From the Editor

Dear Readers,

Since its launch in May 1984, so far, a total of 84 issues of SHP News (a quarterly) have been published. Our readers live in over 90 countries or regions around the world, including international participants for TCDC training courses held in HRC over the past 20 years, officials from related international organizations, professors and professionals of various specialties in the field of SHP. A long term friendly relationship has been set up between HRC, the publisher and the readers who not only benefit from the magazine, but also contribute a lot of information and articles to it, keeping our journal well-informed with a richly rooted forum.

Entering the new century, along with the rapid development of Internet, the Global Village where we all inhabit is becoming smaller and smaller. In 2002, HRC established its professional website: www.hrcshp.org, which keeps a stable rate of access everyday, enjoys a good reputation, and becomes one of the main exchange channels for SHP research, training, information dissemination and technical consultation throughout the world, especially in the Asia-Pacific region.

Thanks to the rapid response and timely effectiveness of Internet, being free from the limitation to circulation volume and the inconvenience of mailing, it gradually becomes a significant supplement to the printed publications. In order to ensure a more timely and effective platform for information dissemination, view exchange and technical discussion, we are trying to set up a column of SHP News on HRC homepage from the first quarter of 2007, as a nonperiodic electronic publication at all times, to substitute the original printed quarterly SHP News. At the end of each year, all the materials released in the column are to be selected and printed as an annual for our readers to keep and look up. It is highly expected that the integrated utilization of the Internet and the printed form will get consensus from and be supported by our readers and be a success.

Both the electronic and printing version of SHP News will continue to well serve our readers based on our long-standing strategy of publication. It will mainly focus on the following contents: (1) annual information on big events and international conferences in the field of SHP all over the world; (2) country papers submitted by the international participants for TCDC SHP training courses held in HRC each year; (3) updated information on SHP development in China, including the newly-promulgated polices and regulations, as well as the progress on technical research, etc.; (4) selection of technical papers delivered at various international conferences; (5) introduction of SHP reports and books published in the countries concerned; (6) contributions from the professionals inclusive of our readers; (7) HRC annual report and the prospectus for international training courses, etc.

To better run SHP News, we sincerely expect to have continuous support from you, our dear readers, by contributing papers or recommending articles to us now and again. If you would like to continuously receive the free printing version of SHP News in future, please fill in the subscription form attached to this issue, and send it back to us as soon as possible, based on which, we will update our mailing list.

Your comments and suggestions are always welcome!

Best wishes

SHP News Editorial Office

July 19,2006

The Hydropower Development policy, 2001

(Approved by His Majesty's Government on 15 October 2001(2058.6.29))

1. Background

Water resources are important natural resources for the economic development of Nepal. Availability of abundant water resources and geophysical features provides ample opportunities for hydropower production in Nepal. Out of the total hydropower generation capacity of about 83,000 megawatt(MW)in the country, about 42,000MW of power generation appears feasible to date from financial-technical perspective. In view of the internal consumption and export possibility of hydropower in the context of the overall development of the country, an investment friendly, clear, simple and transparent policy is necessary to enhance the development process of hydropower. An open and liberal policy pursued in the hydropower sector after restoration of democracy has started yielding positive indications in the field of hydropower development. Our past experiences as well as working in close association with the private sector, even though for a short period, have guided our path in this regard. It is also observed that the need to overcome the shortcomings and weaknesses that have emerged in the course of involvement and participation of the private sector in the water resource sector.

In view of the contribution that hydropower development in Nepal could make in the speedy development of not only the national economy but also the regional economy; it is expedient to put forward efforts on integrated water resources development based on bilateral and regional cooperation with prime considerations to the national interests of Nepal. Such efforts shall result in the economic development, industrialization, flood control, environment protection, creation of employment opportunities in the country in addition to benefits from allocation of benefits substantially resulting to the lower riparian country from large storage projects built in Nepal.

2. Rationale

Generation and consumption of electric energy in Nepal is minimal. The major sources of energy are still the agriculture and the forest-based resources. Despite the abundant possibility of hydropower generation as a renewable energy source, this source has not been harnessed to the desired extent. Majority of the people is still deprived of electrical energy. The industrial enterprises have not developed at the desired pace due to the lack of electrical energy. In this context, development of hydropower energy that can be generated from our own available resources in Nepal has become imperative.

An opportune hydropower policy is foreseen as prerequisite for supply of hydropower energy at a reasonable price by developing hydropower, which has the pivotal role in the development of rural electrification, supply of domestic energy, creation of employment and in the development of industrial enterprise. It has become important in this context that the hydropower policy should clearly reflect the direction on vital issues such as development of multipurpose plans for maximum utilization of the available water resources, appropriate sharing of benefits, role of public and private sector, utilization of internal as well as external market, and clarity and transparency in activities of His Majesty's Government with the private sector, etc. Based on the experiences gained in the course of implementing the principles followed by the Hydropower Development Policy, 1992, emerging new concepts in the international market and their impacts, technological development, possibility of export of hydropower energy, possibility of foreign investment and commitment in environmental protection with a view to make it clear, transparent, practical and investment friendly; revision and improvement of the hydropower policy has become imperative.

3. Objectives

Hydropower shall be developed to achieve the following objectives:

3.1 To generate electricity at low cost by utilizing the water resources available in the country.

3.2 To extend reliable and qualitative electric service throughout the Kingdom of Nepal at a reasonable price.

3.3 To tie-up electrification with the economic activities.

3.4 To render support to the development of rural economy by extending the rural electrification.

3.5 To develop hydropower as

an exportable commodity.

4. Strategies

The following strategies shall be pursued to accomplish the aforementioned objectives of hydropower development.

4.1 To extend hydropower services to the rural economy from the perspective of socio-equity with the realization of the fact that development of power sector, having a direct concern with agricultural and industrial development, is a pre-requisite.

4.2 To pursue investment friendly, clear, simple and transparent procedures so as promote private sector participation in the development of hydropower, also taking into account internal consumption and export possibility of hydropower.

4.3 To implement small, medium, large and storage projects for hydropower development focusing on national interest, environment protection and maximizing benefits in the development of water resources of Nepal.

4.4 To develop hydropower projects by attracting investment from private sector as well as from governmental sector, as necessary, and through joint ventures of government and private sector for the promotion of hydropower development.

4.5 To make the river basins of specific rivers as the basis of development and management of water resources in order to achieve maximum benefits from the utilization of water resources of Nepal.

4.6 To pursue a strategy of bilateral or regional cooperation in the hydropower development sector taking into consideration the feasibility of hydropower in Nepal and the demands of electric energy in neighboring countries in view of the fact that development of hydropower in Nepal supports not only the domestic but also the regional economy.

4.7 To adopt a broader perspective on national development in the context of macro-economy in developing and managing hydropower in line with the concept of developing resources in an integrated manner.

4.8 To minimize the potential risks in hydropower projects with a joint effort of government and private sector, and to make provisions for allocating the non-mitigable risks to either the government or private sector based on their capability to bear the risk at the lowest cost.

5. Policies

The following policies shall be pursued for the implementation of the above-mentioned matters:

5.1 Hydropower potential of the country shall be utilized to the maximum extent in order to meet the domestic demand of electricity.

5.2 Hydropower projects suitable to the electric system for domestic use as well as the storage projects shall be developed as per requirement on competitive basis.

5.3 Implementation of hydropower projects based on the concept of Build, Operate, Own and Transfer shall be encouraged.

5.4 Appropriate incentive provisions shall be provided and transparent process shall be pursued to attract national and foreign investment in hydropower development.

5.5 Efforts shall be continued for implementation of large storage type hydropower projects and multi-purpose projects. Large storage type multi-purpose projects shall be developed in such a away that downstream benefits resulting from the projects would yield maximum benefits to the nation.

5.6 In the case of multi-purpose projects, His Majesty's Government may participate with the private sector in view of possibility of irrigation development.

5.7 Contribution shall be made to environment protection by developing hydropower as an alternative to biomass and thermal energy.

5.8 In addition to mitigation of adverse environmental impacts likely to result from the operation of hydropower projects, appropriate provision shall be made to resettle the displaced families.

5.9 Emphasis shall be given on mobilization of internal capital market for investment in power sector.

5.10 Electrification of remote rural areas shall be encourage by operating small and mini hydropower projects at local level.

5.11 Rural electrification shall be extended in order to make electric service to as many people as possible. In addition to mobilization of pubic participation, a Rural Electrification Fund shall also be established for the purpose.

5.12 Unauthorized leakage of electricity shall be controlled. For this purpose, necessary technical measures and appropriate legal provisions shall be adopted and, mobilization of public support shall also be emphasized.

5.13 It shall be encouraged to utilize the electric power available during low demand in the sectors such as rural water supply, irrigation, industry, tourism, etc.

5.14 Provision shall be made to provide appropriate benefits at the

local level while operating hydropower projects.

5.15 Proper provision shall be made to cover risks likely to occur in hydropower projects.

5.16 In view of the concept of bilateral and regional cooperation and taking into consideration the abundant hydropower generation capacity in the country, export of electricity shall be encouraged.

5.17 The existing institutions in the public sector shall be re-structured to create competitive environment by encouraging the involvement of community/ cooperative institutions, local bodies and private sector in generation, transmission and distribution of hydropower in order to extend reliable and qualitative electricity service throughout the Kingdom at a reasonable price.

5.18 Attention shall be paid to safeguard the consumers ' interests by providing reliable and qualitative electricity service to the consumers at a reasonable price.

5.19 Process for electricity tariff fixation shall be made rational and transparent so that electric energy shall be supplied at a reasonable price.

5.20 Priority shall be given to utilize labor and skills of Nepal in the implementation of hydropower projects.

5.21 An institution shall be developed to impart training within the country to produce skilled manpower for the development of hydropower and to enhance the capability of the persons involved in this sector. The institution may also carry out studies and research works related to hydropower development.

5.22 Consumers shall be encouraged for demand side management to enhance energy conservation.

6. Provisions vis- à -vis Working Policy/hydropower development

The following working-policy shall be followed in order to enforce the hydropower development policy and fulfill the underlying objectives therein.

6.1 Environmental Provision

6.1.1 Provisions to implement the programs identified under the environmental impacts assessment study report shall be made in the project sites where implementation of infrastructures such as powerhouses, embankment sites, tunnels or canals and reservoirs, transmission lines, distribution lines of the hydropower generation project have direct adverse impact. The prevailing laws shall govern the environment-related matters during the construction of hydropower projects. Provision shall be made to release such quantum of water which is higher of either at least ten per cent of the minimum monthly average discharge of the river/stream or the minimum required quantum as identified in the environmental impact assessment study report.

6.1.2 The private sector obtaining the license shall be encouraged to acquire the houses and land required to construct a hydropower project on its own. Provided, however, that if the necessary houses and land could not be obtained, His Majesty's Government may make available such houses and land to the private sector, in the same manner as it acquires the land to any institution under the prevailing laws. The licensee has to bear all the expenditures incurred in obtaining such houses and land. If the land is government owned, His Majesty's Government shall make it available on lease for a period up to the term of license in accordance with the prevailing laws.

6.1.3 The licensee has to rehabilitate and resettle the families to be displaced while generating, transmitting and distributing electricity in accordance with the standards specified by His Majesty's Government. The private sector shall be provided necessary assistance by the governmental level in this respect. Provided, however, that the investors themselves have to bear the necessary resources required therein by including it in the project cost of the project in operation.

6.2 Provision concerning Water Rights

Legal provisions shall be made to prevent adverse effects on the availability of water or water right of the projects for which license is not required or being operated after obtaining the license.

6.3 Provision for Investment in Generation, Transmission and Distribution

6.3.1 Hydropower shall be developed attracting the investment of domestic and foreign investors in the hydropower generation, transmission and distribution projects through sole or Joint Venture Company and shall also be developed through Joint Venture Company of the private sector and the public sector. In general, foreign investors shall be encouraged, with priority, to make joint investment with Nepalese investors.

6.3.2 Capital market shall be mobilized to encourage domestic investment in hydropower generation. Financial institutions, bonds as well as other financial instruments as required for such purpose shall be developed.

6.3.3 The Infrastructure Financial Institution to be established un-

der the Build, Operate and Transfer of public Infrastructure Policy, 2000 shall also be utilized for the hydropower generation and distribution projects.

6.3.4 The agreement made to receive loan from foreign institutions for investment in the projects related to generation, transmission and distribution of hydroelectricity shall require approval of his Majesty's Government in accordance with prevailing laws. Approval required to be obtained in borrowing loans by a licensee of the project related to generation, transmission and distribution of hydroelectricity from such foreign lender against security of the shares and immovable assets and other matters pertaining thereto shall be as determined by law.

6.3.5 In cases where irrigation benefits may also be availed from any storage project, His Majesty's Government may be a joint venture partner with the private sector in such a project.

6.4 Provision of Special Investment for Infrastructure Development of Rural Electrification

6.4.1 His Majesty's Government shall gradually extend rural electrification. Appropriate institutional arrangement shall be made for this.

6.4.2 Appropriate arrangement to undertake rural electrification shall be made while awarding the distribution license.

6.4.3 Rural electrification shall be encouraged in the rural areas affected directly from the electricity generation project. Energy royalty on the electric energy consumed in such an area shall be exempted. Such exemption shall be given until the first fifteen years of the commencement of commercial production.

6.4.4 One per cent of the royalty obtained by His Majesty's Government from a hydropower project shall be provided to the Village Development Committees that are directly affected by the hydropower infrastructure with the sole purpose of expanding electrification of these Village Development Committees.

6.4.5 A Rural Electrification Fund shall be established for the development of micro hydropower and rural electrification by pooling in a certain percentage of the amount received as royalty.

6.4.6 His Majesty's Government shall provide grant through the Alternative Energy Promotion Center to the domestic private sector to generate and distribute electricity by building hydropower center of up to 100kWcapacity at the rural level. Moreover, such projects shall be included in the prioritized loan sector, and facilities shall be provided to such projects accordingly.

6.4.7 Electricity shall be supplied from small hydropower projects in the mountainous rural area falling outside the access of the national power system. Provision shall be made to hand over the responsibility of operation and maintenance of such small hydropower projects to the local cooperative groups and these groups shall also be involved in the course of formulation and implementation of plans.

6.5 Provision relating to Transfer of Project

6.5.1 Any hydropower generation project has to be transferred, ipso facto, to His Majesty's Government in a good running condition, after expiration of the period of time as specified in the license. His Majesty's Government shall not provide any compensation therefor. His Majesty's Government may cause to operate the project so transferred by an agreement. In such operation of the project, first priority shall be given to the previous operator company.

6.5.2 The regulatory body shall prescribe the guidelines for repair and maintenance of main electric equipment and structures of the hydropower project in good running condition and the Department of Electricity Development shall make appropriate arrangements for monitoring and inspection.

6.5.3 Provision shall be made for involvement of His Majesty's Government as well in the operation of the hydropower project two years prior to the expiration of the period for transferal.

6.6 Provision relating to power purchase

6.6.1 Except in cases where a private party itself also distributes the hydropower generated by it in the Kingdom of Nepal, a power purchase agreement has to be made to sell and purchase the hydropower generated. Provided, however, that it shall not be required to conclude a power purchase agreement for the electricity generated from the captive plant to be consumed in any specific industrial enterprise in Nepal.

6.6.2 Power purchase agreement should be transparent.

6.7 Provision relating to Visa

Non-tourist visa and work permit shall be provided to the investor of a hydropower project, his/her authorized representative and necessary foreign experts, skilled wanpower and their families, as provided for in the agreement unit the construction and operation of the project.

6.8 Maximum Utilization of Local Resources and Means

6.8.1 Foreign entrepreneurs shall be encouraged to be affiliated with local organizations as the cost of hydropower decreases if the project is developed through the domestic construction entrepreneurs and consultants.

6.8.2 The person licensed to build or operate a hydropower project shall carry out or cause to be carried out works such that technology is transferred to the Nepalese citizens in the course of performing the works in accordance with the license.

6.8.3 The person licensed to build or operate a hydropower project shall utilize Nepalese labor, skills, means and resources to the maximum extent possible and, shall also give priority to utilize local labor.

6.8.4 Development of industries producing construction materials and equipment to be used in the power sector shall be encouraged.

6.9 Management of Investment Risks

6.9.1 Hydropower project, transmission system and distribution system established by the private sector shall not be nationalized during the term of the license.

6.9.2 Exchange facilities shall be provided to the foreign person, firm or company making investment for the power generation, transmission or distribution project to be constructed by the private sector to repatriate the following amount from the Kingdom of Nepal in foreign currency at the prevailing exchange rate.

(a) Amount necessary for repayment of the principal and interest of the approved loan borrowed in foreign currency for the hydropower project.

(b) If the electricity has been sold within the Kingdom of Nepal, the amount earned as profit or dividend in lieu of the foreign investment.

(c) In the case of an export-oriented power project, cent per cent of the payment of principal and the interest on the loan, profit and dividend may be repatriated in the currency in which the income has been received in the Kingdom of Nepal by selling the electricity.

(d) The amount received from the sale of the share of foreign investment as a whole or part thereof may be repatriated in the same currency in which the share has been sold. Provided, however, that if the share has been sold in Nepalese currency, foreign currency exchange facility shall be available only for seventy-five per cent thereof.

(e) Other facilities to the foreign investor in relation to the foreign currency shall be as provided for in the prevailing Foreign Investment and Technology Transfer Act.

6.9.3 If there occurs a geological and hydrological condition that is adverse than was anticipated at the time of granting the hydropower generation license or a force majeure event occurs, provisions shall be made to extend the term of the generation license up to a period not exceeding five years as compensation, by evaluating the nature of risk and its impacts in order to mitigate the impacts resulting from such risk.

6.9.4 The customs and value-added tax facilities equivalent to which a new project may be entitled under this Policy shall also be provided for upgrading the capacity of the electricity generation center or for carrying out the repair and maintenance required because of exigency or natural calamity.

6.9.5 A licensed company, corporate body or a person may arrange for the security of the project on its own or may request His Majesty's Government for the same. His Majesty's Government may, if it thinks necessary, arrange for security of such a Project. In case where His Majesty's Government has made such security arrangement, the licensed company, corporate body or person has to bear the actual cost of such security arrangement.

6.9.6 If, after the project license has been granted, the licensed company, corporate body or person suffers from any loss or damage because of the failure of His Majesty's Government to carry out the duties required to be carried out by it, as stipulated in the license and in accordance with this Policy, issues related to such loss or damage shall be as set out in the agreement.

6.9.7 In cases where His Majesty's Government is required to bear the compensation pursuant to paragraph 6.9.6 above, His Majesty's Government may extend the license period in lieu of such compensation amount by evaluating the license period in terms of money.

6.9.8 His Majesty's Government shall not revoke the license in contravention of the terms stipulated in the license after the license has been granted. If the license is revoked contrary to paragraph 6.9.8, His Majesty's Government shall bear compensation for the actual loss resulted therefrom. Provided, however, that in cases where the licensed company, corporate body or individual fails to carry out the deeds in consonance with the progress, goal, quality standard as well as other terms set forth in the license, His Majesty's Government may revoke the license; and in such cases, His Majesty's

Government shall not bear any kind of compensation.

6.9.9 His Majesty's Government shall, prior to revocation of the license on the basis of the terms as referred to in the license, provide an opportunity to the licensed company, corporate body or person to defend, by providing prior information in writing.

6.9.10 Clear provisions shall be made in respect of the procedures on providing opportunity for defense pursuant to paragraph 6.9.9 above, the warning or direction to be issued after defense and the action to be taken in the event of subsequent violation of the terms of the license.

6.9.11 Settlement of disputes shall be governed by the agreement or by the prevailing law on foreign investment and technology transfer.

6.9.12 No additional or new tax, charge, tariff or governmental revenue under whatever title shall be levied on the existing hydropower project except those levied in accordance with the agreement entered at the time of issuance of the project license. In respect of the license issued or agreement entered into prior to the commencement of this Policy, it shall be as stipulated in the license or the agreement.

6.10 Provision on Internal Electricity Market

6.10.1 Establishment of power-based industries shall be encouraged.

6.10.2 For the private sector operated hydropower projects with capacities up to one MW and not linked to the National Grid System, the private producer may sell and distribute the electricity by determining the tariff rate of the electricity on its own.

6.10.3 Provision shall be made so that the person or body licensed to distribute electricity fixes different rates of electricity tariff for peak, off-peak, seasonal and bulk, to be sold to its various consumers.

6.10.4 Necessary provision shall be made in the electricity tariff structure to allow consumption of additional energy within the country. For demand side management, provision for time-of-day and seasonal tariff shall be made to harmonize with the supply of the electricity.

6.10.5 Provision shall be made to create awareness among consumers on increased use of energy conserving electric equipment and to grant special exemption on customs duties to such equipment.

6.11 Provision on Export of Electricity

6.11.1 If the electric energy generated in the country is to be exported abroad, it shall be done as per the agreement entered into between the exporter and His Majesty's Government.

6.11.2 If His Majesty's Government thinks necessary, it may, on mutual understanding, purchase the power up to 10 per cent of the electricity generated from the export-oriented projects for domestic consumption.

6.11.3 Electricity shall be exported by identifying the export-oriented projects and developing such projects through the private sector. For this purpose, necessary study shall be conducted towards extending power system at the bilateral and regional level.

6.11.4 Non-power benefits such as irrigation, flood control shall be evaluated in such a manner as to acquire maximum benefits from large multipurpose storage projects, taking into consideration the national interest. Such benefits shall be utilized within the Kingdom of Nepal to the maximum extent. If the benefits are in excess of those accruing to Nepal and the lower riparian states are benefited substantially, the benefits obtainable thereof shall be determined through negotiations with the lower riparian states. A permit for implementation of such projects shall be provided with the approval of His Majesty's Government under this Policy. Provided, however, that the issue of sharing of the natural resources shall be outside the domain of this Policy.

6.11.5 The body licensed to generate power shall render necessary assistance to His Majesty's Government in acquiring non-power benefits to be obtained from the projects.

6.11.6 His Majesty's Government may, if necessary, render appropriate assistance to conclude a power purchase agreement for the power to be exported abroad.

6.12 Provision on License

6.12.1 Provision shall be made such that the local people can also be directly benefited from the operation of the hydropower generation project. Such provision shall be included in the agreement to be made with the licensee. In addition, ten per cent of the amount obtained for royalty shall be provided to the District Development Committees of those Districts affected from the dam, reservoir and powerhouse constructed for the generation of hydropower, to be spent in development and construction work of those Districts, pursuant to the Local Self-governance Rules.

6.12.2 In addition to the capacity of the project, the following subjects matters, shall also be taken into account in categorization of the hy-

dropower generation center:

1. The center supplying the internal demand,

2. The center exporting electricity,

3. The captive plant built by any specific industry, which will consume at least 60 per cent of the energy generated.

6.12.3 (a) The provision of license shall be as follows:

1. Study/survey License

2. Generation License

3. Transmission License

4. Distribution License

(b) No license shall be required for hydropower project up to a capacity of one MW. Such hydropower project shall be registered with the District Water Resources Committee prior to commencement of the works of such project. Information of such registration shall be given to the Department of Electricity Department. The basis for registration of such projects shall be as determined by his Majesty's Government. Such projects shall be entitled to the facilities in accordance with this Policy.

(c) An application has to be duly submitted to the Department of Electricity Development to obtain the license. The study/survey license of a hydropower project up to a maximum capacity of 10 MW shall be issued normally within 60 days of the submission of all the details. The licenses of all other types shall normally be issued within 120 days of the submission of all the details.

6.12.4 The license to carry out detail survey of, and generate electricity from, a hydropower project with capacity of more than ten MW, of which feasibility study has already been done by the government level and electricity from which is expected to be consumed in the Kingdom of Nepal, shall be issued on competitive basis through invitation of proposals.

6.12.5 The survey and generation license has to be obtained for the captive plant. The license shall normally be issued within 120 days of the submission of all the details.

6.12.6 A licensee who holds the study/survey license has to make submit an application for the generation license within the validity of the license. If the application for generation license is not made, the ownership of the study/survey report shall devolve on His Majesty's Government. His Majesty's Government may, on the basis of such study report, generate electricity from that project on its own or let any other company, selected on competitive basis, generate electricity from that project. If the generation license of such project is issued to the private sector in a manner to use that study report, refund of justifiable expenditure incurred in the study/survey of that project may be arranged from the person who has obtained the generation license.

6.12.7 License may be granted to export electricity from projects with installed capacity of more than 100 MW and deemed appropriate by His Majesty's Government. The license for such a project shall be issued by His Majesty's Government through invitation of proposals or through negotiation with the applicant, who has submitted application for the license.

6.12.8 The license shall be issued by the Ministry of Water Resources.

6.12.9 The grounds for granting the license shall be made transparent.

6.12.10 His Majesty's Government may, as per necessity, conclude a project agreement with the application to attract private, national or foreign investment.

6.12.11 Term of the License:

(1) The study/survey license:

The term of the study/survey license shall be for a maximum period of five years.

(2) The hydropower generation license:

The term of the generation license, depending upon the nature of the project, shall be as follows:

(a) The project supplying the internal demand:

Thirty-five years from the date of issuance of the generation license

(b) The export-oriented hydropower project:

Thirty years from the date of issuance of the generation license

(c) In the case of the captive plant producing energy of which at least 60% is utilized by any national industrial enterprise on its own:

Up to the period the concerned industry remains in operation. If the industry does not remain in operation, up to 30 years from the date of issuance of the generation license.

(d) For storage project, the term of the generation license may be extended for a maximum period of five years on the basis the construction period.

(3) The Electricity Transmission and Distribution License:

The license has to be obtained for the transmission and distribution of electricity.

(a) His Majesty's Government may specify any transmission line or grid as the national transmission line or grid.

(b) The term of the electricity transmission license shall be twenty-five years from the date of issuance of the license.

(c) The term of the electricity distribution license shall be twenty-five years from the date of issuance of the license.

(d) In respect of the the term of license for generation, transmission and distribution of electricity and generation and transmission or distribution only of electricity, the term of electricity transmission and distribution shall be the term of license for generation.

(e) The term of the license for electricity transmission and distribution may be renewed for ten years at a time in accordance with the prevailing law.

(f) The term of transmission and distribution of electricity generated from the electricity generation center with a capacity of up to one MW shall remain valid so long as the center remains in operation.

(4) In cases where any person is generating and distributing electricity in any specific area independently with or without obtaining a license, any other person may request for license for generation and expansion of electricity with higher capacity in the same area, adversely affecting that project. Provided, however, that such a person shall purchase, on mutual understanding, the hydropower center, transmission and distribution lines in operation therein. If a mutual understanding could not be reached as referred to in above, His Majesty's Government shall, based on the national interest, make arrangements to reach an understanding with reasonable compensation for the structures.

(5) A body that obtains the generation, transmission and distribution license should be registered in Nepal. Prior to obtaining the generation, transmission and distribution license, the license holder shall furnish the guarantee as prescribed, to His Majesty's Government.

6.12.12 Any licensee shall be entitled to use the national grid system by paying the specified fee for the transmission of the electricity generated by such a licensee. For this purpose, necessary grid-codes and basis for load dispatch on the use of the national grid system shall be prepared.

6.12.13 Electricity may be supplied independently in any area under the local system without being connected to the national grid system after obtaining the license.

6.13 Provisions relating to Fees

6.13.1 Royalty

A hydropower generator shall pay the royalty as follows to His Majesty's Government after the commencement of electricity generation.

(a) Internal consumption project:

	Electricity capacity	Up to 15 years		After 15 years *	
		Annual capacity Royalty, per kW	Energy Royalty, per kWh	Annual capacity Royalty, per kW	Energy Royalty, per kWh
1	Up to 1 MW	-	-	-	
2	From 1 MW to 10 MW	Rs.100/-	1.75%	Rs.1000/-	10%
3	From 10 MW to 100 MW	Rs.150/-	1.85%	Rs.1200/-	10%
4	Above 100 MW	Rs.200/-	2.00%	Rs.1500/-	10%
5	For captive use	Rs.1500/-	-	Rs.3000/-	-

Provided, however, that if the excess electricity is sold to the electricity distribution system from the electricity center established for captive use, the energy royalty shall be charged on such electric power similar to a hydropower project with a capacity of more than 100 MW.

(b) Export-oriented hydropower project:

	Type	Up to 15 years		After 15 years *	
		Annual capacity Royalty, per kW	Energy Royalty, per kWh	Annual capacity Royalty, per kW	Energy Royalty, per kWh
1	Export-oriented run of-the-river project	Rs.400/-	7.5%	Rs.1800/-	12%
2	Export oriented storage project	Rs.500/-	10%	Rs.2000/-	15%

* After 15 years from the date of commercial operation.

(c) The royalty rates referred to in clause (b) above shall be applied on the projects built on commercial basis with installed capacity up to 1,000 MW. In the case of the projects with capacities up to 1000MW and built on noncommercial basis, 15% (fifteen per cent) of electricity and energy shall be charged as royalty per annum on the basis of monthly power and energy generation capacity from the date of commencement of production.

(d) In the case of the export-oriented project with an installed capacity of more than 1,000 MW, the rate of royalty shall be settled by negotiations, also taking into account the grounds referred to in clauses (b) and (c).

(e) In the case of the hydropower projects which sell energy for internal consumption and exports the remaining energy, the energy fee equivalent to that chargeable for the export-oriented project shall be charged on the quantum of energy exported abroad.

(f) The royalty shall have to be paid in the same currency in which the exported electricity is sold.

Note: The following formula has been used herein to work out the energy royalty and the capacity royalty.

Energy royalty = (Generated energy − Self consumption) × Average Selling price × Energy Royalty Rate

Capacity royalty = Capacity Royalty Rate × $(1+5/100)^{\text{year-2058}}$ × Installed capacity(kW)

6.13.2 Registration Fee

A Registration fee of 0.0001 percent shall be charged for the registration of deeds related to a foreign loan for investment on projects concerning hydropower generation, transmission and distribution and on the registration of deeds conveyed to pledge the movable and immovable assets (such as shares of a project company) in the name of the foreign lender for such loan.

6.14 Facilities relating to Tax and Customs

6.14.1 The income-tax payable in operating the hydropower generation project, transmission system and distribution system shall be as provided for in the prevailing Income Tax Act.

6.14.2 In the present situation where value added tax is not levied on the electricity tariff, value added tax shall not be imposed on the industrial machineries, equipment and spare parts imported, after obtaining permission, by a project so as to use them in the construction of hydropower project. If value added tax is levied on the electricity tariff, value added tax shall also be accordingly imposed on the above-mentioned materials and machineries, as well.

6.14.3 Only one per cent customs duty shall be imposed on the devices, equipment, machineries and spare parts related therewith to be imported with permission by the project during the construction phase. Provided, however, that the valve of such spare parts shall not exceed twenty per cent of the total value of the devices, equipment and other machineries to be imported.

6.14.4 In cases where the machines required for such project during the construction period have been imported on the condition of taking them back, such machineries have to be taken back after completion of the project. In the event of failure or inability to take them back, custom duty shall have to be paid, at the prevailing rate, after completion of the project, as per the rules, on the remaining value after deducting depreciation.

6.15 Institutional Provision

6.15.1 The following institutional arrangement shall be made for the development of hydropower.

(1) Regulatory body:

The existing Electricity Tariff Fixation Commission shall be developed as a regulatory body. In the course of monitoring and supervising the quality standards of electricity, this regulatory body may give direction and make supervision as per necessity, also taking into account of the power purchase agreements of the public and the private sector producers.

(a) The functions of the regulatory body shall be as follows:

- To fix electricity tariff and wheeling tariff,
- To monitor and supervise the safety of the electric system, and the reliability of supply and quality standards of electricity,
- To protect the interests of the consumers,
- To prepare Grid Codes,
- To approve the criteria for load dispatch,
- To prepare criteria for safety and quality standards of electricity, etc.

(b) The electric energy generated from the hydropower center may be purchased and sold with the mutual understanding between the generator and the purchaser. Prior to concluding the power purchase agreement, the basis for fixation of the rate of sale and purchase of electricity shall require a review from the regulatory body. The regulatory body shall review and render opin-

ion no later than 45 days of the receipt of request for review. The review of the power purchase agreement made by the regulatory body shall be taken as the basis for purposes of fixation of electricity tariff.

(c) The regulatory body shall fix the rate of electricity tariff to be sold and distributed to the consumers. In fixing the electricity tariff, the interest of the consumer shall also be taken into account.

(2) Study and Promotional Body

(a) The Department of Electricity Development shall carry out the following functions:

■ To conduct competition in the course of issuing the license,

■ To provide facilities available under the one window policy and to attract the private sector in the development of hydropower,

■ To encourage private participation in the hydropower projects,

■ To carry out acts related to the approval of the hydropower projects with a capacity of more than one MW to utilize and cause to utilize the water resources optimally.

■ To carry out feasibility studies of the hydropower projects and study works of multi-purpose projects.

■ To render necessary assistance to the private sector in the operation of the projects and carry out monitoring and promotional works.

(b) The Water and Energy Commission shall carry out the following functions

■ To carry out acts related to national load forecast for electricity and system planning study.

■ To carry out acts related to preliminary identification of hydropower projects.

■ To conduct various policy research works for electricity development

(3) Electric Energy Management Research Institute

An electric energy management research institute shall be developed in order to carry out study and research on financial, legal, environmental and technical aspects of electricity and to provide training thereon.

6.15.2 The functions pertaining to the operation of the power centers, operation of electricity transmission and national grid, and electricity distribution owned by the Nepal Electricity Authority shall be gradually unbundled, and appropriate institutional arrangement shall be made therefore. An autonomous public body shall be entrusted the responsibility for operation of the national grid. The local body, community/cooperation body and private sector shall be encouraged in the operation of electricity distribution system.

6.16 Construction and Operation of Hydropower Projects by His Majesty's Government

His Majesty's Government may, as per necessity, build and operate hydropower projects on its own, by concluding, and in accordance with, a treaty or agreement with any friendly country or international organization. ■

TEAM Company of Thailand Signed a MOU with HRC

On July 26-28, 4 seniors of TEAM (TEAM Consulting Engineering and Management Co., Ltd) in Thailand headed by Dr. Prasert Patramai, Board Chairman, paid a visit to HRC. At the meeting, both sides exchanged ideas on SHP development and signed a Memorandum of Understanding (MOU).

TEAM's main consulting businesses are water, environment, transportation, urban and regional development, alternative energy and energy conservation, public acceptance, management & organizational development and information technology. Its experiences include design and supervision of hydropower projects, hydrological data telemetering implementation, related automation system, environmental impact assessment and mitigation measures study. HRC has signed the MoU for SHP cooperation with TEAM, in which rights and responsibilities of both sides have been agreed. For example, TEAM shall be responsible for selecting and analyzing potential hydropower projects in Thailand or its neighboring countries, and responsible for civil works, engineering supervision and project management etc., while HRC be responsible for preliminary design, detailed construction design, equipment supply, EPC (engineering, procurement and construction) contracting etc. Both sides are confident to the future cooperation, and promised to jointly bid for 2 SHP projects in Thailand.

In the mean time, Thailand counterpart also visited Institute for Thermal Power Engineering (ITPE) of Zhejiang University, Hangzhou Boiler Group Co., Ltd. and Qiaosi Solid Waste Power Plant, and intensively discussed the renewable-energy development issues with related experts, especially in power generation with waste. *(HRC)* ■

Hangzhou Declaration on Global Hydropower Development

Adopted by the Second Global Forum on "Hydropower for Today", Held at Hangzhou, P. R. China, from 22 to 25 April 2006

Preamble

Hydro Power, currently having a global share of 15% of all electricity produced, is facing challenges for further development due to rigorous licensing requirements. In an era of Green Power and competitive environment, this renewable energy source, which is as a result of a natural phenomenon, rather than a finite resource like coal, oil or gas, deserves to be utilized increasingly under consolidated planning and management by the governments, with due consideration to issues of social equity.

Declaration

1. The participants to the Second Global Forum on Hydropower for Today acknowledge the efforts of Peoples Republic of China in the sustained development of hydropower including small hydropower, and appreciate the joint initiatives in co-organizing this discussion forum by the International Center on Small Hydro Power (ICSHP), United Nations Industrial Development Organization (UNIDO), International Centre for Hydropower (ICH), Hydropower Agreement of International Energy Agency (IEA), CANMET Energy Technology Centre (Canada) and the China International Center for Economic & Technical Exchange (CICETE).

2. The Forum recognizes the need to integrate hydropower development with other demands on water resources such as drinking water supply, irrigation, flood prevention, pollution abatement, tourism, environmental protection, regional biodiversity maintenance, and other local economic development needs and requests all concerned to develop innovative methods for realizing this opportunity.

3. The Forum appreciates the need for development of hydropower potential in moderation and the need to have an effective governmental framework to achieve these objectives, as it is governments that should draw up national plans for hydro-energy generation and mandate the amount of river runoff that must be maintained free and to build capacity to manage this critical resource for the benefit of society as a whole.

4. The Forum also recognizes the roles of international agencies in promoting global hydropower development and calls for developing multilateral channel cooperation, and to optimize and ensure maximal use of water resources for the common benefit, through new and revised policies that reflect issues of ecological balance and social equity.

5. The Forum takes note of the fact that the hydro power project inputs are based on impact of submergence and river re-direction as well as on the potential carbon dioxide emissions, and this is inadequate. The Forum recommends that all hydro projects should be covered under the CDM and reasonable mitigation of the impacts built into the project budgets. However, higher compensation will upset the project viability and it is recommended that the international agencies involved in promoting hydropower agree on sustainable guidelines and come up with reasonable cost structures for evaluating the impacts and benefits of hydropower projects, so they can be constructed at reasonable cost.

6. In view of the very low percentage of electrification in Africa and the abundance of hydro resources in the African continent, the Forum considers it appropriate to focus more on environmental-friendly and economically-viable hydropower development in Africa during the next decade to help in global reduction of GHG emissions.

7. The Forum further calls upon all agencies related to hydropower, to support the promotion of replicable and sustainable models of small hydropower projects, backing income generating activities, non-formal education and training in skills in rural areas of developing countries, and especially in sub-Saharan Africa.

This Second Forum on Hydropower for Today has re-kindled the hope of promoting further, the development of hydropower globally on a new note of high environment compliance and increased social responsibility and pledges itself to the realization of increased role for hydropower in the energy scenario of the World. ■

Investigation and Feasibility Study for Renovation of Small Hydropower Stations in Xingjiang

Entrusted by the World Bank, Hangzhou Regional Centre for Small Hydropower (HRC) has engaged in the project of investigation and feasibility study for renovation of small hydropower stations (SHP) in Xingjiang. An expert group was sent to SHP stations to be renovated in Xingjiang for on-site investigation and data collection. Twenty more stations in South and North Xingjiang were investigated under companion of the Xingshui Co. This report has been prepared and delivered according to the analysis and studies on the basis of the investigation.

Ⅰ Basic Conditions of Xingjiang

Xingjiang Uygur Autonomous Region, located in the North-west part of China, is situated in the hinterland of the Euro-Asian Continent. It is surrounded by high mountains: with Altai Mountain in the North, Kunlun Mountain System in the South and Tiansan Mountain lying across the whole region.

A unique geographical environment is formulated by the so-called "2 Basins surrounded with 3 mountains", which signifies that the above-mentioned three mountains encircle the two Basins, Zhunge'er and Talimu. With a length of about 1500km in North-south and about 1900km in East-west, the total area is 1.66 million km^2, about one sixth of the whole country's area. The land resources are rich, with a green area of 60,000 odd km^2 and reclaimable uncultivated land of about 100 million mu.

Under jurisdiction of the Autonomous Region, there are 5 autonomous Zhou (prefecture), 8 prefectures, 1 municipality at prefecture level, 17 municipality at county level,6 autonomous counties, and 63 counties. In addition, there are also 171 agricultural and husbandry farms in the Region, which separately belong to 10 Agricultural Division, 3 Farm Administration, and 1 Construction Division under the Production and Construction Corps.

Kezier water reservoir built at the end of 1980's is located on the crossing site of Muzati river and Kezier river. It has integrated multiple functions, with main function on irrigation, flood control, as well as power generation. The installed capacity of this hydropower plant is 26,000kW. The total investment is 385 million Yuan RMB.

Total population is 17 million, 62.5% of which is minority ethnic majored with Uygur nationality. In the total, 12.47 million is of agricultural population. Total GDP in 2003 was 174.5 billion Yuan (RMB). The development in the Region is unbalanced, with fairly big discrepancy among various regions.

The weather in Xingjiang belongs to typical continental dry weather. The resources of light is abundant, duration of sunshine long, but the precipitation rare, of which, 84.3% is in mountainous area. In plain area, the precipitation is only 100~200mm in North Xingjiang and 16~85mm in South Xingjiang. The evaporation is just opposite, with 1500~2300mm in North Xingjiang and 2100~3400mm in South Xingjiang. Main feature of dry area in Xingjiang is the oasis in desert, which signifies the evident dependability of water: oasis where there is water and desert where there is no water. The oasis is the basis of living for human beings in the dry areas.

Ⅱ General Profile of Water Resources and hydropower

1.Water resources

There are a lot of rivers in Xingjiang, with 570 more large and small ones, and great disparity in water volume. Most rivers are short

in water course and small in water volume. There are 487 rivers each with annual runoff less than 100 million m^3 and total water volume of only 8.3 billion m^3, while there are 18 rivers each with flow greater than 100 million m^3 and total volume of 58.4 billion m^3. In whole Xingjiang, the runoff of ground water totals at 88.4 billion m^3 and exploitable underground water at 25.2 billion m^3. The average water volume per capita in Xingjiang is 2.2 times that of the whole country and stands in 4th of the nation. In this respect, the water resources in Xingjiang is relatively rich, and could meet the demand of mid and long-term sustainable development in the Region, if the unbalance of time and space distribution of water resources could be solved and resources exploited, conserved and rationally allocated. But with respect to the land area in Xingjiang, the average water volume is only 4.8 m^3 per km^2,counts backward in 3rd of the country. In this sense, water resources volume in Xingjiang is of serious deficient with rare precipitation and delicate ecological environment. The underground water resources in Xingjiang are mainly transformed from ground water. The underground water resources produced in mountainous area usually supply river courses in the area in the form of spring or seepage flow and form a part of ground flow in the area. The underground water resources are therefore mostly included in the ground flow in outlet of the mountain. The exploitable underground water resources mainly signifies that in plain area, the total supply volume of which counts about 39.5 billion m^3, in which 25.2 billion m^3 is exploitable.

2.Features of time and space distribution of water resources

Rivers in Xingjiang are mainly supplied from high mountain glacier and snow deposit. The glacier reserves in the three Mountain systems are about 260 million m^3 which form a giant solid reservoir and exert significant function of regulation for ground water flow in Xingjiang. The annual average melt water from the glacier is about 17.8 billion m^3, 22.5% of the ground water runoff in the Region. The total volume of the water resources there is comparatively stable with small yearly variation, the coefficient of which is 0.1~0.5 in general. But distribution in a year is uneven, with complicated variation. The common feature is concentration of water in Summer, in which the maximum 4 months' water volume (June, July, August, and September) comprises 70~80% of the whole annual runoff. The spring water volume in most rivers are fairly small and weak in regulation capability which could not meet the demand of agricultural spring irrigation and is prong to spring drought. Shortage of water also emerges in autumn in a few places. Spring drought, Summer flood, salinization, wind carried sand and shortage of electricity are known as "4 disasters and 1 shortage "in Xingjiang.

3.Utilization of water resources and SHP development

A lot of water diversion and reserving engineering projects has been constructed in the green land in plain area near mountains outlet at downstream of various rivers. About 70~85% of water volume has already been utilized except Yili and Erzhis River. In Xingjiang, SHP development is basically combined with agricultural irrigation. Water, in general, passes through power station first for electricity generation and then flow into the tailrace channel and irrigation canal. Mono purpose water engineerings for generation alone are few.

Hydropower potential in Xingjiang is rich. Theoretical and economically exploitable resources are 34.78 million and 16.16 million kW respectively, in which 12.26 million kW for SHP, 76% of the total exploitable one. By now, installed capacity of exploited SHP is 1.19 million kW, most of which were built in 1960s~1980s.

4.Problems of existing SHP stations

Xingjiang covers a vast area, where counties are separated afar. The inter-regional connection of both hydro and energy are rather weak. No regional grid has been set up. Local small grids are basically of self-supply and self-sustained, which leads to the seriously unbalanced power supply. In rural, husbandry and remote areas, power supply is in backward state. Most of SHP stations and local grids were built in 1960s~1980s in combination with irrigation projects and have embodied decisive effect in the development of local economy. However, these stations are getting old. Equipment ageing and out-of-date, low automation and technical level exist widespreadly.

In some stations, hydro turbines encounter backward performance, out-of-dated technology and poor manufacture quality. Old runner type stipulated in 1964 such as ZZ600, ZZ460, ZZ587, HL365, HL123, HL702, HL638,etc. are still under operation, which are of 1930s~1940s technical level in the world. Turbines in some SHP stations have lot of flaws due to poor fabrication and could not be recovered under long time repairing. They are running in spite of illness, with insufficient output, low efficiency and reliability, and are thus

non-economical.

Some of the stations have operated close to 30 years. Their control and protection equipment are out-of-date and protection method backward, automation level low. Most equipment belongs to obsolete product and difficult to solve spare parts problem. Logic control and maintenance in those traditional relays are complicated with high rate of mal-function which would affect safe operation of the station. The cavitation in turbines are serious, with low efficiency even after many times weld mending. Serious wearing between main axis and bearing enlarges the gap and swing which has caused difficult operation for the machine.

Some stations have operated for more than 30 years, exceeding the life span of equipments. Main equipment such as generators, equipments of generator voltage, control panels etc. have been ageing seriously. Burnt smell is felt frequently around the generator units during operation. Insulation resistance of generator drops seriously which would result in accident of breakdown towards ground or inter-windings short circuit at all times.

A large part of SHP stations in Xingjiang (especially mini stations) would be further damaged even shut down in the coming 5~8 years, if above-mentioned problems could not be solved. This will bring about adverse affect to development of economy in Xingjiang which has already suffered shortage of electricity. It will also aggravate difficulties of living for the people in the Region. Due to serious seepage of turbines, oil and grease in the turbine also leak into water and flow into down stream of the river where people draw drinking and irrigation water. The water pollution problem surely causes negative affect to the people.

Aggravation of electricity shortage had increased electricity price in the Region. People who could not afford to pay the tariff thus turned to coal and fire wood for living energy sources. Burning of firewood not only caused deforestation but also produced large amount of CO_2. As per annual average household consumption of firewood is 4 tons, and take 800kg/m^3 and 6.25 m^3/mu of land for estimation, then every household consumed 0.8mu of forest and add CO_2 emission of 14 m^3 annually, which in turn would further destroy the already delicate ecological environment in Xingjiang.

III Analysis of Existing Problems of SHP

Upon on-site investigation for these SHP stations with flaws, discussion with staffs in the stations concerned and analytic study, it is felt that main causes for the problems emerged there are in the followings:

1.Flaws of equipment

Flaw of equipment itself existed at that time due to limitation of manufacturing level. In addition, maintenance of turbine generator (T-G) units was not well performed due to shortage of funds in various places. Therefore, these units became out-of-date, resulting in high rate of stoppage, lowering of generation capacity and utilizing factor, etc. Defects of leakage and seepage etc are serious. For example, in Sankou SHP station in Habahe County, the turbine runner had no lower ring which caused a heavy accident of drop of runner blade. The lower ring was then mended on the runner and yet the output and efficiency lowered a lot.

2.Extended active duty of equipment

The designed life span of E-M equipment for SHP manufactured in China before 1980s was 25~30 years, the smaller the units, the shorter the life span. During investigation, it was discovered that equipment in the existing SHP stations are all in extended active duty under worn-out condition. Serious leakage and seepage occur in a whole T-G unit, output of T-G unit greatly lowered, electric insulation was heavily aged, most of components and parts belong to obsolete products, and spare parts of which can hardly be obtained. Accidents are therefore possibly be happened at any time. For instance, Output of the 2×250kW T-G units in SHP in Buerqin Town was greatly lowered because the equipment was in extended active duty, and worn-out, not being renovated yet. The 6×1250kW SHP units in Duanjequ station in Yili could only generate 1000kW each only.

3.Marginal conditions of the stations changed

Some SHP stations such as Wuyi station has suffered from reduction of efficiency, lowering of output and increase of vibration caused by deviation of operation from optimal condition due to silt raise of tail water level and decrease of water head. Some others, such as Kezier station requests additional flow through its hydro turbine due to increase of agricultural irrigation flow for downstream field.

4. Irrational design and backward equipment selected

Two 6500kW Kaplan T-G units installed in Renmin Canal SHP station has not equipped with vacuum breaking valve. Lifting of the unit would occur in case of emergency stop; water draining is not smooth due to improper selection of drain pump; speed governor and excitation equipment are of backward type which needed to be renovated just 2 years after commissioning.

5. Change of environmental condition results in worsening of water quality and aggravation of operation condition of turbines

Four Kaplan unit each of 6300kW in Xidajiao station in Aksu has suffered from serious wear of turbine runner and sealing of main shaft caused by increasingly raised heavy silt content of 2kg/m^3 in water and even of 18 kg/m^3 in flood season.

6. Main parameters (N, H and Q) of turbines could not fit with actual operational criteria, which results in deviation of the unit operation from high efficiency region

(1) In SHP stations built before 1970s, special phenomenon of "existing power house looking for T-G units" or "ready made T-G units looking for a power house" existed due to objective conditions then and there. This usually resulted in incompatibility of T-G unit parameter with actual situation of the station.

(2) Only a few types of turbine runner in the standard serial of hydro–turbine model were stipulated in early stage in China, which could be used in selection of wide ranges of water head. Quite a lot of SHP stations were thus only possible to adopt neighbouring runner in the series, which resulted in deviation of the unit from actual operational parameters of the station.

(3) Importance was not paid by some local authorities in selection of turbines for SHP stations. Even some design institutes did not pay serious attention to or embody sufficient level for the selection, which resulted in that parameters of the units do not compatible with actual situation of the stations.

(4) Actual hydrological data such as incoming flow or water head did not conform with designed ones after completion of stations or even lack of necessary hydrological data. These resulted in incompatibility of selected turbine parameters with actual running conditions of stations.

In any one of the above 4 cases, turbines would be operated in non-optimal region, which brought about low operation efficiency, more water consumption, heavier vibration and higher noise, more generation loss and greatly shortening of running life of the turbine.

Ⅳ Measures for Solution of Problems

To solve existing problems in these stations, it is necessary to implement renovation, i.e. , to renovate old station with modern technology, which could not only recover due functions of the station but increase its capacity and efficiency as well. As per above-mentioned analysis, different renovation measures could be adopted for variously classified stations. However, for renovation of every SHP station, principles of using advanced technology, rationality, reliability, economic feasibility and particularity should be followed. Optimal design has to be figured out according to various specific stations and proceeded in the light of local conditions. Constraints that are un-changeable or not proper for changing should be closely integrated with and carefully treated. Annual generation volume and economic benefit of the power station should be increased as much as possible.

1. For stations under service duration of 25～30 years or longer with utterly shabby equipment, entire refurbishment of equipment should be launched

When this measure is used, we have to make the most of the original hydraulic engineerings and embedded components to shorten construction time and reduce the cost. Newtech should be adopted not only for selecting equipment with high–efficiency, advanced and reliable performance but also fitting the hydraulic criteria of the station, and matching the existing hydraulic facilities and embeded components. For example, in renovation of Xiakou hydropower station in Jiangshan municipality, Zhejiang province, whole replacement of equipment was carried out except hydraulic engineerings in the powerhouse and turbine parts embedded in the concrete (including embed parts of hydro-generator foundation, draft tube, spiral case and stay ring of the turbine).

Newly refurbished equipment was closely fitted with the existing hydraulic facilities and embedded parts as the original facilities were fully utilized during renovation. The original turbine runner HL263 was replaced by the new one HLA643 compatible with the flow passage. Operation has been good after renovation, with noise reduced to 78 dB, maximum efficiency of turbine exceeded 93% and an output increase of 37.5%.

In this method, attention should also be paid to the suction head of the new turbine runner for its compatibility with the original h_s of the station which was not able to change for an existing powerhouse.

2. For stations with equipment service duration not exceeding its life-span and main equipment not heavily aged but still with a lot of problems, part renovation of main equipment and entire refurbishment of accessories and electric control and protection facilities were launched.

(1) For hydro-turbine

For turbines under serious damage and great reduction of efficiency due to combined effect of serious wear caused by high silt content of water flow in the desert area of Xingjiang and cavitations on the rotating parts of turbine, runner, guide vane and bearings built of low grade steel, the stream line of guide vane should be improved to lower and equilibrate the flow speed in the guide vane area. In the meantime, anti-abrasion measures should be adopted based on fabrication design of structures, materials and protective coating. For instance, combined coating paint of silicon carbide and epoxy resin could be coated on the runner blade for anti-abrasion and non-contact sealing structure could be used for sealing of main shaft of the turbine. These are all able to extend the service span of the turbine. Runner with good performance of high energy and good cavitation indices is preferably to be used; for runner blade, die pressing fabrication is better to be adopted.

(2) For hydro-generator

With low grade insulation, stator and rotor were seriously aged with its insulation after long time operation, which may easily cause grounding fault and threaten the safe operation of the unit. It is better to raise its grade of insulation by changing grade B into grade F. By this measure, it is also possible to increase the cross section of coil winding for raising the output of the generator.

Low reliability of the thrust bearing in the hydro-generator due to poor quality of manufacture or installation usually results in the accident of burning of bearing bush. The bearing bush of early produced units was mostly made of Babbit metal, which was frequently burnt during un-proper stop down of the unit under emergency condition or fault of cooling water due to its low capability of high temperature endurance. Elastic metal plastics could be used for the bush of thrust bearing, which would not burn even under emergency shut down of the unit and fault of cooling water. This will greatly extend the life span of the bush and greatly increase the reliability of the unit. It could also be installed conveniently.

(3) For excitation and speed governor

Excitation facilities and governors for SHP stations produced before 1970s were of low automatic level and low reliability due to limit of manufacture and component level at that time. Excitation current of the hydro-generator was in general provided by the D.C. exciter installed at the extended shaft end through commutator made of carbon brushes. Frequent abrasion of the carbon brushes would cause loss of excitation which in turn result in the shut down of the generator voltage and of the unit itself. Over voltage would usually happen under impulse current of the unit, which in turn affect the consumers equipment and bring about damage to the insulation. This type of excitation not only possess low reliability, but also slow response with poor regulation performance which lead to great variation of terminal voltage of the generator. In this case, the electricity quality could not be ensured. For the old type governor, the pendulum motor was generally used for response element of T-G speed, which was also of long delayed and slow response, low accuracy of regulation and high frequency of trouble. Over speed would usually occur which results in serious accident of runaway speed of the unit. For these kinds of equipment, entire renovation should be made. Adoption of computerized excitation system and governor based on modern technology not only embody high reliability, high accuracy of regulation, but also strong anti-impulse capability, lowering the rate of fault. Further, its high level automation is conducive to the adoption of computerized supervision and control in the station, which enables the station to be un-attended only with a few guards.

(4) Equipment of electric secondary circuit

Electric secondary equipment produced before 1980s such as measurement, control and protection equipment were mostly of relay logic control, of which major portion of

components were already obsolete, and no spare parts could be obtained. As the ordinary relay logic control was manually operated with complicated maintenance and high rate of malfunction, it would affect the safe operation of the station. Adoption of computerized supervisory and control system could raise the automatic level of the T-G units and greatly increase their reliability, reduce the rate of malfunction as well as greatly lower the labor strength of attendants. The un-attended with a few guards operation mode implemented through computer and communication technology could greatly reduce personnel of the station thus lower the production cost and raise the rate of labor production.

3. For stations with higher water head and larger flow than the originally designed ones, expansion of capacity should be made in renovation

Due to various reasons, the actual water head and flow in quite a few stations were different from the designed ones. For those stations with higher and larger values, the rated output should be expanded according to the concrete conditions. Appropriate new or customized runner type should be selected for the turbine to run within the higher efficiency region. In this way, both unit capacity could be increased and running efficiency of turbine raised, the annual generation volume of the station could be considerably added as well.

4. For stations with less water head and flow than the originally designed ones, reduction of capacity should be made in renovation.

Reduction of rated output of the station should be made according to the actual head and flow. New or customized runner type should be selected for enabling the turbine to run in the most or comparatively optimal working region in improving its efficiency and raising its annual generation.

V Several key Issues Need Careful Treatment During Expansion Renovation Design of SHP Stations

1. Water transmission system of the turbine

For diversion type pressurized water transferring system with penstock manifold, in particular, calculation should be made for hydraulics and regulation insurance. The hydraulics calculation is for identifying the overflow and head loss value of the system to determine the appropriate rated head and flow of the turbine. The regulation insurance calculation is for verifying the possible maximum water pressure and running speed of the T-G unit during transient process according to the characteristics of the unit and hydraulic features of the water transmission system. Verification should be made whether the maximum water pressure is within the designed value of the system, and for studying and determining the rationality and possibility of adopting reinforcement and strengthening measures. The head loss and endurable maximum water pressure of the water transmission system is one of key links which may hinder the capacity expansion of the turbine and thus not to be neglected. Otherwise, economic benefit and safe operation of renovation would not be effected.

2. Strength of turbine spiral case

The spiral case of the turbine generally remains unchanged during renovation of the power station. The passing flow and output of the new runner after renovation are usually increased. Some changes may also result from regulation insurance checking. Therefore, review of the strength of spiral case is necessary.

3.The strength of generator buttress

Original generator buttress is usually utilized during renovation of SHP stations. The output of the new runner after renovation is generally increased and its axial water thrust and magnetic pulling force would also have some changes. Checking the strength of the generation buttress is therefore necessary.

Last but not least, attention should be paid to design during renovation of power stations. A good design scheme could bring about high benefit. On the contrary, negligence of design would easily result in mistakes and even in unnecessary work over again as well as economic losses. Design should be formulated in ahead of implementation and done once for all integrately. Implementation may be carried out either once for all or by stages with orders arranged by the designs institute. In the investigation, it was also discovered that the renovation order of some stations was unproper. For instance, excitation facilities, governors and electric equipment in some stations were refurbished in ahead and then turn to T-G unit replacement. In case the capacity of the unit was increased, during renovation, the excitation system and governor would have to be refurbished, resulting in a waste.

(The Chinese report is provided by Jianping Lu,and translated by Xiaozhang Zhu) ■

China Issued a Provision for Enforcing the Management of Rural Hydropower Construction

China's Ministry of Water Resources issued a "provision for enforcing the management of rural hydropower construction" on August 24th, this year.

The booming of rural hydropower in China has become an important factor for the development of the rural economy and society, and a strong force to increase the supply of energy. It has played an indispensable role in improvement of the energy structure, guarantee of the energy security and protection of the ecological environment. But with the rapid development of rural hydropower, there raised some issues of disorderly development, to a certain extent affecting on the public safety and social stability. In some places, some serious problems still exist: the responsibility in the management is not clear, the development plan is violated sometimes and construction is carried out without examination and approval. Therefore, Ministry of Water Resources issued the related provision, which includes the following contents:

(1) Strengthen the planning of exploitation of hydropower resources of rivers;

(2) Be strict with the technical examination and administrative approval;

(3) Establish and implement the system of pre-examination of environmental impact assessment;

(4) Establish and implement permit system for water take-off and verification system of water resources;

(5) Stick to the policy that the project construction starting report should be examined and approved before construction starts;

(6) Strengthen the supervision of construction process;

(7) Seriously carry out the project examination & acceptance system;

(8) Take the risk prevention first and be strict with safety supervision;

(9) Strengthen the construction market supervision.

All the measures above will strengthen the rule of the rural hydropower development in China, hopefully making the rural hydropower exploitation more orderly. *(HRC)* ■

HRC's CDM SHP Project Approved by China's National Development & Reform Commission

— Yanling small hydropower project of clean development mechanism in Hunan province, jointly developed with HRC, has recently been verified by China's National CDM Project Verification Council and approved by China's National Development & Reform Commission. The project could hopefully achieve the equivalent greenhouse gas (carbon dioxide) reduction by 17,678 ton annually. The purchaser for the emission reduction is UK's Coal Resource Management Co.*(HRC)* ■

HRC Provides Equipments to Turkish Basaran Power Plant

Hangzhou Yatai Hydro Equipment Completing Co., Ltd., one of HRC's subsidiaries, provided 2 set of local control units to the Turkish Basaran hydropower station. This hydropower station is of runoff type and has installed capacity of 2×320kW. The total investment of this power plant is 2 million TL. The engineers and technicians of HRC installed and tested the equipments on site. The Turkish customer is satisfied with the equipment and the work by HRC engineers. They expressed to import computer-based supervision & control system and water-level monitoring system from HRC. *(HRC)* ■

HRC Provides Electro-Mechanical Equipment for Peru

Hangzhou Yatai Hydro Equipment Completing Co., Ltd., one of HRC's subsidiaries, signed a contract with a Latin American company called Rio Santa in Peru, to supply a complete set of electro-mechanical equipment for Gera II hydropower station (with the installed capacity of 1×1950kW) there. The contracted equipment shall be delivered to Peru in January 2007, and HRC engineers will go there for providing site services such as supervision on the installation, commissioning and testing of the equipment. Now both sides have set up a very close relationship and are negotiating for the supply of valves and equipment of another 4 hydropower projects. *(HRC)* ■

A Summary of 2006 SHP Training Workshop for Central Asia

The 2006 TCDC (Technical Co-operation among Developing Countries) Training Workshop on SHP for Central Asia was held from 25 May to 3 July 2006 by Hangzhou Regional Centre for Small Hydro Power (HRC). Attended altogether 7 participants.

In early July, Hangzhou seemed to be more charming with lotus flowers in initial blossom. At the closing ceremony in HRC, HRC's honorary director, Mr.Zhu Xiaozhang, HRC's deputy director, Ms. Cheng Xialei issued certificates to the 7 participants, praising their earnestness and spirit of cooperation during the whole training course in HRC. Many participants commented at the closing and expressed their gratitude by presenting their national dresses and various gifts to HRC staff for all the efforts taken to ensure the success of the training workshop.

This training workshop which is the 42th international SHP training workshop conducted by HRC was sponsored by Chinese Ministry of Commerce, as one of the technical collaborative projects among the developing countries. All the lodging, boarding, training, pocket money and the domestic transportation fees were borne by the Chinese government. That is part of the Chinese contribution to the South-South cooperation.

Visit to Tangpu SHP Station

Visit to Tianhuangping Pumped Storage Plant

Some features of the workshop:

1、This is the first time for HRC to conduct SHP training in Russian language since its establishment in 1981. The major difficulty HRC confronted was that no Russian lecturers were available in HRC. So, efforts had to be taken to seek those who should be both proficient in Russian and good at hydropower technology. Without such talents, the success of the training could hardly be achieved. Finally, the multi-channel exploration led to a sound result.

2、Based on the previous experience and in combination with the concrete requirement of this training workshop, the organizer adjusted the items and optimized the routes of the study tours. The newly added four sites for the tour include: Wenling tidal power plants, Tianhuangping pumped storage station, Taizhou water diversion project and Xinanjiang hydropower station.

Visit to Xinanjiang Hydropower Station, the 1st one designed and constructed by Chinese

Discussion between the participants and the students with Russian teachers in Zhejiang University

SHP Forum

Visit to water diversion project in Jiangsu Province

Visit to a tea garden

SHP Forum

3、Apart from the technical visits, the participants also enjoyed the visit to Chinese tea garden and to the Russian department of Zhejiang University where discussion was held between the participants and the students with Russian teachers there.

4、All the presentation was given in Russian, with some through interpretation. In addition, the electronic Point Power versions have been translated into Russian by those both proficient in Russian and good at hydropower technology so that the participants may use them after the training.

5、"Participants' Guide" in Russian which was prepared by HRC for the first time was helpful to the participants. It covers points for attention, HRC hotel facilities, services, city transport, sports, shopping, introduction to scenic spots and etc.

6、During the training, SHP forum was conducted where Uzbekistan and Kazakhstan participants presented their SHP country papers and introduced the SHP status and experience in their own countries. Meanwhile, technical discussions for potential cooperation were also held between HRC staff and the participants. HRC express its willingness to provide technical service and promote the exploitation of SHP resources in these countries.

Discussion for cooperation

The training workshop ended with success.

One participant from Uzbekistan commented, 'Dear teachers: From my heart, I should say you've done full preparation work and I'll always keep the impressive teaching materials you provide to us. It is a very rare chance for me to be able to come to China.

At the evening party

Walking towards the future

Environmental Protection Stressed for Rural Hydropower Development in China

Provision on Environmental Protection for Rural Hydro-electrical Project Development have been issued by Ministry of Water Resources recently. It has defined pre-examination of environmental impact assessment (EIA) for rural hydro-electrical development in detail and put forward explicit requirements on environmental protection facilities and corresponding management. The Provisions is a key administrative regulation in administration of rural power industry and aims to implement State Council Decisions on Carrying out Scientific Approach to Development and Strengthening Environmental Protection and Outline Planning for the Eleventh Five-year Plan Period, promote environmental protection and management of rural hydropower projects, insist on rationally developing hydropower in the basis of ecosystem protection and facilitate coordinated development between hydropower development and environment.

The Provision clearly defines that water resources administrative department of the State Council is responsible for providing guidance on pre-examination of EIA for national rural hydropower development projects and corresponding supervision on environmental protection. Following their jurisdiction of river courses, river basin authorities and water resources administrative department under the provincial, autonomous region and municipality directly under the Central Government take responsibility of pre-examination of EIA for national rural hydropower development projects at respective levels, and implement supervision and management of environmental protection for rural hydropower development within their administrative regions in line with laws, administrative provisions concerned and the Provisions.

The Provision concludes that EIA Report for rural hydropower development project which should be submitted to environmental protection agencies for review and approval must be prior pre-examined by water resources administrative department at the same level. All rural hydropower projects should work out an EIA Report and get it approved before projects are examined or approved. Only EIA Report is required for rural hydropower projects with a unit capacity less than 1,000kw and located in non-environmental sensitive area.

The Provision stipulates that formulation of EIA Report should follow relevant technical codes, including EIA Process for Rural Hydropower Stations and EIA Technical Guidance for Water and Hydropower Projects and so on.

The Provision stipulates that the preliminary design of rural hydropower projects should incorporate a chapter on environmental protection. The chapter should not only include measures to prevent and dispose environmental pollution and damage of ecosystem, but also make clear operation and regulation method to ensure healthy river ecosystem after projects are in formal operation, as well as investment budget for environmental protection facilities. Water Resources administrative department should organize examination on preliminary design of rural hydropower development and give no pass if the chapter of environmental protection does not meet the requirement.

Other aspects also covered by the Provision include main content, agencies responsible for drafting, EIA pre-examination procedure of EIA Report and environmental protection in construction, and so on.

The promulgation of the Provision is helpful to awareness rising of rural hydropower industry and important to build up an environmental sound society and harmonious rural hydropower development. ■

(Source: Website of Water Resources Ministry, P.R.China http://www.mwr.gov.cn/english1/index.asp)

I'd recall with deep feeling and tell my friends, relatives and colleagues what I experienced here in China. The Chinese people are so kind and happy, love to work. That is why, as I feel, China has developed so fast. I wish your prospect be bright for ever and your expectation be realized smoothly.'

Participants from Kazakhstan felt proud of the achievements scored in the field of SHP by China, through the exchange of experience and technology with senior experts from HRC. They expected to serve as bridge between HRC and related organizations in Kazakhstan for future SHP development and cooperation. *(By D. Pan)* ■

A Chinese Magazine "Small Hydropower" by HRC

The Chinese "Small Hydropower", a magazine that National Research Institute for Rural Electrification (NRIRE) and Hangzhou Regional Centre (Asia-Pacific) for Small Hydro Power has edited and published for 130 issues (bimonthly), was allocated with the International Standard Serial Number ISSN 1007-7642, and China Standard Serial Number CN33-1204/TV. It was published in Chinese attached with title of articles in English. Its special features are technical experience of SHP development in China. Information of international SHP activities and important events in the field of SHP have also been widely included.

This magazine carries news, views and articles on all aspects of small hydro power. It is useful to those who are intersted in technical experience of SHP development in China.

"Small Hydropower" is the only professional publication on small hydropower in China, which is issued domestically and abroad. It is widely circled in all corners of China concerning SHP, and getting more and more popular in over 600 rural counties which is primarily hydro-electrified, more than 2,300 counties with hydropower resources, more than 50,000 small-sized hydropower stations, thousands of colleges or universities, research institutes and other administrative authorities on SHP. Advertising is welcome for any equipment manufacturer to target Chinese market on SHP construction, equipment purchasing or other businesses. ■

The main contents of issue No.130 (2006 No 4) read as follows:

Strategy and Policy

Management regulations for electricity generation from renewable energy

Tentative management measures for price and sharing of expenses for electricity generation from renewable energy

International Exchange

Centralized operations: automation practices of small hydro units

Rural Hydropower and Electrification

The technology of renovation of SHP stations is urgent to be strengthened

Review of alleviation measures on negative impacts of hydropower projects on ecological environment

Technology Exchange

Lessons and suggestions for SHP station's runoff calculation

The parallel regulation structure of Pelton turbine governors

Multiple debugging of excitation system

Planning and Design

Determination of installed capacity for SHP stations

General layout design of FengJiaWan hydropower station

Renovation

Effect and renovation of added units in TuKan hydropower station

Renovation of generator excitation equipment in JiuNiuZhen hydropower station

Computer Application

Preliminary plan of the monitoring automation for LiuXiHe dam

The excitation system and its application in FengShuBa generation company

Project Construction

Crack cause analysis and solution in the upper reservoir's dam of HuiLong pumped storage plant

Discussion on supervision of quality control for soft foundation treatment in deep water reclamation

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