A Brief Introduction to resettlement and Interest Sharing in Reservoir Area of Shuibuya Hydropower Station

Hubei Qingjiang Hydroelectric Development Co., Ltd.

I. General Condition of Qingjiang River Valley Cascade Development and Shuibuya Hydropower Station

Qingjiang River lies in the southwest of Hubei province and flows through ten counties (cities) in Hubei province. It is a large branch of Yangtze River after Three Gorges, covering totally 423km. The valley area reaches more than 17,000km^2 and the total height difference reaches 1,430m.

The river valley is rich in water resources and the development conditions are favorable. In addition, it is situated nearby the electric load center, and suitable for the construction of water conservancy and hydropower projects with large reservoir capacity and good regulating performance. According to the state-approved Qingjiang River Valley Cascade Development Plan, the developing task of Qingjiang mainly includes power generation, flood prevention and navigation, in conjunction with other related industries capable to promote regional economic development. The developing emphases focus on the three cascade hydropower stations located on the river section of the Qingjiang mainstream after Enshi, i.e. the Shuibuya, Geheyan and Gaobazhou Hydropower Station. Upon the completion of the three cascade hydropower stations, the total installed capacity will exceed 3,300 MW, and the annual power generation capacity will reach 8 billion kWh.

In order to implement the Qingjiang River Valley Development Plan, Hubei Qingjiang Hydroelectric Development Co., Ltd (HQDC) was established in 1987 to be in charge of the construction and operation management of the three cascade hydropower stations in Qingjiang River valley. With 20-year efforts, the development task of Qingjiang River valley cascade hydropower stations has basically completed. Wherein, Geheyan Hydropower Station and Gaobazhou Hydropower Station was put into operation in 1994 and 2000 respectively, and Shuibuya Hydropower Station will be put into full operation in this year, which mean that the three large cascade hydropower stations situated on the first river implementing “valley, cascade, cycling and comprehensive” development mode, Qingjiang, will step into the stage all-around exerting their social and economic benefits. At the same time, HQDC has become the first trial enterprise in China that succeed in implementation of comprehensive development mode for river valley, and also the first operation management enterprise completely realizing full-valley dispatch of cascade hydropower stations.

Shuibuya Hydropower Station is located in the midstream of Qingjiang river, belonging to Badong county of Enshi Prefecture, and is the flagship hydropower station on the Qingjiang trunk stream. The damsite is 117km away from Enshi, the capital city of Enshi Prefecture, in the upstream, and 92km from Geheyan Hydropower Station in the downstream. The catchment area of the damsite reaches 10,860km^2 and occupies 64% of the total valley area. As an over-year regulation reservoir, the normal water level is 400m and the total reservoir volume is 4.58 billion m^3. The project involves an inundated plowland of 17,558 Mou and a relocatee number of 14,145. Compared with other water

conservancy and hydropower projects in similar scale, the loss of inundated properties is smaller.

Shuibuya Hydropower Station is composed of structures such as concrete faced rock-fill dam, water diversion type underground powerhouse, left-bank flood spillway and right-bank emptying tunnel. The highest height of dam reaches 233m, which ranks the highest among similar type of dams in the world. Shuibuya Hydropower Station is a backbone hydropower station with peak regulation and frequency modulation functions in central China power grid. The total installed capacity of the hydropower station is 1,840 MW, and the annual power generation capacity is 3.98 billion KWh. Due to the reverse regulation function to the two downstream hydropower stations, i.e. Geheyan and Gaobazhou, the annual power generation capacity of cascade hydropower stations can be increased by 357 million KWh.

The total scheduled construction period of the project is nine and a half years. In order to advance the benefits of the project, the Owner modified the schedule for river closure and power generation one year ahead, i.e. to realize river diversion in October 2002, to put the first unit into operation in 2007 and all the four units into operation in August 2008, and complete the whole project in 2009.

II. Implementation of Resettlement for Shuibuya Hydropower Station

(I) Comparison and selection of relocation proposals

The total population of relocated residents involved in Shuibuya Hydropower Station reservoir is relatively smaller. Most residents are relocated to nearby regions and more than 95% residents still engage in agriculture and planting industry. In order to minimize the impacts of reservoir submersion, many proposals have been compared in different stages of engineering design, and the relocation proposal has been optimized to avoid relocation or minimize the population of residents to be relocated.

Banxia damsite 10km away in the downstream was taken for comparison of damsite. The impact of reservoir submersion at Shuibuya damsite is 20% reduced compared with that of Banxia damsite, which significantly reduce the impacts of submersion on local ecological resources and social environment, especially the population of relocated residents.

405m proposal was taken for comparison for normal water level. The current 400m proposal can reduce 15% inundated area than the 405m proposal, in particular, the submersion area of 405m water storage proposal might involve the low region in Enshi municipal district at the end of reservoir, which may increase the resident population to be relocated by 60%.

Comparison of different resettlement plans, optimization of relocation mode, treatment of reservoir submersion and resettlement planning are essential parts in the design of water conservancy and hydropower project, and also the foundation for proper relocation of residents. After determining the project proposal, detailed investigation has been made on the scale of resettlement to define type and quantity of impacts, verify the population of residents to be relocated, investigate the status quo of economic activities in the inundated area and the relocated population, compare various proposals to select a proper resettlement plan, and optimize the investment proposal to make the production and living

conditions after relocation reach the original level.

(II) Preparation of Resettlement Plan

According to the design specification, the preparation and submittal of Shuibuya reservoir resettlement plan for approval shall include the following stages:

● Preparation and submittal stage of *Investigation Outline for Full-size Indicators* and *Detailed Rules for Investigation*, *Investigation Outline for Full-size Indicators* and *Detailed Rules for Investigation* shall be approved by Hubei provincial government.

● Investigation stage of full-size indicators, the investigation result shall be summarized and verified jointly by the design institution and the local government, an investigation memo shall be signed for confirmation, and the residents shall recognize the full-size indicators with their signatures.

● Preparation of *Planning Outline* and *Planning Report*, and submission for approval. Planning documents shall be reviewed by professionals, discussed, modified and accepted by the provincial migration authority, the Owner, local government and other interest parties, and submitted to the provincial government for review and then to relevant state authority for approval before implementation. In implementation, corresponding implementation plans shall be established for different counties as the guideline for resettlement work.

Shuibuya reservoir resettlement plan complies with the developing migration policy and applies the method of compensation and allowance in early period and support in late period to properly arrange production and living of residents and gradually make the life of residents reach the original level or even better off. The primary arrangement for farmer residents shall be land-oriented and planting-centered agricultural relocation to make the residents possess fundamental cultivated land and garden land, and to relocate them in local and nearby regions as far as possible by means of sufficiently developing and utilizing land, improving land of moderate or low productivity, regulating contracted land with proper payment. Selection of residence location shall be closely combined with production arrangement. The new location shall be of stably geology and relatively flat landform, shall be easy to solve counterpart facilities such as water supply, electric power supply and transportation, and shall minimize the occupation of cultivated land and prevent to occupy the most productive land.

The new location of towns shall have wholly stable geology, relatively mild landform, with the elevation higher than the highest water level of reservoir and with available land for construction. In the relocation planning, importance shall be attached to taking advantage of the mountain terrain and compact layout. District, boundary, point and location shall be clearly defined for the relocated enterprises and residents.

For the roads, bridges, ferries, water conservancy and electric power facilities, and special industrial facilities such as telecommunication line and broadcast line that inundated by the reservoirs, the investment for rebuilding them as per the original scales and standards or recovering the original functions (three-original principle) shall be included in the resident compensation cost, while the additional investment for expanding scale or enhancing standard level shall be solved separately by local government.

According to the full-size indicator investigation results and the three-original principle, the relocation compensation to farmer residents mainly includes:

● Compensation for cultivated land and garden land

● Compensation for land other than cultivated land or garden land

● Compensation for house and appurtenances

● Compensation for small-sized water conservancy facilities

● Compensation for scattered fruit trees

● Relocation fee: including transportation compensation, relocation loss compensation, cost for labor-hours lost, in-trip accommodation cost, and relevant medical cost incurred in relocation

● Living allowance for transition period

● Capacity increase fee of school and medical network

● Construction cost of infrastructure

(III) Implementation Management System of Resettlement

According to the *Report On Submersion Treatment Of Shuibuya Reservoir Region And Resettlement Plan* approved by the state in 1999, the inundated region of Shuibuya reservoir involves five counties and cities (Badong, Hefeng, Jianshi, Xuanxian and Enshi), 17 towns, and 131 villages. The population in the inundated region is 9950, including 8570 farmer population. The inundated area includes 17558 Mou of cultivated land and garden land, 17077.3 Mou of forest land, and 28269.7 Mou of brush mountain. The inundated area involves 481,600 m^2 various housing area, 4 towns, 7 bridges, 2 ferries, 53.57km graded roadways, 16 hydropower stations, and 18 industrial enterprises. The planned population to be relocated is 14145 people (where 11034 farms in villages and 3111 residents in towns), the planned population for farmer relocation is 10502 people, and the investment for relocation compensation approved by the state is RMB 921 million Yuan.

In accordance with the currently effective policies and practices in China related to resettlement for large and middle-sized reservoirs, the relocation management mode “under the charge of government, with investment on a contract basis, with the participation of the Owner and the supervision of relocated residents” shall be applied and the developing relocation guideline shall be complied with. Resettlement work in the project is not directly organized by the Owner, but organized and implemented by local government. The project Owner is mainly responsible for organizing the preparation of *Resettlement Planning Report*, and obtaining governmental approval; during implementation, the Owner is responsible for paying the fund for relocation compensation, following on the implementing progress of relocation, and participating in coordination and settlement of problems encountered in resettlement. In 2001, Hubei provincial government confirmed by a paper that the relocation task and relocation fund for Shuibuya reservoir are contracted to related provincial departments and Enshi municipal government, implementing a management system uniformly guided by the provincial government, under the charge of Enshi municipal government, and organized and executed by relevant counties and towns.

Migration Office of Hubei Province is the principal department in the provincial government in charge of resettlement, and at the same time, the instructing party for the execution of relocation for Shuibuya reservoir in charge of dividing tasks, dispatching tasks, appropriating funds, providing business instruction, personnel training and fund supervision, following on the process and organizing acceptance test etc, and responsible for communicating and coordinating with the Owner and local government, balancing the interests of various parties, solving contradictions between various parties, and solving

various problems occurring in execution. Various levels of governments in relevant cities and counties and towns are responsible for organizing the detailed execution of resettlement work and corresponding migration organizations are responsible for centralized management of concrete business.

(IV) Implementation Development and Effects of Resettlement

Implementation of relocation for Shuibuya reservoir begun in 2001. After six and a half year, i.e. in June 2007, all resettlement works lower than the normal water level of reservoir have been finished, and passed the provincial acceptance test, upon which the reservoir started to be applied for water storage. At present, except a part of newly impacted region of reservoir in which the relocation has not been finished due to landslide, all other resettlement work and various special project construction for the reservoir have been basically completed, and it is planned to complete the total acceptance test for relocation in the reservoir region next year.

The resettlement for Shuibuya reservoir is synchronized with the project construction, which has created favorable conditions for reservoir impoundment power generation and properly settling problems related to relocation, development, production, living of residents and construction of reservoir region, so as to pave a solid foundation for residents' live and work in peace and contentment, long-term social order and economic development in the reservoir region.

Explore new ways and seek satisfactory living and working relocation for farmer residents. In the original plan, building resident communities is the main relocation method for most farmer residents, and others serve as auxiliary means. In execution, in order to satisfy the relocating willingness of residents, the land-oriented, agriculture-centered and scattered relocation principle is erected, and four scattered relocation means are provided for residents to choose from. Namely, local transfer, moveing to live with relatives and friends, utilization of vacant resources such as land with land, forest and house but without residents, and government deployment. Scattered relocation method applying multiple approaches speeds up the step of resettlement and arrangement and shows good effects. According to investigations, the housing area for each relocated resident has reached 39.82 m^2, house structures are generally better than those before relocation, and infrastructure for farmer residents such as water supply, electric power and roadway has been primarily furnished. Every relocated resident averagely possesses over 1.26 Mou of cultivated land and garden land and corresponding means of production such as agricultural mountainous forest. Living and working conditions of most relocated residents are not lower than the level before relocation and not lower than the local average level. In this way, the residents don't have to leave their homeland, don't have to change their living habits, and can live in the same and familiar environment, which facilitate them to be easily combined into the local society and realize life in peace and work in contentment.

Relocation of towns in the reservoir region also speeds up the construction step of small towns in Enshi Prefecture. The inundated towns to be relocated in Shuibuya reservoir region include Nantanhe town in Badong county, Jinjikou town in Hefeng county, Jingyanghe town in Jianshi county, and Zhongjianhe town in Xuanen county. The total population in the directly inundated region is 1668 people, and the planned population to be relocated is 3599. The planned area of construction land is more than 400 Mou. The

total relocation fund is nearly 100 million Yuan, plus the internally raised fund among residents and other social investment, the total investment reaches nearly 400 million Yuan. New positioning and construction of various relocated towns with higher starting point according to higher standard obviously enhance the functions of towns. The established four new towns are alike but with respective characteristics, and together with resident communities, natural villages and immigration spots in the reservoir region, form a favorable economic and cultural network, which has not only improved the living environment of residents and farms in towns within the reservoir region, but also urged major revolution of rural production and life styles. Many villagers have been librated from the first industry and transferred to the domain of the third industry such as commerce, architecture and logistics, which has vigorously accelerated the economic development in the reservoir region.

Reconstruction of special projects has promoted construction of public infrastructure facilities such as roadway network, post and telecommunication, broadcast and TV in the reservoir region, and significantly improved the environment. The reconstructed special projects in Shuibuya reservoir region include: traffic system, electric power system, post and telecommunication system, broadcast and TV system, and relocation of small-sized industrial enterprises. Where, reconstruction of traffic system is one of the emphases in the reconstruction project. An amount of 220 million Yuan has been invested to reconstruct 45km graded roadways, 7 large-sized bridges and 2 ferries, most of which are located on provincial or county-level trunk roads, and planed, designed and constructed to connect with Enshi municipal roadway network and improve rural traffic network in Enshi Prefecture. Reconstructed roadways and bridges can normally satisfy higher standard than before, which greatly improve the traffic conditions in surrounding area of the reservoir region. For example, Jingyanghe bridge was originally a cableway bridge, the new bridge after reconstruction is an arch bridge made of steel pipes, of full length 519m and main span 260m, which becomes one of the largest bridges on Qingjiang trunk stream; Original Nantanhe ferry and Taofukou ferry were constructed as per low standards, and the navigation service had to be suspended once flood period arrives, while after reconstruction, the problem of suspension in flood period is successfully solved and the freight navigation capacity is significantly enhanced.

In the case of reconstruction of electric power system, post and telecommunication system and broadcast and TV system and relocation of small-sized industrial enterprises in the reservoir region, the compensation fund is used to local infrastructure by inputting into construction projects directly benefiting to the public. In the development and construction of the project, uniform planning and uniform construction are implemented, higher standards are applied, and enhanced functions are realized, which have facilitated local economic development and improved living quality of residents.

Resettlement in Shuibuya dam region varies from that in the reservoir region. In the dam region, the Owner assigns the relocation project to the corresponding county-level government in the dam region on an agreement basis. Relocated residents in Shuibuya dam region involve two counties (i.e. Badong and Changyang), two towns and seven villages, the relocated population is 2598 people, including 2580 farmer residents. Residents within the expropriated scope marked with red line in the dam region have been

completely relocated, and the relocation fund has been compensated as planned, without any side effect remaining.

(V) Problems encountered in execution of relocation project and corresponding solutions

1. In the relocation planning stage, owing to inadequate consideration to many problems or changes encountered during actual execution, the actual execution of resettlement in Shuibuya reservoir region has run into some deviations from the original plan. The project Owner has positively communicated with the provincial migration authority and the local government, adroitly guided action according to circumstances on the basis of sufficient coordination and agreement, timely adjusted and modified the plan, regulated the budget and increased the investment. For example, the originally planned concentrated relocation proposal for farmer residents in the reservoir region involves great execution difficulties and many side effects, so in the actual execution, scattered relocation proposal was applied instead, which has been demonstrated practically that better effects have been obtained by scattered relocation. Take the reconstruction of traffic system in Shuibuya reservoir region as another instance, due to the inadequate design depth in the early period of planning, great fund shortage occurred in the late period because of application of higher standards and expansion of construction scale in order to meet the development demand. After negotiation between the Owner and the traffic department, it is decided that the owner is liable for the part of fund shortage caused by insufficient design depth, and the traffic department is liable for the part of fund shortage caused by application of higher standards and expansion of construction scale. In this way, the problem of fund shortage is solved timely by reasonable allocation.

2. After relocation, a part of residents have not recovered to the original productive condition and living level, and a certain gap exists with the surrounding public. The provincial migration authority, local government and the project Owner have attached great importance to the problem. Various approaches are applied in order to assist relocated residents seeking development under new existing conditions and recover their living level to the original level and realize gradual better-off, e.g. utilizing the support provided in late period, preparing later period support planning, adjusting industrial structure, developing new projects, and vigorously promoting feature industries in the reservoir region such as planting fruit trees and economic woods, tourism, traffic transportation, and aquaculture. Project planning is mainly conducted by local government, and project management, including technical introduction, personnel training, planning, fund management, and project supervision, is implemented by migration authority. Fund sources mainly include revenue distribution, the state’s later period support policy to relocated residents, and reservoir maintenance fund extracted from income of the hydropower station after power output.

3. Contradiction between the Owner’s control on project investment and the high anticipation of relocated residents on compensation. The project Owner is always trying hard to restrict the project investment, and expecting to bring about the maximum benefits of the project with the least cost. While the residents negatively relocated due to the project construction not only strive for the vested interest in relocation, but also anticipate higher compensation. When propaganda and implementation of compensation policy are

insufficient, compensation standard is non-transparant, communicating and coordinating channels are blocked, or solvent of problem is not timely, it is easy to raise contradictions and social problems. In concrete implementing work, besides replying on local government and migration authority to strengthen propaganda of relevant policies, strengthen migration supervision and launch effective communication, the project Owner shall focus on the following work:

● Actively raise funds in strict accordance with the relocation compensation budget approved by the state and the investment defined by provincial organization to appropriate the required relocation fund in advance as scheduled without delay or withholding.

● In the case of changes in national policies, the Owner shall timely adjust and increase investment to maintain the consistency with the currently effective national policies. For example, changes in land compensation policy, price policy, or later period support policy.

● During implementation of resettlement, in the case of inconsistency between actual situation and planned design, after adjustment and planning according to a certain procedure, the Owner shall increase investment according to the adjusted and approved plan.

● In the case of unforeseeable situation, local government shall, together with migration authority and the project Owner, jointly conduct investigation, put forward proper solutions, and after negotiation and agreement, increase the investment.

● For major contradictions or problems encountered during relocation implementation, if it is reasonable and must be solved, after negotiation and agreement between various parties, the Owner shall increase investment; if it is irrational, various parties shall jointly settle the problems by patient explanation.

● The relocation budget shall include all basic reserve funds to be used for solving any unforeseeable problem other than changes in national policy, design revision and price factor.

● Fulfillment of later period support responsibility and implementation of poverty alleviation plan. According to the state's later period support policy, besides the later period support fund, the Owner shall pay reservoir maintenance fund extracted from the income of Shuibuya Hydropower Station on the basis of 0.8 cent/kWh to the provincial finance authority to be used for developing production and improving living condition of residents after relocation and to realize sustainable and stable development of the residents' living and working conditions. In addition, the Owner shall implement poverty alleviation plan in the resettlement region every year to provide free support fund for assisting poor population in the region to improve their living and working conditions and solving their difficulties.

4. Environmental and geological impacts of reservoir water. In the planning design stage of project, the assessing work for environmental impacts of Shuibuya project has been completed. According to the assessing result, there is no environment aspect restricting the construction of Shuibuya project. During construction and operation of the project, except land resource inundated by the reservoir belonging to permanent negative impacts, other negative impacts on the environment can be prevented and avoided by taking preventive or improving measures. After Shuibuya reservoir starts to store water, the

severest problem to be encountered is sudden geological landslide on reservoir bank slope, e.g. at Muzhuping and Tuditang, large-scaled (over 1 million m^3) slope earth has been slid into the river resulted from instability caused by landslide. The Owner and local government shall attach important to the appearance of collapse symptom before landslide, and jointly solve the potential danger of landslide. One, to establish an emergency organization and prepare emergency proposal; Two, to develop risk quantification in emergency, evacuate the public in dangerous area to safe place for temporary escape; Three, to employ design and geological survey institution to carry out verification and examination of landslide in the whole reservoir region on the basis of the previous exploration, define the dangerous area and implement risk quantification measure in relocation, make the public living on landslide body move permanently out of the dangerous area, and implement their resettlement in accordance with the relocation practice in reservoir region and complying with the same standard and policy; Four, to set up a deformation monitoring network to large-scaled landslide body in the reservoir region, and take precautions for geologic hazards.

In the relocation arrangement for residents on landslide body, there are totally over 5000 people relocated, equivalent to one third of the relocation scale in the original reservoir-inundated region, and the owner has input huge fund for this. But on the other hand, by implementing relocation approach for the public living on the landslide body, their living and working conditions have been greatly improved. Since there is no human activity on the landslide body any longer, its ecologic environment is also being protected and improved and the vegetation condition will become better.

5. In the case of different standards for neighboring reservoir, it's subject to contradictions caused by unrealistic comparison. In the surrounding district of Shuibuya Hydropower Station, there are many hydropower station projects both established and in construction. Owing to reasons such as inconsistency in construction time, unequal level of economic development, different physical pattern and different investment modes and owners, some applied standards and practices for relocation compensation are inconsistent. In order to solve the contradiction stemmed from unreasonable comparison between relocated residents, the owner shall sufficiently consider the interests of both local government and relocated residents, and actively coordinate and solve any contradiction. For those solvable, the Owner shall make concessions and provide assistance for settlement; for those incompliant with relevant policies or stipulations, request the departments on a higher level for explanation and persuasion. For instance, the compensation of price difference in investment for Shuibuya relocated residents is a practice taken after comparing with the practice in Three Gorges project.

III. Positive impacts of Shuibuya Hydropower Station on regional economic and social development

(I) Impacts on the Economic and Social Development in Hubei Province and Central China Region

Shuibuya Hydropower Station has functions such as power generation, flood prevention, navigation and other comprehensive functions. It has huge economic benefits and social benefits, and has great improving effect on the economic development in Hubei

province and the sustainable development of energy in central China region.

1. Provide quality peak regulation and frequency regulation power supply

There are many hydropower stations in central China and Hubei provincial grid, but there is only a few having good regulation performance and insufficiency in peak regulation performance is an outstanding problem in the grids. After Three Gorges Power Plant is put into operation, since Three Gorges work needs to undertake a large quantity of flood prevension task on Yangtze River, its output in rich water period and withered water period varies a lot. Shuibuya Hydropower Station lies in the hinterland of central China grid, and is nearby the electric load centers, i.e. Three Gorges Hydropower Station and Gezhouba Hydropower Station, the construction of hydropower stations can not only provide huge electric power and electric energy for Hubei provincial grid and central China grid, but also further stimulate Qingjiang River valley to become a base providing clean and reliable peak regulation, frequency regulation and emergency standby power supply for central China grid, which facilitates the optimized deployment of water resources in central China grid, alleviate the contradiction of central China grid between yearly increasing peak-valley difference and severe insufficiency in peak regulation power supply. The installed generator units in the hydropower station are able to have full output in the case of peak load and keep complete shutdown in the case of valley load of grid during over 80% time, their full capacity shall be able to undertake regulation of peak-valley difference, so it is a precious over-year regulation reservoir with favorable regulation performance in central China. According to estimation of relevant experts, around 2010, Shuibuya work can undertake7%--9% peak regulation capacity of central China grid; if jointly carrying out dispatch together with the downstream Geheyan and Gaobazhou Hydropower Stations, it can undertake 12%--16% peak regulation task of central China grid. After establishing Shuibuya work, the compensation regulation of Qingjiang cascade reservoir and Three Gorges reservoir can be utilized to realize combined operation together with Three Gorges and Gezhouba Hydropower Stations, which can reduce the electricity loss caused by abandoned water of the two hydropower stations during flood period and thus improve the power supply quality of Three Gorges and Gezhouba. According to relevant estimation, Shuibuya Hydropower Station can increase annual yield of hydropower station due to compensation regulation, e.g. increased by 1,796 million kWh for Three Gorges Hydropower Station, and 391 million kWh for Gezhouba Hydropower Station.

2. Alleviate the flood prevention load of Jingjiang river section on Yangtze River, and eliminate water disasters in the downstream of Qingjiang

Qingjiang River valley lies in the rainstorm center in the middle stream of Yangtze River, plus the shallow valley, sudden rise and sharp drop of water level in flood period, large flood peak flow, frequent flood disaster in history, and considering that Qingjiang is right merged into Yangtze River at upstream of Jingjiang river section of Yangtze River and Qingjiang flood often meets with Yangtze River flood, the flood threat on Jingjiang river section of Yangtze River with limited flood overflow capacity is deteriorated. Flood threat to Jingjiang region is all the time a potential danger in Hubei province and even the whole China, therefore, building reservoirs for trunk and branch streams is an essential part for construction of flood prevention system. Besides a 500 million m^3 flood prevention reservoir volume is reserved at Geheyan reservoir, another 500 million m^3 flood prevention

reservoir volume is reserved at Shuibuya reservoir. By combined regulation of Shuibuya reservoir and Geheyan reservoir, blocking up and control Qingjiang flood water at proper time, and staggering with flood peak flow of Yangtze River, it can not only eliminate any flood disaster that may occur to the public living in the middle and down stream of Qingjiang, but also effectively enhance the flood prevention standard of Jingjiang river section of Yangtze River, alleviate flood threat of Qingjiang river to the people living on the banks of Jingjiang river section, and reduce the cost incurred by flood disasters. When a large flood covering the full valley of Yangtze River occurred in 1998, the established Geheyan Hydropower Station reservoir in the downstream of Shuibuya properly restricted Qingjiang flood by blocking and reducing the flood level in Shahe city by 0.2--0.3m, which successfully prevented secondary flood diversion of Jingjiang river, protected 500,000 Mou cultivated land and the people's life and properties against damage, and made a great contribution to anti-flood rescue.

3. Provide convenient outgoing traffic trunk for mountainous area in the southwest of Hubei province and promote commodity exchange and development of various resources.

Under natural conditions, Qingjiang river features multiple shoals and rapid water flow, the streams in the upstream of Shuibuya are basically inaccessible and only small wood boats allowed in non-flood period, so the navigation capacity is small. At present, many civilians still apply laggard manual handling method in many places, sometimes roadways are applied, but the roadway conditions are hard and the cost is high owing to complicated landform and large wavy terrain. After establishment of Shuibuya work, the navigation conditions for Qingjiang trunk streams in the downstream of Enshi have been comprehensively improved, and the original streams with two banks erecting with sheer mountains have become wide and silver waterways, which has provided convenient traffic trunk for mountainous area in the southwest of Hubei province, promoted commodity exchange and development of aquaculture, tourism and various resources, and accelerated the grand economic development in southwest of Hubei province.

4. Construction of Shuibuya project can promote development of related industries in Hubei province, increase tax revenue and accelerate economic development of Hubei province.

Shuibuya Hydropower Station features long construction period and large investment. The engineering construction requires large quantities of labor force, fund, materials and electric power resources etc. The labor force required by Shuibuya project construction has increased direct employment opportunities, corresponding supply of living materials and raw materials and equipment manufacture etc can not only directly promote increase in demand and development of related industries, but also bring about indirect employment opportunities, which can effectively improve the environment for economic and social development in Hubei province.

(II) Promote Economic and Social Development in Enshi Prefecture that the reservoir region located in and bring about in-depth impacts

Shuibuya project lies in Enshi autonomous region in southwest of Hubei province, which is main habitation area of minorities such as Tujia & Miao and where the local

economic development is relatively laggard owing to the restriction of natural conditions. Large quantities of land have been inundated by the reservoir construction and it has changed the original natural and social balance and the original distribution layout of resources. However, the construction of Shuibuya work has also brought about new opportunities and injected with new vigor to the local social and economic development. The impacts and accelerating effects to local social and economic development is significant during the construction period of the project. After the establishment of Shuibuya Hydropower Station, in-depth impacts will be brought about to economic growth, increase of financial income, improvement of cross-linked and comprehensive transportation network, promotion of local tourism, aquaculture and related industries etc. Various nationalities in Enshi Prefecture have deemed Shuibuya project as a “life project” and “hope project”.

1. Great impacts and obvious accelerating effects on local economic and social development during construction period of the project

1) Directly promote economic development in Enshi Prefecture and enlarge sources of local finance income. Since the flow cut-off and commencement of main body project on October 2002, the average annual funded investment for Shuibuya project is over one billion Yuan, and the accumulated investment funded to the project has reached over ten billion Yuan. The annual investment to Shuibuya is equivalent to one fifth of the fixed asset investment in the whole Enshi Prefecture (excluding the investment to construction of Hu-Rong-Xi express way and Yi-Wan railway). Primary estimation shows that the increased architectural business fulfilled by the project construction directly raises the average annual growth of GDP in Enshi Prefecture by 1.3 percentage points. If other investments, e.g. local infrastructure construction, and the growth realized by development of related industries under promotion of this project construction are also taken into account, the total growth of GDP directly and indirectly stemmed from the project reaches about 2.5 percentage points. Besides accelerating economic development, Shuibuya project has increased a large quantity of tax revenue for Enshi Prefecture during the construction period. According to the statistic data provided by tax administration, the tax revenue directly stemmed from Shuibuya project in the period from 1998 to 2007 reaches nearly 200 million Yuan. Under the promotion of investment to major projects such as Shuibuya, investment growth has become a main support to the economic growth in Enshi Prefecture, and tax revenue from major projects has become one of backbone sources of finance income in Enshi Prefecture.

2) Vigorously stimulate the development of related industries in Enshi Prefecture. During the period from 1998 to 2007, the architectural investment to Shuibuya project has reached eight billion Yuan, in which the consumption of main building materials is as follows: steel material 94,000 tons, wood material 24,000 m^3, and cement 600,000 tons. The supply of large quantity of materials, electric power and living materials required by the project construction has vigorously stimulated the development of related industries in Enshi Prefecture.

One, it speeds up the restructuring of rural industry and stimulates the rapid growth of rural economy. The supply of large quantity of living materials required by the project construction has accelerated the restructuring of local rural industry and promoted the rapid

growth of rural economy. For example, the vegetable bases and sporadic vegetable gardens around the dam region has increased from 200 Mou before 1998 to the current 2,500 Mou to supply large quantities of local special products such as vegetables every year to the construction personnel, which has not only brought about direct income to farmers, but also stimulated the farmer's change in production idea.

Two, it stimulates the development of local industry and related industries. By August 2006, the accumulated power supply of Enshi Prefecture to the project has reached 32.03 million kWh; During the period from 1998 to 2006, Zhaoyang cement plant in Shuibuya town has supplied 100,000 tons cement for the project and the construction of the reservoir region. In addition, local traffic transportation industry has been rapidly developed, the quantity of passenger cars in Shuibuya town has increased from one in 1998 to 70 in 2006, and freight vehicles from 10 in 1998 increased to 50 in 2006, with about 2,000 employees involved.

Three, it develops the third industry. The period from 1999 to 2006 is the construction peak period for dam filling work, the quantity of involved construction personnel is averagely 3500 and maximum 8000, and there are totally 60,000 direct and 30,000 indirect employment opportunities provided in the whole construction period. Iindividual businessmen in Shuibuya town has been rapidly developed, and service industries such as commerce and trade, logistics, food and beverage, and tourism etc have been boomed. For example, there are 123 individual businessmen in 2003 in the town covering 1.2 km^2, where, 44 engaging in food industry. Following the commencement of Shuibuya project and the construction of new towns, sightseeing tourists and investigating guests have been increasing year by year, which greatly stimulates the local development of the third party.

3) Resettlement and infrastructure construction speed up the step of new rural construction in Enshi Prefecture. The inundated area of Shuibuya project involves five counties in Enshi Prefecture, namely, Enshi, Badong, Jianshi, Xuanen and Hefeng, and the planned relocated population reaches 14,000 people, and the compensation to farmer residents in the reservoir region occupies 38% of the total relocation investment. Developing relocation guideline is applied for farmer relocation, i.e. to integrate the new rural construction plan and the mountainous characteristics of Enshi Prefecture, take agriculture settlement as the basis, apply scattered resettlement proposal characterized by multi-channel, multi-mode and multi-method, make sufficient use of vacant resources such as the land with house, land and wood but without residents, and utilize compensation fund to build new houses rich in local features taking the advantage of house resettlement opportunities. In addition, the migration authority can relatively concentrate relocation fund and make uniform planning to improve fundamental infrastructure facilities (e.g. roadway, water and electric power system, broadcast, telecommunication, school and medical network).

Along with the deepening of relocation work, some new thoughts, new ideas, new culture and new technologies have been gradually penetrated into the wide relocated regions, which have changed the traditional thoughts and idea, and living and working modes of farmers in mountainous area, gradually made them new farmers in new age, and effectively pushed the new rural construction in Enshi Prefecture.

Relocation of towns in the reservoir region has changed the living conditions of farms

in mountainous area and formed small towns with various minority national features. These newly built small towns have become the politic, economic and cultural centers in rural regions, which are the important basis for marketization of rural economy, and also have created favorable conditions for tourism construction in the reservoir region.

2. In-depth and far-reaching impacts on the economic and social development in Enshi Prefecture after establishing the project

1) The operation of all the four units will directly and significantly promote the economic development in Enshi Prefecture.

One, obvious promotion to economic growth. After all the four units in Shuibuya are put into operation, i.e. the annual average power general capacity reaches 4 billion kWh and the annual yield reaches 1.5 billion Yuan, the economic growth can be increased by approximately 650 million Yuan, which is equivalent to 18.6% of the total economic growth of the entire Enshi Prefecture in 2005, and 10.3% of the growth in 2010. Taking the basic data in 2005 for comparison, the average annual growth created by the four units in Shuibuya project after putting into operation can increase the total industrial yield of the entire Enshi Prefecture by 18.6%, in the “Eleventh five-year” period, the average annual growth is increased by 3.5%; and the GDP of the entire Enshi Prefecture can be increased by 3.8% on the basis of that in 2005.

Two, increment in tax revenue. After the four units in Shuibuya Hydropower Station putting into operation, the annual value-added tax and additional tax to be levied will amount to over 300 million Yuan. After the capital fund of power generation enterprise is completely funded and the hydropower station gains profits, income tax will be levied. In addition, upon the first unit of Shuibuya project putting into operation, water resource fee can be levied, which will amount 12 million Yuan after all the four units have been put into operation. The above listed tax revenue will provide a reliable assurance for local finance income.

2) The formation of deep-water course in the reservoir region will vigorously push the development of shipping industry on Qingjiang river.

The formation of Shuibuya reservoir region will increase one more golden waterway for Hubei province in its southwest. After adjustment and control of Qingjiang trunk and branch streams, the deep-water course will be about 200km long and meet the control grade 5, which can enable passage of 300-ton grade vessels. There will be four freight piers newly built along the 92km trunk stream. Waterway transportation has many potential advantages such as large freight capacity, low cost, low power consumption, small land occupation, and small environmental pollution. The establishing of Qingjiang course will provide a convenient, safe and economical waterway for development and outgoing transportation of mineral resources such as iron ore and coal etc in Enshi Prefecture, which is extremely significant for sufficiently exerting the advantages of Qingjiang waterway shipping and promoting the harmonious development of comprehensive transportation structure in Qingjiang River basin. After 2008, Enshi Prefecture will form a comprehensive transportation and traffic system consisting of roadway, waterway, airway and railway.

3) The unique scenery formulated in the reservoir region will definitely promote the rapid development of local tourism, and make it a pollution-free sunrise industry for economic development of towns in the reservoir region.

Qingjiang River basin is one of top four resorts in Hubei province. Shuibuya reservoir region lies in the middle stream of Qingjiang river, containing rich tourism resources. Grand dam crossing the river and flat lake on the gorges, reflecting with green mountains and clean water, will construct unique natural scenery of Qingjiang river. As per *A Special Research Report in Development of Qingjiang River Basin* issued by China University of Geosciences, there are top five sight spots for Enshi --Shuibuya Qingjiang water leisure: one is Fusantiao drifting exploration, characterized by exciting and alarmingly dangerous; two is Honghuatang geological heritage, characterized by special geological landforms; three is Jingyang valley, characterized by grandness; four is Yesanhe valley, characterized by narrow but steep banks and unpredictable appearance of golden monkey; five is Shuibuya grand dam, characterized by its overshadowing height; just name a few. The unique scenery will surely attract tourists both abroad and at home, and give a bright foreground for tourism in the region.

As the cascade hydropower stations in Qingjiang River basin are successively built, a brilliant scenery with “three dams and three reservoirs” will be formed on the trunk stream, fundamental changes will occur to the whole appearance and the ecological environment in the basin, traffic conditions will be greatly improved, mountains in Qingjiang will turn greener, and water will be prettier, which will provide a previous chance to vigorously develop tourism, stimulate the development of transportation, food and hotel industries around the reservoir region, absorb and digest the employment of migrated residents, and increase their income.

4) Over 60 km^2 water surface in the reservoir region provides an opportunity for vigorous development of reservoir-characterized economy, promotion of local aquaculture industry, and industrial reconstruction.

One, aquaculture industry will have a bright developing foreground. After formation of Shuibuya reservoir and the normal water level reaching 400m, the water surface area reaches to be close to 100,000 Mou (equiv. to 65.5 km^2). Since Qingjiang is situated in valleys in mountainous area and there is no large pollution source around the reservoir, the reservoir will play the role of a huge clarifying and purifying water body. Clear and quality reservoir water and wide water surface have provided favorable conditions for the development of aquaculture industry. In order to make the relocated residents in the reservoir region and other regions live and work in peace and contentment and keep long-term order, local government has established the strategic guideline of “properly developing aquaculture industry of Qingjiang river and building over-water agriculture on the basis of advantages in water resource”, and planned to vigorously develop and rationally utilize Qingjiang fishery resource, seeking effective approaches for farmers in the reservoir region to eradicate poverty and better off.

Two, rural industrial restructuring brings about new opportunities. During the relocation work for Qingjiang reservoir, most residents have chosen to move backward locally and apply scattered resettlement. Establishing and improving living facilities are only a part of the task of resident relocation, the most fundamental part involving large quantity of work is to recover and develop production, and gradually better off on this basis, to achieve peaceful life of residents and long-term social order, which is also the eventual target of resident relocation. Since the reservoir begins to accumulate water, the original existing

environment has been changed and the original living and working conditions of residents have also been changed. If persisting in conventional single crop production, it's hard for residents to meet their basic living and productive demands, to say nothing of better-off. The reservoir has regulation function to the micro-climate in the reservoir region, which will help improve the natural conditions for agriculture. Therefore, rural industrial structure must be adjusted to plant more economic crops with high economic benefits combining with the actual situation and in the light of local conditions in the reservoir region.

The reservoir region can make use of the materials, funds and technologies introduced during the construction period of the project and the later period support funds to relocated residents to improve the cultivation technology and irrigation facilities in the resettled regions, improve the utilization condition of land resource, develop special-fruit-economy-oriented planting industry, and enhance the comprehensive rural productivity. These economic crops are adaptive to the climate environment in the reservoir region and cater for the market demand. In comparison with planting single crop, it will bring higher economic return to the residents and become a relatively stable source of economic income.