal	Wu Weiguo

No.	Title of Academic Papers	Magazine/ Conference	Serial No.	Category	Author
9	Application and Anti-failure Measures for "Soft-Starting Device" of Hydropower Station	Rural Electrification	CN11-2181/TM ISSN 1003-0667	Chinese Ordinary Journal	Wu Weiguo
10	Automation Design and Application of Hydropower Station	Automation Application	CN50-1201/TP ISSN1674-778X	Chinese Ordinary Journal	Wu Weiguo
11	Policy and Regulation: Regulating Development of Small Hydropower in America	Small Hydro Power, No.1, 2012	ISSN 1007-7642	Chinese Ordinary Journal	Cui Zhenhua
12	Opportunities of Small Hydropower Development in Africa	Small Hydro Power, No.1, 2012	ISSN 1007-7642	Chinese Ordinary Journal	Kang Peng, Wu Hao, Zhao Jianda
13	R&D Strategy for Emerging Hydropower Technologies in Canada --- General Survey	Small Hydro Power, No.2, 2012	ISSN 1007-7642	Chinese Ordinary Journal	Zhao Jianda, Kang Peng, Wu Hao
14	R&D Strategy for Emerging Hydropower Technologies in Canada --- Market Analysis	Small Hydro Power, No.3, 2012	ISSN 1007-7642	Chinese Ordinary Journal	Wu Hao, Kang Peng, Zhao Jianda
15	R&D Strategy for Emerging Hydropower Technologies in Canada --- Project Examination and Approval & Ecological Environment Protection	Small Hydro Power, No.4, 2012	ISSN 1007-7642	Chinese Ordinary Journal	Kang Peng, Wu Hao, Zhao Jianda
16	R&D Strategy for Emerging Hydropower Technologies in Canada --- R&D for Emerging Hydropower Technology	Small Hydro Power, No.6, 2012	ISSN 1007-7642	Chinese Ordinary Journal	Zhao Jianda, Kang Peng, Wu Hao
17	A New Financing Model for Construction of Hydropower Station --- Case Study in Macedonia	Small Hydro Power, No.3, 2012	ISSN 1007-7642	Chinese Ordinary Journal	Wang Wanying, Lin Ning
18	Cultivation and Development of Strategic Emerging Industries in Small Hydropower Sector	Small Hydro Power, No.5, 2012	ISSN 1007-7642	Chinese Ordinary Journal	Cheng Xialei, Zhu Xiaozhang

No.	Title of Academic Papers	Magazine/ Conference	Serial No.	Category	Author
19	Research on Performance Appraisal System of Renovation Project of Rural Hydropower Station	Small Hydro Power, No.6, 2012	ISSN 1007-7642	Chinese Ordinary Journal	Zhou Lina, Yang Jia, Tang Yanqiu
20	Comprehensive Assessment of Water Resources of Comprehensive Utilization Project of Water Resources	Small Hydro Power, No.6, 2012	ISSN 1007-7642	Chinese Ordinary Journal	Zhang Zheyu, Feng Dijiang
21	Design of Ice Melting Heater of Water Inlet of Taishir Hydropower Station	Small Hydro Power, No.6, 2012	ISSN 1007-7642	Chinese Ordinary Journal	Wu Weiguo
22	Turbine Runner Selection in Expansion and Renovation of Chetan Hydropower Station	Small Hydro Power, No.6, 2012	ISSN 1007-7642	Chinese Ordinary Journal	Jiang Xinchun
23	Analysis of Selection of Turbine Runner Type in Rennovation Porject of Geshan Cascade No.2 Power Station	Small Hydro Power, No.5, 2012	ISSN 1007-7642	Chinese Ordinary Journal	Wang Xuefeng, Yang Jianfeng, Wu Tao
24	Upgrading and Renovation of Monitoring System of Changtan Reservoir Hydropower Plant	Small Hydro Power, No.6, 2012	ISSN 1007-7642	Chinese Ordinary Journal	Wu Weiguo, Zhang Rongzhi
25	Problems and Treatment of Installation of Turbine Guide Vane in Changzhao Hydropower Station	Small Hydro Power, No.5, 2012	ISSN 1007-7642	Chinese Ordinary Journal	Lu Jianping, Wang Guizhong
26	Status quo of Medium & Small Pumped Storage Station and its Development in Zhejiang Province (the omission in 2011)	Small Hydro Power, No.6, 2011	ISSN 1007-7642	Chinese Ordinary Journal	Jiang Xingfen
27	Renovation for Unattended Operation of SHP Unit outside Changtan Reservoir Hydropower Plant	Small Hydro Power, No.6, 2012	ISSN 1007-7642	Chinese Ordinary Journal	Zhang Rongzhi, Wu Weiguo

(Source:HRC) ■

Academician Zhang Jianyun Gave Special Lecture to International Participants

On June 6th, 2012, Mr. Zhang Jianyun, Academician of Chinese Academy of Engineering and President of Nanjing Hydraulic Research Institute, gave a special lecture "Water Resource & Impacts of Climate Change in China" to the international participants of Training Workshop on SHP Technology for Developing Countries, and won applause of 24 participants from 17 countries around the world.

Academician Zhang first represented Nanjing Hydraulic Research Institute to extend cordial greeting, wishing participants delight study and stay in picturesque city Hangzhou as well as the complete success of the workshop. During the lecture, Mr. Zhang made a comprehensive explanation on the hot issues, such as Chinese water resource, the impact on water resource causing by climate change and water resource strategy, etc. The participants broadened their horizon after having Mr. Zhang's coherent and helpful lecture complete with excellent texts and graphics in PPT, which explained the profundity in simple terms. All the participants actively raised question, which created a warm atmosphere in class. They said that it's an enlightening class with good arrangement.

Besides, a group photo was taken for Academician Zhang and the internatioanl participants of SHP training workshop, and the leaders of HRC, relevant responsible officers of Division of Foreign Affairs & Training, Division of International Cooperation, Science and Technology, New-Tech R&D Center and some staff members were also present at the wonderful moment.

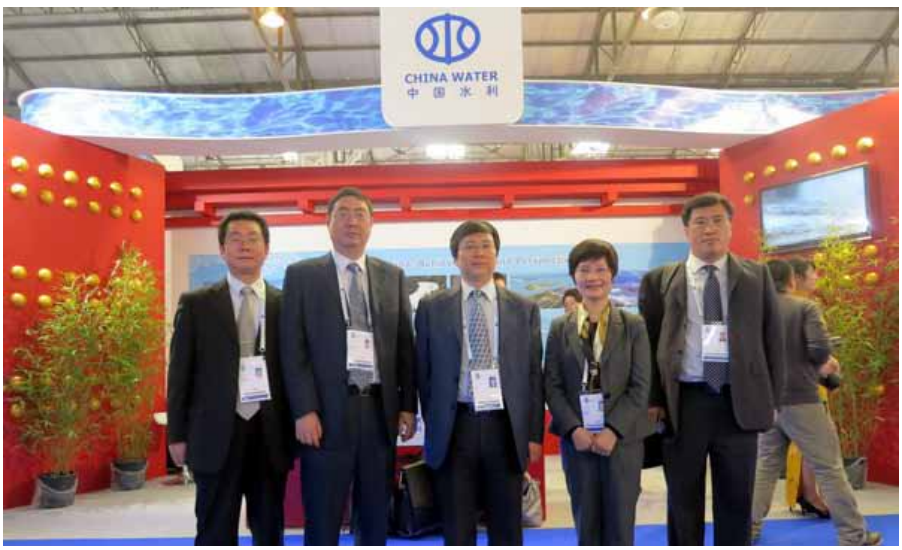
(Source:HRC) ■

HRC NEWS

HRC Director Attended the 6th World Water Forum

▲Mr. Chen Lei, Minister of Water Resources, inspecting the exhibition booth of NHRI

March 12, 2012 saw the opening of the 6th World Water Forum (WWF6) in Marseille, a port city of southern France. With "Time for Solutions" as its theme, this forum has raised 3 strategic directions, 12 key priorities for action as well as 103 concrete targets. In line with the principle of finding solutions for water problems, more than 400 sessions and meetings were held to conduct in-depth discussions on the issues, problems and suggestions summarized and collected from previous forums and international conferences with an aim to carry out concrete actions in real earnest. Co-sponsored by World Water Council (WWC), French government and the city of Marseille, this one-week forum was attended by more than 20,000 participants from over 170 countries and regions. Ministerial conferences, regional days, thematic sessions, water exhibitions and all the other discussions and exchanges of various forms were held to make concerted efforts for solving world water problems. Prime Minister of France François Fillon and President of WWC Loïc Fauchon addressed the opening ceremony. Secretary-general of UN Ban Ki-moon gave a speech through video, in which he called on a global action against global water crisis. The ceremony also witnessed the awarding of the King Hassan II Great World Water Prize to Sahara and Sahel Observatory, a Tunis-based independent international organization.



▲NHRI delegation at the forum

China attended the World Water Forum of this year for the first time as a member of WWC. An official delegation of China headed by Mr. Chen Lei, Minister of Water Resources of China, attended the Ministerial Roundtable, the Meeting on Asian-Pacific Framework for Action, the Ministerial Meeting among China, Japan and South Korea, and MOU signing ceremony among the three countries. An expert delegation as well as an enterprise delegation organized by MWR attended the thematic sessions and water exhibitions.

▲Ms. Cheng Xialei delivering a speech at the thematic session

The NHRI delegation, headed by Prof. Li Yun, Vice President of NHRI, which was also a part of the expert delegation of MWR, focused its attention on two thematic sessions, i.e. Session 1.4.3: "Social policies for disaster risk reduction and resilience" hosted by Global Green Growth Institute of South Korea, and Session 1.4.5: "Reducing disaster-induced economic losses" by US Army Corps of Engineers. Two experts from NHRI delivered their speeches at these two sessions, introducing success cases and social policies of China in flood/ draught risk reduction, early-warning and monitoring. China exhibition section was set up with the largest scale in WWF. NHRI also exhibited its research findings and achievements during the water exhibitions so as to enhance its global influence.

▲Discussion at the thematic session

HRC Director Ms. Cheng Xialei delivered a speech at Session 1.4.3: "Social policies for disaster risk reduction and resilience" and took part in the spot discussion as an invited guest and answered questions. HRC exhibited its scientific research achievements in NHRI exhibition booth.

(Source:HRC) ■

Delegation from Chile Visited HRC

On 16 November, accompanied by Ms. Dai Aiping, Division Chief, Department of Foreign Affairs of Zhejiang Province, the 10-member delegation from Chile headed by Ms. Felisa Ojeda V., Governor of Aysén Province, paid a visit to HRC. The Director of HRC Ms. Cheng Xialei, the Deputy Directors Mr. Xu Jincai and Mr. Huang Jianping delivered a warm welcome to the guests in the hall.

During the friendly bilateral meeting, Director Cheng and Governor Felisa addressed respectively.

Director Cheng said:"HRC is a national research institute specializing in small hydropower and we also serve as a world-wide window for international small hydropower cooperation. Small hydropower is a renewable energy which has been universally recognized by the international society and embraces the obvious advantages of rich resources, proven technology, economic cost, flexible electric dispatching and high energy return rate. The SHP development in orderly manner and its sustainable utilization have played a very important role in reducing the greenhouse gases emission, protecting the forest and the vegetation, improving production and living conditions for rural population and contributing considerably to the rural economic and social development …… As we know, Chile is a beautiful country with comparatively large potential of hydropower development. Since Chinese small hydropower has its unique characteristics in terms of development and utilization, our center HRC would like to make contribution to the promotion of hydropower development in Chile. We hope that your honored visiting can deepen the mutual understanding and promote the bilateral cooperation in the field of small hydropower".

According to the speech of Governor Felisa, Chile is rich in water resources and the government also attaches an importance to hydropower development. In Aysén Province, there are many rivers and lakes; however, due to lack of the experience concerned, they hope to be informed of the achievements and experience of hydropower development in China.

The delegation members took great interests in listening "HRC Briefing" and "SHP Development in China", and asked questions respectively. An in-depth discussion was held and the guests from Chile suggested that a MOU would be signed with HRC and the concrete cooperative projects were expected to be carried out in near future.

After the meeting, on behalf of HRC, Director Cheng presented the souvenirs to the delegation, and a group photo was taken to mark the productive visit.

(Source:HRC) ■

SHP Benefits the Life of Rural Families

—— An Unforgettable Visit of the International Participants to Liugongtian Village

On June 14th 2012, the 24 members of "Training Workshop on SHP Technology for Developing Countries" from 17 countries visited Liugongtian Village in Shengzhou City, Zhejiang Province. The purpose of this trip is to provide the participants of the workshop conducted by HRC with the chance to know the development of China rural economy, especially the role that small hydropower played.

With the company of Shengzhou Water Resources Bureau and the committee leadership of local village, the participants visited Diaojiaowan Small Hydropower Plant. And after that, they were divided into several groups to visit the local rural families and had the chance to talk to them face to face.

Liugongtian Village, locates in Shengxi mountain area, was the village with poor collective economy. In order to cast off the label of poverty, the villagers had strong desire to utilize rich water resources and build hydropower plant to strengthen collective economy. In 1994, with the support of local Water Resources Bureau, one hydropower plant with the capacity of 450kW and the annual power generation of 1, 200,000 kWh was finally built. With the establishing of the power plant, the collective economic of the village had increased a lot, and the welfare of the villagers had been significantly improved. Since the hydropower station had been put into operation 10 years ago, the village not only paid the loan back, but also improved the living condition of the villagers considerably. For examples, the village invested millions yuan in total to install tap water, build village roads, prepare medical care for the villagers. In addition, local students admitted to the universities and colleges can instantly have stipend of 2,000 yuan. And villagers at the age of 60 and above are able to have the living allowance of 250-400 yuan per capita at the end of each year.

The participants were all very interested in the life of local villagers, and asked a lot of questions, e.g. the housing condition of local villagers, and their family members, their incomes, etc. In one house of the local villager, we saw the Chinese painting and handwriting of the householder,

which was greatly appreciated by the participants. In return, the householder introduced Chinese handwriting to all participants, and some of the participants tried to write with the writing brush. At last, the householder came up with his own Chinese hand writing works and presented to the monitor of the training workshop - Mr. Ramesh from Nepal. The householder not only sent his blessing to our guests from foreign countries, but also hoped that the friendship between China and Nepal will last forever.

Many participants expressed that this activity gave them the opportunity to witness the changes of the Chinese villagers' living condition with the construction of small hydropower stations. It was an unforgettable experience and very impressive.

Combined with the visits of international participants, the Party Committee, the Trade Union, and the Communist Youth League of HRC organized the activity to condole with the heirless elderly, and visited 15 elderly people along with the international participants. Representatives from HRC sent rice, cooking oil and other gifts to them to express the care and concern. The activity has been warmly welcomed by the local villagers.

(Source:HRC) ■

HRC Wins 2011 First Prize for Science and Technology of Zhejiang

Key Technology and its application of Network Control and Optimization for Small Hydropower Stations, which was completed by Zhejiang University of Technology, Hydropower Management Center of Zhejiang Province and HRC, wins the first prize for science and technology of Zhejiang province for 2011.

The result was achieved with the joint funding by several projects at national, provincial and ministerial level. Combining with the requirements of the development of small hydropower stations, with "Economical and Practical, Simple and Reliable" as the guideline, an in-depth research is conducted on the effective utilization of small hydropower and generic technology of safe operation in terms of remote control and maintenance of small hydropower networking, modern intelligence control system, and the optimization of operation dispatch. The networking control equipment for small hydropower stations with self-owned intellectual property rights has been developed. This research achievement is applied abroad in large-scale. It has been successfully applied in dozens of hydropower stations in Zhejiang, Gansu, Jiangxi, Shaanxi, Chongqing, Guizhou, Fujian, Guangdong, and been exported to over ten countries, such as Turkey, Peru, Vietnam, Mongolia, Kenya, Angola, with significant economic and social benefits.

The achievement has obtained 8 patent licenses, 2 new and practical patents and 6 software copyrights.

(Source:HRC) ■

Training Opportunity by HRC for 2013

No	Name of the Training	Date	Fee
1	Seminar on Rural Electrification for Developing Countries	From 9 May to 6 June, 2013	Fellowships will be provided, including international airfares, boarding, lodging, local transportation in China, pocket money and etc. The interested applicants may contact, directly or through their governmental organization, the Commercial Office of the Chinese Embassy for further information and approval.
2	Formation sur la Technologie de Petite Hydro-Electricité pour les Pays Francophones d'Afrique	Du 23 août au 19 septembre, 2013	
3	Training Workshop on Small Hydropower Technology for African English-Speaking Countries	From 16 Oct to 26 Nov 2013	

(Source:HRC) ■

HRC's Small Hydropower Engineering Quality Inspection Center obtained China Metrology Accreditation (CMA)

HRC's Small Hydropower Engineering Quality Inspection Center obtained CMA issued by CNCA on March 23th, 2012 with certificate number: 2012003283F. CMA logo could be used.

The authorized certification items include 116 detection parameters in 12 categories: physical and mechanical properties of the soil, mechanical properties of rocks, foundation treatment engineering, geotechnical synthetic material, engineering measurement and monitoring, metal structure, hydraulic machinery, electrical equipment, etc. The acquirement of CMA indicates that HRC's Small Hydropower Engineering Quality Inspection Center is qualified to issue the data and results that have the function of proof, and have the ability to conduct the inspection, evaluation and research for engineering quality, efficiency improvement and capacity enlargement, and safety production.

Metrology accreditation is in accordance with the Article 22 of Metrology Law of the People's Republic of China: "A product quality inspection institution which provides impartial data for society must be examined as qualified for its capability and reliability of metrological verification and testing by the metrological administrative department of the people's government at or above the provincial level." The rules in details on the Implementation of the Metrology Law of the People's Republic of China, further stipulate that the metrology accreditation is a compulsory examination to the inspection institution required by the law, and is the official certification given by government authorities for specific types of inspection. The data issued by inspection institution that has passed metrology accreditation is used as notarial data and has the legal force, for the trade certification, product quality evaluation and achievement appraisal.

(Source:HRC) ■

Comments by Participant

I My View of China Before Arrival

Away from the primary issue of SHP discourse, the visit has helped to correct my previous wrong impressions about China as a place and her development strides in infrastructure, culture, social life, governance, geo-politics, and language, science & technological developments. The level of development I have seen is miraculous and far beyond my expectation (Hangzhou is heaven). To be specific, Chinese language and writing did not catch my fancy until I came and began learning to speak & write them. I commend the vision of the organizers for incorporating the Chinese language class in the programme. Apart from the language, I have also come to terms with the Chinese dance, Tianiji, hiking, meals/green tea, chop stick and I hope to continue to learn, use, practise, enjoy and promote them back home. As a matter of fact, the CCTV channel was not my favourite channel before, but the story is different now. Since my arrival, I have not missed my most favourite TV shows – the ''CROSSOVER''and the ''DIALOGUE''. I have been following China's social & family lives with the ever articulate broadcasters like JI JIAOXIN & DOMINIC JOHNSON HILLS; and Chinese geopolitics with the two charismatic TV broadcasters, Mr.YANG RUI & Ms. TAI WEI on ''DIALOGUE''. It was through the TV Dialogue programme that I formed my first opinion that China believe in harmonious world. My awareness about ''one country two administrations'' mode of governance between China and Hong Kong was also better sharpened through this medium. Permit me to add with high sense of patriotism that CCTV AFRICA is a delight.

II Sightseeing Programme & Tourism Potential of China

SIGHTSEEING visits to the Grand West Lake, Eco-Parks, Museums, Grand Canals, historic Monuments, Temples(Pegodas), Tombs of Heroes (like the Dayu Imperial Tomb), Zoo Parks, shopping at different major Supermarkets and YIWU International Market, HAINING Leather Market, PUDONG New Development Zone in Shanghai, China EXPO Centre in Shanghai all added great colours to my rich experiences during this visit. The 6 weeks stay was never boring because of the SIGHTSEEING VISITS which also exposed the rich culture (depicted in different museums) of China to me. As a matter of fact, I was visibly shocked on realizing the economic potentials and benefits of the BAMBO TREE in China. Indeed, China's commitment to the development of her huge cultural and Trade potentials is commendable and worthy of emulation.

As Water Resources expert, the National Water Museum in my opinion is a masterpiece in China's effort towards preserving her rich national history, heritage, scientific and technological inventions in the Water Resources Sub-sector. China's Water Museum is my best and I call it 'Wonder Museum'. The BOAT FEASTIVAL coincided with our stay and it was also a nice side attraction for me and indeed all the participants of this workshop. I have lots and lots of pictures and video clips to use in telling the story of my sightseeing spree back home in Nigeria (laughs).

The SIGHTSEEING experience has made me to believe that if given similar attention, my Nigeria's tourism potential with her vast natural scenery, landscapes, historic monuments and diverse cultures, the Tourism Sub-sector will equal the oil Sub-sector in revenue generation.

III Recommendations

The following recommendations may be useful for future improvement of the programme and enrichment of the course content for fuller benefit to participants. They are:

• Study of Environmental Impact Assessment detailing on the procedures, mitigative

Measures and how to write EIA Report/Statement should be included in the curriculum because EIA Certificate is a mandatory legal requirement for approving engineering project of this magnitude with associated high risk factor;

• Planning and Site Selection techniques should stand out clearly in course modules;

• Topics such as Remote Sensing techniques, Flood Duration Curves, Computer Models(DEM, DTM) may be introduced in hydrological assessment of prospective sites;

• Geological problems differ from one country to another and it could be serious in some countries, therefore, its consideration should not be limited to the Chinese situation for obvious reason. The workshop is an academic exercise and should be holistic in content. There is alarming incidences of earth's subsidence, tremor, earthquake, land-and-mudslides world over, hence geological aspects of SHP ought to be given the deserved attention to promote higher degree of public safety.

• HRC may employ (hire on temporary basis) an experienced Engineering Geologist to handle lectures on geological aspects of SHP in a more passionate and profound manner in view of the fact that the earth crust is the foundation for all civil engineering structures, hence its integrity should not be in doubt but thoroughly investigated using appropriate technology.

• Establishment of computer laboratory for tutorials and application of design softwares

IV Acknowledgement

Space will not allow me to acknowledge the valuable roles of all those who made my participation and experiences on this workshop memorable and rewarding. Let me however place on record the roles of the following:

• The Peoples' Republic of China through the Ministry of Commerce for the Sponsorship;

• HRC Director(Professor Ms Cheng), Honorary Director, Academic & Non-academic Staff for their goodwill, love, hospitality and friendliness;

• Professor Pan Daqing for his unique, patient, consistent, likeable and un-assuming disposition. Inspite of the persistent pressure from the class of 24, he NEVER for once got angry. I praise his sense of maturity and excellent temperament. His prompt response to the collective and individual concerns of the class was worthy of my note;

• My appreciation goes to the indefatigable Staff of Foreign Affairs Department for their friendliness. The SHENs, the TANGs and others were excellent team players. I will miss you all;

• To the SMALL HYDRO FAMILY I say: Let us all keep the contact to keep the flag flying.

(By participants of 2012 SHP training workshop, Mr John Ochigbo, Federal Ministry of Water Resources, Nigeria)

(Source:HRC) ■