

## HRC's 2006 Annual Report & Plan for 2007

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### I Four international Training Workshops on SHP Implemented

No	Name	Countries	Participants
1	Hydropower Training for SCO	2	7
2	Seminar on Water Resource Planning & Management for Cambodia	1	15
3	Seminar on Electric System Planning & Analysis for Cambodia	1	15
4	Training Workshop on SHP	30	42
Total			79

#### 1 Hydropower Training for SCO

Hydropower Training for Shanghai Cooperation Organization was held from 25 May to 3 July at HRC for participants from central Asia, as entrusted by the Chinese Ministry of Commerce. Seven engineers from Kazakhstan and Uzbekistan took part in. It was first time for HRC to hold the course in Russian, however, it was implemented with full success.



As the first time to conduct in Russian, the grave problem we faced was shortage of hydropower professionals who could speak Russian. Advertisements were put nationwide, as the result, highly qualified personnel were selected, winning the praise from the participants. Secondly, we adjusted the items for study tour, in accordance with the concrete requirement of the training course and based

on the previously training experience. The sites selected for the study tours were welcomed, including the tidal power in Wenling, Tianhuangping Pumped Storage Plant in Anji, Xinanjiang Power Plant and Water diversion project in

Jiangsu.

#### 2 The seminar on water resource planning & management for Cambodia

The seminar on water resource planning & management for Cambodia was held by HRC from 23 Nov to 12 Dec 2006, as entrusted by the Chinese Ministry of Commerce. Fifteen participants from Cambodia attended with satisfactory result, as the monitor of the seminar on water resource planning & management commented at the closing ceremony, "20 days passed very quickly, but we have got a huge wealth, because we gained much experience, advanced technology and methods from teachers and fields visits. All these are related to the field that we need to upgrade our officials. We anticipate that the Chinese government could hold such seminar every year so that the officials from our country could benefit"

#### 3 The seminar on power system planning & analysis for Cambodia

The seminar on power system planning & analysis for Cambodia was held by HRC from 23 Nov to 12 Dec 2006, as entrusted by the Chinese Ministry of Commerce. Fifteen participants from Cambodia attended with satisfactory result.

In the report to the Chinese Embassy in Cambodia and to the Chinese Ministry of Commerce by the

team leader of the 2006 seminar on power system planning & analysis, it points out "This training course is very interesting and from this course, we could learn more experiences from HRC of electric power planning and analysis, not only in development of power demand forecast, optimization of the project, economic analysis, environmental impact assessment,



and financial method for implementation of small hydropower projects and also from the observations of the small hydropower plant, pumped storage hydropower plant, dam simulation laboratory, turbine manufacturer, but also from other company on biomass power generation which are suitable for rural electrification in Cambodia."

That is also the first time for HRC to conduct "power system" seminar. The scheduling, teachers, teaching materials and study tours are quite different from the "SHP" as what we did in the past. The study tours we arranged to the dispatching center of Zhejiang province, Hangzhou Garbage Power Plant and Beilun Thermal Power Plant were just appropriate and appreciated by the participants of the seminar.

#### 4 SHP Training Workshop

In all, 42 participants of 30 coun-

tries from 5 continents attended the small hydropower training course from 19 Dec 2006 to 8 Feb 2007, as entrusted by the Chinese Ministry of Commerce. An international lecturer from Sweden was invited to give presentations for two days.

Under the support of Ministry of Commerce, Ministry of Water Resources, Department of Foreign Trade & Economic Cooperation of Zhejiang province, and Foreign Affairs Office of Zhejiang province, the year 2006 witnessed a breakthrough in HRC's implementation of international training programs.

First, it is the first time for HRC to conduct as many as 4 training workshops in a year. Secondly, HRC conducted two workshops or seminars for "Officials", i.e. seminar on water resource planning & management for Cambodia, and seminar on power system planning & analysis for Cambodia. It is the first time for HRC to conduct seminars for "Officials". According to the Ministry of Commerce, the requirements for holding seminars for officials are different. Thirdly, It is the first time to have 79 trainees in a year, exceeding 40 for one class. It is the first time to conduct training in Russian. Through the implementation of so many training programs, HRC increased its capacity in holding training workshops and its staff's ability increased considerably, thus, the working efficiency enhanced.

China pays great attention to the overseas training missions for the numerous developing countries. China's president Mr Hu declared recently 8 measures at the Beijing Summit of Sino-African Forum for promoting new Sino-African strategic partnership and cooperation in a wider scale and higher level, including training 15000 African personnel within 3 consecutive years.

## II、R&D

### 1、Key technology for containerized SHP station

HRC has cooperated with Tyco Tamar Co of Australia and conducts the research on key technology for containerized SHP station which has the features of low construction cost, short construction period, easy operation and maintenance, able to realize unmanned operation, and appropriate for the hilly remote areas.

### 2、Rural hydro intelligent control and management technology



HRC has cooperated with POWERBASE of Canada to conduct the research for rural hydropower intelligent control and management technology. The project has been listed as key item of international science and technology (2006DFB61400) cooperation by the Chinese Ministry of Science and Technology. It aims at promoting the development and management for

rural hydropower energy resource in China.

3、Continuous implement action of the research of “Sustainable Development of SHP in China” assigned by the Chinese Ministry of Water Resources. Its draft has been completed.

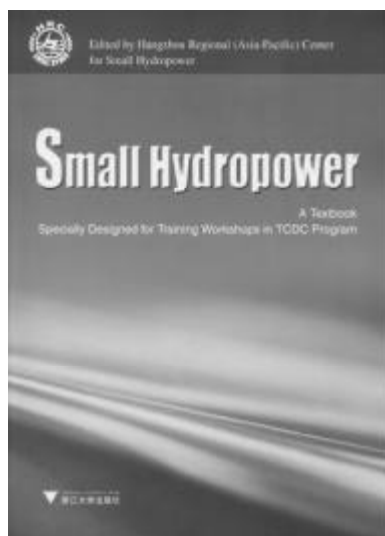
4、Research project of “Collection & Comparison of Application of International SHP Norms” assigned by the Ministry of Water Resources. The project mainly collects the standards, norms and regulations related to hydraulic engineering, hydropower, electric, mechanical and materials etc. It compares comprehensively and systematically the differences of system, application scope, and concrete technological parameters in technology, economy and management with that of foreign countries, and analyze the reasons to the differences. Based on that, put forward the recommendations for improving the regulations, standards and norms related to SHP in China, policy recommendations how to realize the transfer of “China standards” to “world standards” for decision makers. So far over 10 items of norms or standards related to hydropower and environment have been collected for analysis.

5、HRC has cooperated with Carbon Resources Co. of UK for two CDM projects in Hunan and Hainan provinces. Both these two projects have been checked and approved by the state Development & Reform Commission in China.

### III、Information Exchange & Publications

1、The textbook <SHP> in English was revised by HRC and published by Zhejiang University Press. A large amount of revision was made, attaching with 5 special topics. The year 2006 marked the 25 anniversary

of HRC's establishment and the pub-



lication of the textbook is the gift for the anniversary.

2、The book “Blue Energy for A Green Europe — Strategic Study for the Development of Small Hydro Power in the European Union” (approximately 60,000 words in total) has been translated, and was published by Hohai University Press in June. Based on the research report BlueAGE, which was released by European Small Hydropower Association (ESHA) in the end of 2004, the book offers the details on the actual



state-of-the-art of the SHP development in European countries, makes analysis on the issues concerned, such as environmental protection, market competition and market permit, etc, trying to point out the main obstacles to the further SHP exploitation. Meanwhile, it focuses on the new concept of “exploitable environmental protection”, the updated technical research, the simplified procedure for checking and approval of project, and the incentive policies, etc, aiming to give some concrete recommendations for the promotion of further SHP development.

3、The book “Small Hydropower in Asia-Pacific Region — Status quo and Problems” has been translated from Chinese into English. Check and revision are still on-going.

4、Participation in compiling chapter 8, “SHP” in the Fifth volume “Hydropower Engineering” of <Electrical Engineering Canon in China> as entrusted by China Hydropower Engineering Society. The canon has been the first large comprehensive reference book which consists of 15 volumes and 35 million Chinese characters, for the past 30 years of electrical engineering development in China, which is practical, advanced and authoritative. The compilation plan and outline of this chapter have been submitted to the Rural Hydropower Bureau.

5、Altogether 6 issues of <SHP> in Chinese and 3 issues of <SHP News> in English were published by HRC. In all, 28 papers were issued including 3 papers published in China's kernel magazines, 4 papers issued in international conferences and one paper issued in international journal.

6、The influence of HRC's homepage has been increased, becoming an important window for publicity and a platform on which the HRC



staff receive information easily. According to statistics, 101 pieces of information in Chinese and 30 pieces of information in English were edited and issued in the year.

7、Accomplishment of publized materials of SHP and HRC with 3 languages of Chines, English, and French, exhibited on the 2006 Exhibit of Sino-African Friendly Co-operation organized by Chinese government. Lots of governmental leaders and ministers were present there.

8、 Provided articles for 2006 Provincial Yearbook on Foreign Affairs of Zhejiang.

#### IV. International Trade on Hydropower Equipment Supply

In April 2006, the engineers from Turkey, who were once in HRC attending the international training on SHP years ago, again come back to HRC with Turkey Customers for the cooperation of importing Chinese E-M equipment. The Memorandum of Understanding has been signed. In the 1st half of the year, HRC has succeeded in exploring the hydropower market in Latin American countries. The agreement of supplying a set of unit of 1950kW was signed recently with CRS in Peru. Meanwhile, close cooperation has been undertaken between HRC and the peers from the fields of hydropower in many

countries, inclusive of Nepal, India, the Philippines, Pakistan, Indonesia, Australia, Zambia, Thailand and Korea, etc. The quotations have been offered for over ten potential hydropower projects.

The under-implementation projects for hydropower equipment supply, which were signed in 2006, are shown as below.

The packaged equipment exported to Peru(1950KW):USD357,630.00;

The micro units exported to the Philippines(30KW):USD17,200.00;

The control system exported to Peru(1950KW):USD54,000.00;

The micro units exported to the Philippines(30KW):USD25,600.00;

The micro units exported to Canada(50KW):USD25,200.

#### V. Foreign Delegations Received by HRC & HRC's Outbound Missions

In 2006, 12 foreign delegations, 131 guests in total, paid visits to HRC (shown in Table 1).

This year, HRC sent 7 missions,

10 engineers in total, to go abroad (shown in Table 2).

#### VI. Work Plan for 2007

1. In response to the plan put forward by the Chinese Central Government that "China would help to cultivate 30,000 various talents for developing countries in the coming three years", in the year of 2007, we applied for assignment of 4 international training courses from the Ministry of Commerce. With joint efforts of HRC staff, we strive to well implement these up-coming training workshops and offer more contribution.

2. To edit and publish continuously the journal "Small Hydropower" in Chinese (6 issues/year), and the "SHP News" (electronic edition) in English as well as the Year book of 2007.

3. To finalize and publish the book "Small Hydropower in Asia-Pacific Region —— Status quo and problems" (English Version).

4. To pursue the potential SHP cooperative projects, try to make more addition based on the contract volume of 2006.

5. Continue to strengthen the management on foreign guests reception and outbound missions.



Table 1 Foreign Guests Received by HRC

No	Delegation	Guest	Time	Objectives and results
1	CRS, Peru	2	Mar	Visited HRC for purchasing SHP equipment.
2	Turkey	4	Apr.	Visited HRC and held in-depth discussions on the project recently set to construct in Turkey (2x1412kW), covering issues of equipment selection, technical parameters, after service, and terms of payment, etc.
3	Ministry of Energy, Sudan	1	Apr.	Visited HRC and focused on SHP cooperation with African countries.
4	Uzbekistan; Kazakhstan	7	May-Jul	Attended "Training Course on Hydropower for Shanghai Cooperation Organization", which adopted Russian as the working language firstly in HRC. Fruitful results were achieved.
5	"International Water Science Summer Camp" Participants from 15 Countries	21	Jun.	Visited historic sites and hydropower stations, and learnt more about the long history of water resources and the status quo of SHP development in China
6	TEAM, Thailand	4	Jul.	Visited HRC and hydropower stations. An Agreement on Cooperation was signed.
7	TEAM, Thailand	4	Oct.	Focused on issues for the joint bidding on SHP projects in Thailand in December.
8	PESI, the Philippines	4	Oct.	Visited hydropower stations and the equipment manufactures. A MOU was signed successfully with the details discussed intensively on the export contract to be signed.
9	Collaborators from Peru	4	Oct.	Based on the contract signed before, visited the factories and took inspection on products.
10	High-rank officials from Cambodia	30	Nov.	Attended the two seminars that were successfully held for Cambodia, i.e. "Seminar on Water Resource Planning & Management for Cambodia" and "Seminar on Power System Planning & Analysis Cambodia".
11	Vice provincial governor and Owners of THAI AN station, Vietnam	8	Dec.	Held in-depth discussion on the design of Thai An Hydropower Station in Vietnam, and signed an Agreement on Cooperation.
12	Participants from 30 Countries	42	Dec. 2006-Feb. 202007	Attended "Training Course on SHP", sponsored by Chinese Ministry of Commerce.

Table 2 HRC's Outbound Missions

No.	Time	Delegate	Country	Tasks & Achievement
1	Mar.	3	Mongolia	Attended the technical coordinating meeting for Tashir Hydropower Station in Mongolia. A summary of the meeting was finalized.
2	Mar.	1	Mexico	As one of the members of the Chinese delegation, attended the "4 <sup>th</sup> World Water Forum", which was held in Mexico City from 16th to 22nd March 2006, with the theme of "local actions for a global challenge."
3	Mar. – Apr.	1	Turkey	Undertook the on-site technical assistance to Basaran Hydropower Station, a cooperative project in Turkey, of which, the two sets of low-voltage automatic control panel were supplied by HRC.
4	Apr.	1	Vietnam	Participated in the follow-up Training Seminar of "2005 Management of Hydro Power Development", a program sponsored by SIDA. The HRC representative submitted the "Plan of Action" named "Environmental Integration of SHP Development", which was highly evaluated by the Swedish experts and other participants from various countries.
5	Sep. – Oct.	1	Sweden	Participated in "2006 Management of Hydro Power Development", a program sponsored by SIDA. Vattenfall, a leading European energy company, conducted the training program, in which, 25 delegates from 20 countries participated.
6	Dec.	2	Cuba	Offered technical assistance to the equipment installation and testing for MOA and CROJO hydropower stations, the two projects in Cuba with financial support from Chinese Government.
7	Jan. 2007	1	India	To attend the International Training Course on "Small Hydropower: Assessment and Development" held in India from Jan.30 - Feb.10, 2007.

( By HRC Secretariat, Feb 2007 )

## Two Seminars for Cambodia Officials conducted by HRC

The 2006 seminar on power system planning & analysis and seminar on water resources planning & management with duration of 20 days were conducted by HRC from 23 Nov. to 12 Dec. 30 Officials from Cambodian Council of Ministers, Ministry of Industry Mine & Energy, Ministry of Water Resources & Meteorology participated in the seminars.

Leaders from Foreign Affairs Office of Zhejiang province, Department of Foreign Trade & Economic Cooperation of Zhejiang province, Department of Water Resources of Zhejiang province attended the open ceremony and some speeches delivered. A special message of congratulation sent from the Department of International Cooperation, Science & Technology of the Ministry of Water Resources was read at the ceremony.

With the powerful support and deep concern by leaders at various levels, and with the joint efforts by the participants and HRC staff, the two seminars were implemented with full success.

In the report to the Chinese Embassy in Cambodia and to the Chinese Ministry of Commerce by the team leader of the 2006 seminar on power system planning & analysis, it

points out "This training course is very interesting and from this course, we could learn more experiences from



HRC of electric power planning and analysis, not only in development of power demand forecast, optimization of the project, economic analysis, environmental impact assessment, and financial method for implementation of small hydropower projects and also from the observations of the small hydropower plant, pumped storage hydropower plant, dam simulation laboratory, turbine manufacturer, but also from other company on biomass power generation which are suitable for rural electrification in Cambodia."

The monitor of 2006 seminar on water resource planning & management commented at the clos-

ing ceremony: "20 days passed very quickly, but we have got a huge wealth, because we observed much experience, advanced technology and methods from teachers and fields visits. All these are related to the field that we need to upgrade our officials."

In spite of all the success of the



two seminars, there still remains much for improvement. HRC will strive every possible way to achieve more for implementing international training programs.



## Opening Speech from The Department of International Cooperation, Science & Technology, MWR

### ——For 2006 Cambodian officials' Seminars

Distinguished guests, ladies and gentlemen,

Good morning!

Pleased to know that 2006 Seminars on "Water Resources Planning & Management" and "Power System Planning & Analysis" are being held for Cambodia today, and the Department of International Cooperation, Science and Technology under the Ministry of Water Resources would like to extend its congratulations, and a heartfelt welcome to Cambodian officials and experts from power and water sectors for attending these 2 seminars.

China and Cambodia have long been friendly from generation to generation, and two governments and peoples have enhanced their profound friendship during the long history of cooperation and exchange. In recent years, the mutually benefited interaction of two nations becomes more frequent day by day, the bilateral trade continues to increase, and in 2005 the trade volume amounts to 560 million US dollars more.

In the fields of water resources and electric power, the cooperation between 2 governments has never been interrupted. In last December, the Minister of Water Resources, His Excellency Mr. Wang Shucheng paid a visit to the Ministry of Water Resources and Meteorology of Cambodia and held an official meeting there, and both Parties had signed a MOU on cooperating in the field of water resources. This visit thus enhanced

the scientific, technical and economic cooperation between 2 countries in the water resources management and the sustainable water resources utilization. Our government and concerned water resources departments are also taking an active part in the



management and development of Mekong River Basin, and they are playing an important role in the economic and technical cooperation in Great Mekong Sub-region Cooperation (GMS). As one of the important windows of the Ministry of Water Resources for international cooperation in water resources, Hangzhou Regional Center (Asia-Pacific) for Small Hydro Power has successfully hosted over 40 international training workshops on SHP since it was set up 25 years ago, among which, many engineers were from the water sector and the power sector of Cambodia. Through other channels, the concerned water resources or power departments of both nations are continuously strengthening their long-term cooperative relations in the energy field.

China is vast in space and rich in water resources. After the New China is founded, Chinese govern-

ment has built a huge number of large and medium-sized water resources and hydropower projects on many big rivers, such as Gezhouba Hydropower Project, Xiaolangdi Multipurpose Project and Three Gorges Project etc., and these great projects

have attracted widespread attention from China and abroad. In recent years, regarding the water conservancy, our country initiated a new thought on sustainable water management, with the priority given to harmonizing the people and the nature.

Great achievements have been made in China for small hydropower development, construction and management, with fruitful experience accumulated, and now the number and the scale of small hydropower are leading the first in the world.

Therefore, all these successful experience and good practices can lay a foundation for the mutual exchange between China and Cambodia, and we are also expecting to learn the practicable experience in the development of water resources and electric power from Cambodia. These two seminars held right here, just provide a platform for both Parties to extensively and intensively exchange ideas, so that two sides can further strengthen the cooperation in infrastructure facility construction and development of water resources. Finally, wish a full success to two seminars in advance!

November 24, 2006



## Opening Speech by the Office of Foreign Affairs of Zhejiang Provincial People's Government

### ——For 2006 Cambodian officials' Seminars

Deputy Director General, Mr. He Yifeng gave the speech in the opening ceremony for 2006 Seminar on Water Resource Planning & Management for Cambodia and Seminar on Power System Planning & Analysis for Cambodia

Good morning! Distinguished guests, ladies and gentlemen,

I feel glad to be invited by Hangzhou Regional Center (Asia-Pacific) for Small Hydro Power (HRC) for attending the opening ceremony of 2006 Seminars on "Water Resources Planning and Management" and "Power System Planning and Analysis" for Cambodia. On behalf of the Office of Foreign Affairs of Zhejiang Provincial People's Government, I would like to congratulate HRC for holding these 2 seminars, and meanwhile, I would also extend my warmly welcome to all the friends from the water sector and the power sector of Cambodia.

Zhejiang has a long history of interacting with foreign countries. During the prosperous Tang dynasty of over 1200 years ago, products from Zhejiang such as silk, porcelain and tea made their way to Middle Asia and Europe by merchant ships and

through the famous Silk Road. During the 13<sup>th</sup> century, the great Italian traveler, Marco Polo, came to Hangzhou and was deeply attracted to its profound culture and beautiful scenery, so he acclaimed Hangzhou as "the finest and most magnificent city

in the world". From then on, Hangzhou has been renowned as "the paradise on earth".

Recently, more and more countries and international organizations are cooperating with our province. So far, the province, together with cities under its direct jurisdiction, has established friendly relations with 168 provinces, cities and counties in 40 countries such as Japan, the U.S., Germany, France, U.K., Brazil, South Africa and so on. Moreover, the province has established widespread exchange and cooperation with more than 220 countries and regions in the fields of economy, trade, science and technology, culture etc., framing an extensive and far-reaching worldwide cooperative network.

China and Cambodia cherish a long-term traditional friendship, and recently the visit exchanges between



two governments further enhanced this friendship of two peoples. We believe, these seminars held here, can also promote the mutual exchanges between the related Cambodian departments, local governments, and Zhejiang province.

Finally, with this opportunity, I sincerely wish that the traditional friendship between our two governments and peoples can be further deepened, and also expect a long-term and extensive cooperation to be set up between our province and your provinces, and between Chinese concerned departments and your related sectors. Wish a full success to the two seminars in advance, and also wish all the Cambodian friends have a nice stay in Zhejiang. Thanks.

*November 24, 2006*

## Owners From Peru Visiting HRC

—From 28 October to 1 November, a group of Peruvian guests headed by Mr. Alvarado, General Director of Electric Power Company of Peru, paid a visit to HRC. The guests are the owners of hydropower equipment being supplied by HRC.

Accompanied by HRC's project

members, they visited the manufacturers—Linhai Machinery Works and Zhejiang Linhai Electric Machinery Co., LTD., to view and inspect the production condition of the contracted equipment. They were satisfied with the production schedule and the production capacity of the factories. Dur-

ing this period, HRC also arranged the visit to Tangpu Power Station, and they expressed keen interest in the control system provided by HRC, which has been initially decided as the next item of the cooperation. Through the exchange, both sides strengthened the trust.

## “Training Workshop on SHP” Held by HRC

—On 19 December 2006, a beautiful sunny day in Hangzhou, the opening ceremony of “Training Workshop on SHP” was held in HRC. 42 engineers from 30 countries have participated in this training workshop. Entrusted by the Ministry of Commerce, HRC is honored to implement the 52-day training programme, which is under the list of foreign aid by the Chinese government to other developing countries.

HRC leaders, lecturers, the course organizers and many distinguished leaders attended the ceremony, i.e. Mr. Xia Yungui, Deputy Director, Bureau of Economic Cooperation, MOC; Mr. Xia Weihai, Deputy Director, and the Official Ms. He Xiaoqun, Department of Foreign Trade & Economic Cooperation, Zhejiang Province, etc.

For this training workshop, HRC not only arranged schedule and study

tours related to SHP, but also covered a certain subject related to other renewable energy, and study tours have included the nuclear power and garbage power plant. Such arrangements were highly appreciated and appraised by the participants.

An international lecturer from Sweden was invited to give presentations for this SHP training workshop. Such topics he delivered as SHP environmental impact assessment, CDM and etc. were very much welcomed by the participants. Meanwhile, as designed by the international lecturer, the “Role Play” by the participants as SHP developer, poor villager, rich villager, politician, design engineer, consultant and journalist was so interesting and imaginative that HRC may adopt it for the upcoming SHP training workshops.

HRC has organized several rounds

of talks exploring the potential international SHP cooperation with participants from Nigeria, the Philippines, Tanzania, Indonesia, East Timor, Zimbabwe, Vietnam, Myanmar and Benin. The participants introduced to HRC staff the SHP development and future SHP potential sites for exploitation in their own countries. And they expressed that HRC could offer technical assistance for the SHP development, including feasibility study, consultation, training and etc. HRC has expressed the willingness to provide technical service and participate in the SHP development process.

HRC also organized two times of badminton matches and one football match, several evening parties and five city tours around Hangzhou. All these activities we expect have enriched the life at spare time for the participants in a foreign country.

## A Joyful New Year's Eve Party

—On that wonderful night of 31 December 2006, a joyful New Year's Eve Party was held in HRC for the 40 international participants of 2006 TCDC Training Workshop on SHP, with the beaming presence of the HRC leader and working staff. Beautiful lampion, flying balloons, colorful ornaments and dulcet music..... singing and dancing together, happily to wait for the arrival of a pros-

perous new year.....

With the New Year bell's clangor, time to say farewell to the year 2006 and to cheer 2007 with hopes and wishes — on behalf of HRC, the presider extend best wishes to all the participants..... the attractive music was mixed with the exciting jubilation — various complexion, figures and accents, however, with the same pleasure, ideality and pur-



suing..... Embracing each other warmly, singing loudly in chorus a charming song of “Happy New Year”.....

## HRC's Training Program for 2007

For 2007 at least two international training workshops on small hydropower will be conducted by HRC. They are:  
**1 TRAINING COURSE ON SMALL HYDROPOWER**

*Time: 17 May — 25 June 2007*

*Venue: Hangzhou, China*

*Language: English*

**2 STAGE DE FORMATION POUR L'AFRIQUE SUR LES PETITES**

**CENTRALES HYDRO-ELECTRIQUEE**

*Time: 16 Aug — 24 Sept 2007*

*Venue: Hangzhou, China*

*Language: French*

Full fellowships could be provided, if requirements are met. For more information, please contact HRC or the Commercial Office of the Chinese embassy as early as possible:

Mr. Pan or Ms. Shen

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## Vice Minister Mr. Hu Siyi Visit Rural Hydropower Bureau

On January 4<sup>th</sup>, the first working day of 2007, Vice Minister Mr. Hu Siyi paid a special visit to Rural Hydropower Bureau to listen to the work report presented by the new leadership group. Director of Rural Hydropower Bureau, Mr. Tian Zhongxing gave the report on working circumstance and development. The discussion on the policy and management of rural hydropower was carried out warmly. At

last, Vice Minister Mr. Hu Siyi pointed out that the rural hydropower development should combine with the farmer's benefit, with the local development and environment protection. It was also pointed out that the importance should be put on the renovation of mechanism and policy making of rural hydropower development. Experience gained from previous practice should be summarized theoretic-

cally to make concrete experience systemised, perceptual knowledge rationalized and successful approaches turning into policies. At the same time, Mr. Hu Siyi also analyzed the problems of hydropower construction management, ecology compensation, etc., and gave the instruction for the next step work.

*Source: MWR*

## China-Canada Seminar on Dam Safety Held in Nanjing

China-Canada Seminar on Dam Safety and Risk Management was held in Nanjing Hydraulic Research Institute from Dec. 11 to 13, 2006.

The purpose of the Seminar is to summarize the outcome of the Sino-Canada Dam Safety and Reservoir Risk Analysis Project in the past two years, exchange experience of dam safety and risk management between two countries, and explore the devel-

opment directions of dam safety management technologies to promote management of dam safety and risk in China.

Experts from China and Canada delivered presentations on Canadian Legislative Framework of Dam Safety, Dam Safety Accounting Approach, Dam Risk Management Status in China and warmly discussed similarity and difference in terms of dam

safety practice.

Representatives from Canadian Embassy to China, Canadian International Development Agency, Dam Safety Management Center of Ministry of Water Resources, and experts with long-term experience also attended the seminar.

*Source: MWR*

## ADB funds Nanjing water and sanitation project

The Asian Development Bank (ADB) will lend 100 million U.S. dollars for a project to clean up the environment of Nanjing city and manage and protect the city's water resources.

The project, part of a broader water resource initiative being carried out by the Chinese authorities for the Qinhuai River and Nanjing City, as well as the Yangtze River Basin, will reduce water pollution, help prevent flooding, and improve the urban environment, said the ADB's China office on Thursday.

The project will tackle sewerage and water replenishment, waste water treatment, stormwater drainage, sludge treatment and disposal, and institutional development.

"All aspects of the project will contribute significantly toward improving water quality in the Qinhuai River, which empties into the Yangtze," said Sangay Penjor, an ADB Principal Financial Analysis Specialist. "Living conditions and public health standards for about 2.7 million city residents will improve as a result of the reduced pollution and flooding."

Rapid economic growth over the last two decades has put pressure on Nanjing's environment and city infrastructure. The Qinhuai River that flows through this city of 4.5 million residents has suffered greatly from wastewater discharge.

ADB said the project will contribute to the city's 2010 target of treating 85 percent of wastewater.

The project will also create at least 450 full-time permanent jobs with the operators of the wastewater facilities and 6,000 person years of labor during the five years of construction, according to the ADB.

The bank said the Nanjing municipal government and China Development Bank will contribute approximately 81 million dollars and 55 million dollars, respectively, toward the total project cost of 236 million dollars.

The Nanjing municipal government is the executing agency for the project, which is due for completion at the end of 2011.

*Source: Xinhua*

## Environment tops agenda for science co-operation

Energy, environmental protection and water resources technologies top the agenda for China's international science co-operation in the 11th Five-Year Plan (2006-10), according to a document released by the Ministry of Science and Technology yesterday.

The Outline of the 11th Five-Year Plan of International Science Co-operation states that technologies in the three areas have become bottlenecks in China's economic development, according to Minister of Science Xu Guanhua.

"Breakthroughs in the three sectors are also urgently needed for building a harmonious society," he told China Daily.

"Clean" energy technologies such as clean coal and the comprehensive utilization of oil and gas are

given top priority in the outline.

Shang Yong, the vice science minister, told China Daily that China is poised to join FutureGen, an initiative by US President George W. Bush to build a giant coal-using, emission-free electricity plant.

International nuclear energy development, such as the US\$12.8 billion International Thermonuclear Experimental Reactor as well as collaboration in energy and resource saving, are stressed in the outline.

Environmental protection technologies are given an unprecedented emphasis in the outline, such as those dealing with urban air pollution, heavily polluting industries and refuse recycling.

The focus of water resource technologies will include those for water conservation, use of sea water

and prevention of river pollution.

The country is facing a critical water shortage partly as a result of rising pollution accidents. Severe toxic spills into rivers occurred several times in the past year.

A chemical leak into the Songhua River in Northeast China last November forced water supplies to be cut off for millions of people along the river.

Besides technologies in the three areas, the outline gives emphasis to food safety, development of an environment-friendly agricultural industry, and medical solutions for chronic and epidemic diseases.

"The improvement of people's health is a primary goal," said the outline.

2006-12-4 Source: China Daily

## Hydropower stations dot the Yangtze River

A thousand kilometers upstream from the titanesque Three Gorges Project, China continues to throw up hydropower stations on the Yangtze.

Construction began Sunday on the 6-million kw Xiangjiaba hydropower facility, the second on this section of the Yangtze after earthworks began on the Xiluodu project last year.

The section of the Yangtze that flows between Yushu in Qinghai Province and Yibin in Sichuan Province is often called the Jinsha River and, before long, it will be littered with hydropower developments.

Jinsha means golden sand in Chinese, and the Jinsha River is said to have produced "golden sand" since ancient times.

The China Yangtze River Three Gorges Project Development Corpo-

ration has plans to build at least two more hydropower stations on the lower reaches of the Jinsha.

According to Li Yong'an, general manager of the China Yangtze River Three Gorges Project Development Corporation, developer of all the projects, a feasibility study for the 12 million kw Baihetan hydropower station has been completed and approved by experts. Work has also started on a feasibility study for the Wudongde hydropower station.

The four hydropower stations will have a combined capacity of 38.5 million kw upon completion, said Li, but the potential hydroelectric capacity of this 2,300-km section of the Yangtze is estimated at 112 million kw.

The Xiangjiaba hydropower station — located near Yibin — will displace 88,000 residents from six

counties in southwest China's Yunnan and Sichuan provinces.

Some 8,000 people have already been resettled.

Budgeted to cost 43.4 billion yuan (about 5.43 billion U.S. dollars), it will be completed in 2015 and will be able to generate 30.7 billion kw/hour of electricity a year.

In addition to providing power, the project will also play a role in flood control, farmland irrigation, will improve navigation and have a positive effect on the environment, according to Li.

Electricity generated by hydropower stations on the Jinsha River will mainly be sold to China's eastern, southern and central regions.

2006-11-27 Source: Xinhua

## New policy stresses quality of foreign investment

China on Thursday published its 11th five-year-plan (2006-2010) for utilizing foreign investment, which says the priority of policy will be given to the quality rather than quantity of such investments.

The National Development and Reform Commission published the document on its website, the first time such a document has been published.

"This is an important measure taken by China in creating a stable and transparent foreign investment management system as well as a fair and predictable policy environment," the NDRC said.

According to the document, China utilized 383 billion U.S. dollars of overseas investment during the 10th five-year-plan period (2001-2005), including 286 billion dollars in overseas direct investment, 38 billion dollars in stock issuances and 46 billion dollars in foreign loans.

It criticizes some local governments for their blind seeking of foreign investments, some of which are apparently against the central government's industrial policy.

The document notes that emerging monopolies by foreign businesses in certain industries are posing a potential threat to China's economic security.

It also criticizes foreign businesses for abusing intellectual property right protection laws, adding that this has adversely affected Chinese

enterprises' capacity for independent innovations.

The document says China will push for further shifting of policy priority from the quantity to the quality of foreign investment during the next five years.

Priority shall be given to the introduction of advanced technologies, management expertise and high-quality talents, rather than the use of foreign capital, the document says.

More emphasis shall also be given to the protection of environment and efficient use of natural resources, it says.

The document stresses the need for more foreign investments in areas such as research and development as well as sophisticated design, so that China could eventually become a major manufacturer of high value-added products.

It also calls for more foreign investment in China's remote west and the northeast rust belt, which are currently lagging far behind the coastal regions in the amount of foreign investment.

Despite the stress on quality, the document says China expects its foreign investment to keep rising in the next few years.

"During the 11th five-year-plan period, the domestic and international environment affecting foreign investment in China will generally tend to improve, making it possible for China

to improve the quality of foreign investment while maintaining quantity," the document says.

According to the document, China will continue to encourage foreign investment in agriculture, electronics and information, petrochemicals, chemicals, automobiles and infrastructure.

Foreign businesses will be encouraged to take part in the restructuring of traditional industries such as machinery, light industry, textile, raw materials and construction.

Foreign investment in environment protection, including the control of water and air pollution and recycling, will be welcomed, the document says.

In the service sector, the document says China will fulfill its duties under the World Trade Organization and open its banking, insurance, securities and telecommunications sectors to foreign investment in a positive and prudent manner.

In response to the rising concern over foreign acquisitions of leading Chinese firms in critical sectors, the document says China will speed up legislation and step up the supervision of sensitive acquisitions and takeovers to ensure critical industries and enterprises remain under Chinese control.

2006-11-13 Source: Xinhua

## Zhan Tianyou Civil Project Award goes to Taipuhe Pump Station

Taipuhe Pump Station was awarded the 6th Zhan Tianyou Civil Project Award by Chinese Civil Engineering Society and Zhan Tianyou Civil Engineering Science Development Fund Committee as the sole water project won the honor.

The Taipuhe Pump Station is located in Wujiang City, Jiangsu

Province. It is composed of pump station, trash screen, road bridge, inlet and outlet, and switch yard. The project is the largest pump station around the world in terms of flow rate (50m<sup>3</sup>/s) and total designed flow volume of 300m<sup>3</sup>/s. The project is to improve water quality of inlet of the Huangpu River and of domestic and

industrial consumptions as well as flood control, drainage, environmental upgrading.

The Zhantianyou Award set up at 1999 was entitled as China Civil Project Award to promote scientific innovation in terms of civil engineering.

2006-12-21 Source: MWR

## Small Hydropower: way out of energy crisis in Pakistan

The single renewable energy resource that Pakistan possesses in abundance is hydropower, the most environmental friendly, cheapest source of energy. It has a potential of more than 41,722MW. Despite this, Pakistan now is faced with a most serious energy shortfall. The acute shortage of electricity has resulted in loadshedding during the current summer season, costing the economy millions of rupees. The installed power generation capacity at the end of 2005 was 19,560MW, of which 65 per cent was thermal, 33 per cent was hydroelectric and 2.4 per cent was nuclear. The 33 per cent share of hydroelectric power amounts to only 6,595MW. We should not forget the fact that the projected lifetime of the existing natural gas and oil is just over 15 and nine years respectively. Domestic coal reserves may be exploited only at great financial and environmental costs. Seventy per cent of Pakistan soil needs are met through imports. The average cost of hydel energy generation in Pakistan was Rs0.50 per kilowatt hour in 2000-01. The annual per capita electricity consumption in Pakistan is around 320kwh, and this only caters for 60 per cent of the population. Forty per cent of Pakistanis still have no access to electricity. In view of these facts, the best solution to Pakistan's energy/electricity crisis is hydropower. An abundant, cheap, environmental friendly and renewable source of energy has remained untapped. To meet Pakistan's power requirement, WAPDA and the Ministry of Water and Power developed a strategy called the Hydropower Development Vision-2025 in the year

2001. The strategy was based on an average annual demand increase of 3.7 per cent. Recently though the demand for electricity rose sharply, in excess of eight per cent per annum during the last two years. In Vision-2025 a short-term plan was developed and the commissioning date of eight hydel projects with a total generation capacity of 716MW was fixed on June 2006. These projects were proposed and designed as run-of-river plants, meaning one with little or no storage capacity, such as Ghazi Barotha hydropower project, in which no big reservoir is to be constructed. But unfortunately none of these projects could be completed. The root-cause of the failure to provide the needed energy is lack of strategy for implementation. The strategy prepared by the ministry fails to take into account the ground realities and the project management capabilities of executing agencies. The World Bank rightly proposed institutional reform in WAPDA for decentralisation in order to increase efficiency in management. While preparing the future strategy the Ministry of Water and Power should keep in view the completed hydropower projects, such as Ghazi Barotha, and the lessons learnt from them. The Ghazi Barotha project's feasibility survey was carried out in 1987 and the project finally commissioned on 19 August 2003. This means that 16 years are required for WAPDA to complete a run-of-the-river project. Another cause of the present energy crisis is that the federal government has not taken small hydropower projects (SHPs) in its own hands. Such projects are very viable as they

do not require building of large dams and do not pose problems of deforestation, submergence or rehabilitation. Comparatively small capital investment and short gestation periods are required to complete these projects and they cause minimal transmission losses occur compared to WAPDA's current line losses, which are more the 25 per cent. In Pakistan, all small hydropower projects up to 50MW are the responsibility of the provincial governments which cannot construct small hydropower projects due to financial constraints, among other reasons. In India, developing small hydro projects at a fast pace is one of the components of their energy policy. The central government there has completed 90 small hydro projects with 270MW capacity in the past five years. The state of affairs in Pakistan should change. Punjab has enough financial resources but it has made no real progress on small hydropower plants, even though WAPDA has not only identified various locations having a potential of 350MW but also completed the necessary design works. In Azad Jammu and Kashmir, which is endowed with abundant hydel potential, the AJK Hydroelectric Board has only completed hydro projects having a capacity of 36MW against an identified potential of 5,329MW. This hydrogeneration cannot even meet the electric demand of AJK itself, which is 250MW; while the anticipated power demand by 2007 will be 350MW. The AJK Hydroelectric Board is facing serious financial problem in starting the projects as funding is not available. International donor agencies are

## The European Parliament shows the way forward on renewables – binding targets for each renewable energy sector demanded

The European Parliament responded to the European Commission's Green Paper on sustainable, competitive and secure energy by calling for binding sectoral targets for renewables in order to achieve 25% of renewables in primary energy by 2020.

At the same time the European Commission is preparing its proposal for a roadmap that will effectively change the existing, successful sectoral approach to renewables legislation, by proposing vague measures and ambiguous commitments. By omitting sectoral targets in its draft Roadmap, the Commission is providing cynical window dressing, according to the European Renewable Energy Council (EREC).

"The Parliament's vote today is a historic opportunity for the Commission to listen to European citizens'

demands for more renewable energy. Together with the Parliament they could show leadership by proposing binding targets and legislation for all three sectors: electricity, heating and biofuels. The draft Roadmap, as it stands, would undermine existing law, create a legislative vacuum for many years to come and fire up widespread investor uncertainty. The Commission should focus on creating the missing link in EU renewables legislation – heating and cooling – rather than undermining existing legislation for electricity and biofuels," said EREC policy director Oliver Schäfer

"An overwhelming majority of 479 representatives of European citizens voted in favour of sectoral targets for renewable energy and only 16 parliamentarians voted against. We urge the European Commission to

team up with the Parliament, acknowledge its visionary approach and put Europe on the road to a truly sustainable energy future in its upcoming proposal for a Renewable Energy Roadmap. The Parliament's call will hopefully not be overheard by President Barroso" Schäfer added.

The European renewable energy industries call on the European Commission to support the European Parliament's approach in its upcoming Renewable Energy Roadmap. Anything else would threaten to dismantle the current, successful framework for renewables.

The EU should continue its successful approach of specific sectoral targets to avoid putting existing frameworks under threat and creating widespread investor uncertainty.

2006-12-14 Source: ESHA

reluctant. In the Indian-held Kashmir, recently twenty small hydro projects were commissioned at various selected sites by the UNDP. Baglihar and Kishan Ganga hydropower projects are in the stage of completion. The biggest problem is faced by our Northern Areas where the electricity demand is more than 100MW but total power generation from hydel power stations is a mere 46MW. To bridge the gap between demand and supply a diesel power plant with a total generation of 5MW has been commissioned by the government. Instead of tapping ingenious hydropower potential, the Ministry of Water and Power has decided to construct a 765-kv transmis-

sion line that is 794-km-long, to import 1000MW from Tajikistan via Afghanistan at a much higher rate. For self-reliance in energy and for eradicating poverty, hydropower is recognised as a renewable source which is economical, non-polluting and environmentally benign. In order to maintain a balance between hydropower and thermal power, the ministry should announce a policy to accelerate hydropower generation in the country. Development of small hydro projects at an accelerated pace should be one of the tasks set by the policy to meet the present power crisis. This is the only cost-effective solution to meet the increasing electricity demand. Success here is possible

only if public-sector funding is made available by the government. The financing of such projects remains a problem for funds from international donors for such projects are difficult to get, considering their commitment to facilitate investments in private thermal-based power plants. Instead of trying to imitate and compete with India in nuclear energy, we should consider the way countries like Laos, Thailand and China have developed small hydropower projects for development and economic prosperity.

*The writer is a visiting research fellow at the Sustainable Development Policy Institute in Islamabad.*

2006-9-27 Source: IEA international small- hydro atlas

## Small Hydropower Development in Ghana

Bayor Jude Simons & Darko Sylvester

### Introduction

The Power Sector in Ghana is vested in the Ministry of Energy which sets out the policy and guidelines for power generation, transmission and distribution for the sector.

The Volta River Authority (VRA), is the state-owned public power generation and transmission authority in Ghana. The VRA owns and operates the 1020 MW Akosombo hydropower plant, Ghana's icon symbol of progress and development, and holds it in trust for the people of Ghana. It is responsible for ensuring the integrity of the Volta dam, one of the largest man-made lakes in the world, and stands sentry in respect of all activities in the Volta River Basin. Besides Akosombo hydro plant, the Authority owns and operates a second 160MW hydro generating station at Kpong, downstream of Akosombo.

The VRA also has a 330MW combined cycle thermal plant at Aboadze and has joint venture ownership of a second 220MW open-cycled thermal plant at the same site and was later topped up with a further 110 MW. VRA also has a subsidiary called Northern Electricity Department (NED) since 1987 which distributes power to the northern sector of Ghana.

The Electricity Company of Ghana (ECG) is also a state-owned private company which is the premier national distributor and retailer of electric power. It currently operates in the six southern regions of Ghana. It sells power to bulk customers, the mines and other industrial entities.

Ghana's electric power market consists of wholesale (deregulated) and retail (regulated) sections. The

VRA dominates the wholesale market, sells power to the ECG and export power to Ghana's neighbors-Togo, Benin and Burkina Faso.

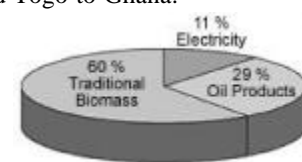
With a customer population of about 1,500,000, demand of power has grown to outwit supply resulting in overloaded network coupled with obsolete plants which makes power delivery very difficult. The load on the distribution infrastructure has grown at about 10% a year, but there had not been adequate investment and expansion of the distribution infrastructure to match the growth in load. Before 1996, utilities in Ghana were faced with low tariff regime (average End User Tariff (AEUT) 4-5 US cents, high domestic demand growth (10%), no reserve margin in generation, overloaded and aged distribution networks, and lack of investment capital. Facing these challenges, Ghana initiated, adopted and formulated a policy in the Power Sector in 1996 with dual objectives of creating the necessary enabling environment for the efficient and transparent generation, transmission and distribution of electricity as a business in Ghana as well as encouraging

private sector participation.

### Energy in Ghana

In the year 2000, it was estimated that electricity accounted for about 11 % of the total energy consumed. Ghana's electricity supply is mainly obtained from hydro and thermal sources. Ghana also relies on some level of imports from neighbouring La Cote d'Ivoire to supplement domestic supply especially during peak hours.

The electricity supply mix in the country is expected to change by the year 2010 from the largely hydro-based system to a largely thermal-based one relying on natural gas as the main source of fuel. This transition would be made possible by the West African Gas Pipeline Project, which is expected to transport natural gas from Nigeria through Benin and Togo to Ghana.



Composition of Fuels in Final Energy Consumption, 2000

### Installed electricity generation capacity and electricity generation in 2004

	Installed capacity in MW (1)	Electricity generation in GWh (2)
Akosombo Hydroelectric Power Plant	1038	4404
Kpong Hydroelectric Power Plant	160	876
TAPCO Thermal Power Plant TAPCO = Takoradi Power Company	330	536
TICO Thermal Power Plant TICO = Takoradi International Comp.	220	222
<b>Total</b>	<b>1748</b>	<b>6038</b>

Sources: 1: Guide to Electric Power in Ghana, 1st Edition, University of Ghana, Legon, 2005. 2: VRA 2005.



The current national access to electricity supply is about 43 % of the population. However, over 80 % of the domestic electricity supply is consumed in the cities and urban towns.

Hydropower and imported fossil fuel are the main energy sources used to generate electricity in the country. See figures Total Electricity Generation 1990-2004 and Percentage Shares of Hydro and Thermal Generation 2000-2004.

There is also the potential for electricity generation from renewable energy sources such as solar, wind, biomass and small hydro. These sources however have not yet been exploited to any significant degree for electricity generation.

There are over 4,000 off-grid photovoltaic (PV) systems installed nationwide as at 2001 with a total capacity is about 1 MW.

### Resources for SHP Planning

Ghana is drained by three main surface water systems; the volta, south western and coastal river systems. These three water systems cover 70%, 22% and 8% percent respectively of the total land area of the country. There is also the Lake Bosumtwi, a meteoritic Lake with a depth of 78m that is located in the Forest Zone covering a land area of 49 km<sup>2</sup>.

These three water systems are made up of 16 river basins which has spread along the length and breadth of the country.

The Volta System is made up of the Black, White and the Lower Volta River Basins, the Daka and Oti River Basins.

The Black Volta Basin has a catchment area of 149,015 km<sup>2</sup> and

**Table 1.1 Hydropower capacities in Ghana**

NAME OF STATION	CAPACITY(MW)	REMARKS
AKOSOMBO	1020	In OPERATION
KPONG	160	In OPERATION
PWALUGU	50	PROPOSED
KOULBI	68	PROPOSED
DABOYA	43	PROPOSED
NTERESO	64	PROPOSED
LANKA	95	PROPOSED
JAMBITE	55	PROPOSED
ASUASO	25	PROPOSED
SODUKROM	17	PROPOSED
JOMORO	20	PROPOSED
AWISAM	50	PROPOSED
KOJOKROM	30	PROPOSED
HEMANG	75	PROPOSED
ABETIMASU	50	PROPOSED
JUALE	90	PROPOSED
BUI	400	PROPOSED

has 35,107 km<sup>2</sup> in Ghana and the remaining 113,908 km<sup>2</sup> outside the country.

The White Volta Basin has a catchment area of 104,752 km<sup>2</sup> with 45,804 km<sup>2</sup> within Ghana and the remaining 58,948 km<sup>2</sup> outside the country.

The main Volta Basin consisting of the Daka and the Lower Volta cover 9174 km<sup>2</sup> and 62,651 km<sup>2</sup> respectively with all the land area of Daka located in Ghana and 59,414Sq of the Lower Volta within Ghana and 3,327 km<sup>2</sup> outside Ghana.

The Oti Basin has a total land area of 72,778 km<sup>2</sup> with 16,213 km<sup>2</sup> within Ghana and the remaining 56,565Sq km outside the country.

The Southwestern System comprises the Bia, Tano, Ankobra and the Pra River Basins. The Bia River Basin has a total area of 10,135 km<sup>2</sup> with 6965 km<sup>2</sup> in Ghana and 3170 km<sup>2</sup> outside the country.

The Ankobra River Basin has a land area of 8461 km<sup>2</sup>, all of which is in Ghana.

The Pra River Basin has all its 23188 km<sup>2</sup> land area in the country.

The Tano River Basin has 14872 km<sup>2</sup> out of its 16074 km<sup>2</sup> land area within Ghana and the remaining 1202 km<sup>2</sup> outside the country.

Finally, the Coastal System is made up of Todzie/Aka with land area of 1865 km<sup>2</sup> within Ghana and 363 km<sup>2</sup> outside the country, Densu has 2551 km<sup>2</sup> all in Ghana, Ayensu has 1709 km<sup>2</sup> all in Ghana, Butre has 466 km<sup>2</sup> in Ghana, Kakum has 984 km<sup>2</sup> in Ghana, Ochi-Amissa has 1638 km<sup>2</sup> in Ghana and Ochi-Nakwa River Basin has 1502 km<sup>2</sup>.

So far two Hydropower Stations have been developed and are operational in Ghana. A further 15 Potential Hydropower Sites have been located for development in the near future. Below is a table (1.1) showing the Hydropower capacities of the various sites in Ghana.

### Requirements for Technical Cooperation and Capital Assistance

A Ministry responsible for Regional Integration and Cooperation has been established to fast track Ghana's role in ensuring sub-regional and Regional Integration of socio-economic issues. The country has liberalized its economy and

practice free market economy.

Ghana government recognizes the private sector as the engine for the development of the economy and has accordingly hived off a substantial portion of government's activities to the private sectors. Most state owned enterprises have been divested. While the country is encouraging private sector investment. Government is creating an enabling environment for the private sector to acquire and use environmentally sound technologies through international cooperation. This is regulatory and enforced.

Hence the private sector investment in Small Hydropower is in the right direction.

Areas of urgent cooperation in the Hydropower sector will be on the development of the 15 proposed hydropower sites. This will involve private sector investment in the feasibility studied, design, construction and operation of Small hydropower plants in Ghana.

### Incentive Policies

To accomplish this target,

power sector reform committee was set up which proposed a four-point action plan to:

- Introduce a new legislation to establish a four-tier regulatory framework which will set "rules of practice and "standards of performance" covering all aspects of power sector operation
- introduce competition in wholesale power supply transaction with "open access" transmission services to facilitate competition in the supply of power to large customer and distribution utilities
- re-organize the existing state-owned utilities into "Strategies Business Units, "improve management accountability to corporate boards of directors, and also re-capitalize the power utilities through public-private partnership and joint ventures
- introduce specific guidelines and procedures to ensure transparency in the setting of tariff for the power sector

From the action plan, Parliament enacted two laws for establishment of two regulatory institutions, namely, Public Utilities

Regulatory Commission (PURC) and the Energy Commission (EC) through Act 538 and 541 respectively. The PURC is concerned with the economies of utilities and tariffs. It is an independent body tasked among others to:

- To provide guidelines on rate chargeable for provision of utility services.
- To examine and approve rates chargeable for provision of Utility Services
- To protect the interest of customers and providers of utility services
- To initiate and conduct investigations into standard of quality of services given to consumers
- To promote fair competition among public utilities

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## International Conference on Hydropower Held in Kunming

2006 International Conference on Hydropower was held from Oct. 23rd to 25th in Kunming, China. More than 300 experts and delegates from more than 20 countries attended the conference.

The representatives from home and abroad have conducted in-depth communications and discussions on relevant tech-



nical issues in the field of damming engineering. The Conference mainly covers four themes: issues

of design and construction of high arch dams; dam safety evaluation and reinforcement techniques; dam and environment (including the setup of fishway, environmental friendly damming techniques and dam regulation with environmental consideration); reservoir sedimentation and downstream river erosion.

*Source: MWR*

## Small Hydropower Development in Zimbabwe

Tobias Mudzingwa

Zimbabwe has significant small hydropower potential, particularly in the eastern highlands, along the border with Mozambique. A UNDP sponsored study conducted in 1996 identified 12 potential hydro sites on irrigation dams, and a further 32 run-of-river sites.

To date, the development of mini and small hydro power stations in the country has been very slow. This has been the case primarily because of:

- The tariff structure has not been sufficiently attractive to encourage private sector participation.
- There has not been adequate funding for small hydro projects
- The energy sector was not, until very recently, fully deregulated to

allow investor participation

A number of small hydro stations are under construction, for example Tsatse (20kW), Nyamarimbira (25kW) and Aberfoyle (350kW).

### POLICY ISSUES

- All new dams are constructed with a provision for a hydro power station to be built. Examples of new dams under construction are Tokwe-Mukosi and Gwaai-Shangani dams.
- Rural electrification act of 2002 has provision for renewable energies, including small hydro, to be used as stand-alone grid extension technologies.

- The electricity act of 2002 allows the entry of IPPs into the power market. The energy sector has been fully deregulated to allow private sector investors.
- The tariff structure is being seriously reviewed to make it attractive for private investors and IPPs to invest in the small hydro sector.

### CONCLUSION

The development of small hydro sector in Zimbabwe looks promising, especially considering that the government, through the ministry of Energy has deregulated the sector to allow private investment in power generation. There is a scope to develop more than 50 small hydro stations in Zimbabwe within the next 10 years, funds and other resources permitting. Small hydropower development will go a long way in alleviating critical power shortages currently prevailing in the country.

However there has been a few small hydro projects successfully implemented in Zimbabwe over the last decade, notably:

Name	Capacity(KW)	Grid connection	Location	Ownership
Nyafaru	35	Stand-alone	Nyanga	community
Rusitu	750	connected	Chipinge	Company(IPP)
Svinural	15	Stand-alone	Cashel valley	community
Claremont	450	Stand-alone	Mutare	community

After successful feasibility studies, the following potential small hydropower sites have been identified and they have since been prioritized for investment:

Site	Capacity (MW)	Annual energy production (GWh)	Economic Tariff(US cents/kWh)	Installation Cost(Millions US\$)	Installation Period (years)
Mutirikwi	5	23-40	3	3	1.5
Siya	0.9	4.6-5.6	4	1	1
Osborne	3	13.4-23.6	3	2	1.5
Galrez	25-30	70	3.3	25	2.5
Tsanga	3.0-3.3	8.8	4	2.1	1.5
Duru	2.0-2.3	6.0	4	1.8	1.5
Manyuchi	1.4	-	3	1.6	1.5

*Tobias Mudzingwa is an energy development officer, works in the Ministry of Energy and Power Development, Zimbabwe, E-mail: tobiasmudz@yahoo.com*

# Development of Hydropower In Myanmar

Min Khaing

## Abstract

Water is the source of life and electricity is the symbol of modern civilization. The topography combined with heavy rainfall from the South-West monsoon endows the country with abundant hydropower resources. In the last two-decades, country's power supply system mainly depends on a number of gas turbine and combined cycle power plants, which requires relatively shorter implementation time and lower investment cost.

Presently, on-shore natural gas available for domestic utilization become insufficient and so power generation from gas turbine and combined cycle power plants gradually declined and become power shortage in the country.

In order to overcome the present insufficient power supply situation and to meet the future power demand, the Ministry of Electric Power had developed many hydropower stations throughout the country.

Since 1988, (28) Nos. of small and medium size hydropower stations were put into operation. At present, about 16 Nos. of medium to large-scale hydropower projects are in various stages of implementation and several more are under planning.

This report describes the status of the projects under implementation and in planning.

## 1.Introduction

Myanmar, with a total land area of 264,300 square miles and a popula-

tion of 54 million, has four rivers and three mountain ranges. The four rivers are the Ayeyawaddy, the Chindwin, the Sittaung and the Thanlwin. The three mountain ranges are Rakhine Yoma, Bago Yoma and Shan plateau.

Four rivers are meandering between these ranges and finally discharge into the Gulf of Mottama dividing the whole country into four topographic regions: the Western Coastal area, Western Hills region, the Central Valley regions and the Eastern Hills region.

There are some tributaries originated in the western hills region and southern part of the country which constitutes around 10% in terms of catchment area and surface run-off. Hydropower potential of these tributaries also had a considerable amount.

The geographic and topographic conditions provide the country with relatively abundant natural water resources in hydropower amounting as high as 40,000 MW, and also impose challenges in the development of its infrastructures.

## 2.Hydropower Potential of Myanmar

### 2.1 Background

Since 1910, the electricity supply system through out the country had been operated by several private power companies, licensed under the country's 1910 Electricity Act. The total installed capacity was approximately 29 MW by 1950 and the largest company was the Rangoon Elec-

tric Tramway and Supply Company (RET&S) which served Yangon with an installed capacity of 16MW.

The Government formed the Electricity Supply Board (ESB) in 1951, Electric Power Corporation (EPC) in March 1972 and Myanma Electric Power Enterprise (MEPE) in March 1989. MEPE is responsible for planning, design, construction, operation and maintenance of electricity supply facilities of Myanmar.

"Department of Hydroelectric Power (DHP)" was formed on January 24<sup>th</sup>, 2002 basically with the engineers and staffs of former Hydropower Development Branch of Myanma Electric Power Enterprise (MEPE) for planning, design and implementation of hydropower projects.

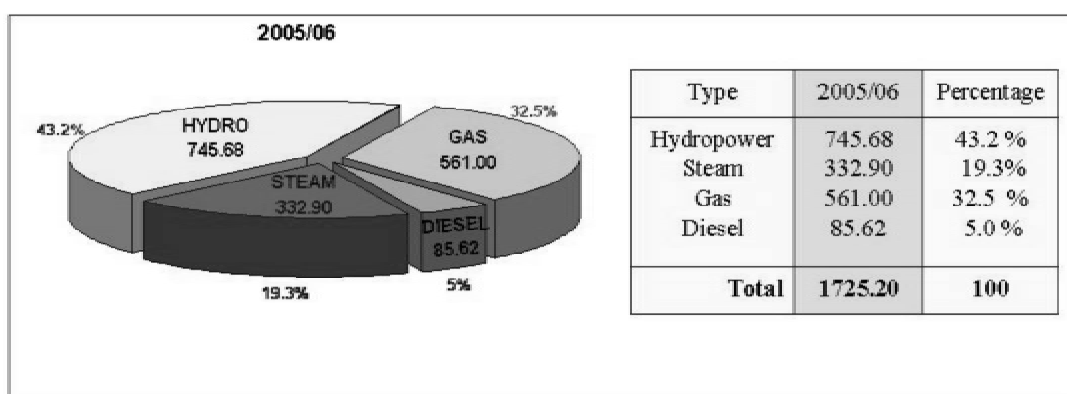
The Government formed Ministry of Electric Power No.1 and No.2 on May 2006. Ministry of Electric Power No.1 is composed of Department of Hydropower Implementation, Department of Hydropower Planning and Hydropower Generation Enterprise. The duties of MOEP (1) are mainly to investigate, construct and operate the hydropower stations all over the country.

### 2.2 Present Electricity Generation & Transmission

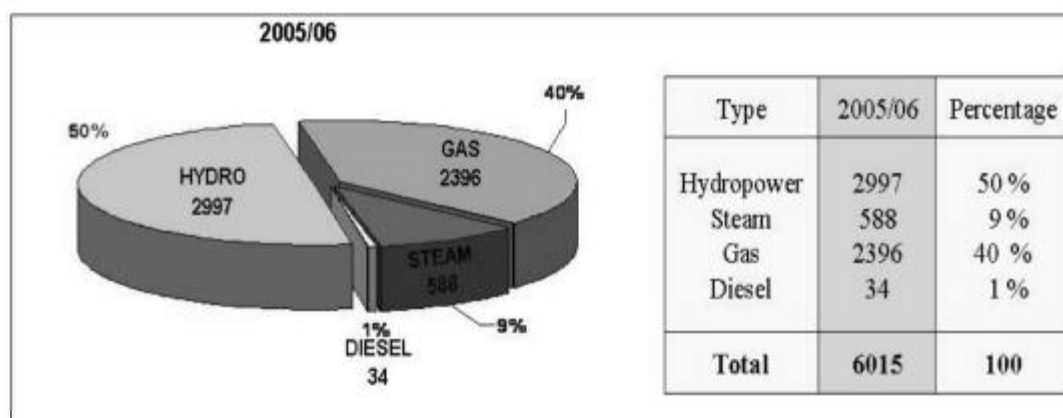
Present electricity generation is shown below. Generation shares by type are approximately 40% by hydropower and 60% by thermal power. The generated electricity were transmitted all over the country through interconnected system (National Grid).

Total Installed Capacity by type				
Installed Capacity	Grid System	Isolated	Total	Percentage
Hydroelectric	721.00	33.68	745.68	43.2%
Gas Turbine	550.10	10.98	561.00	32.5%
Steam Turbine	332.90	-	332.90	19.3%
Diesel	24.90	60.65	85.62	5%
<b>Total installed capacity</b>	<b>1619.97</b>	<b>105.23</b>	<b>1725.20</b>	<b>100%</b>

**Installed Capacity by type of power stations . (MW)**



**Annual Generation by type of power stations . (GWh)**



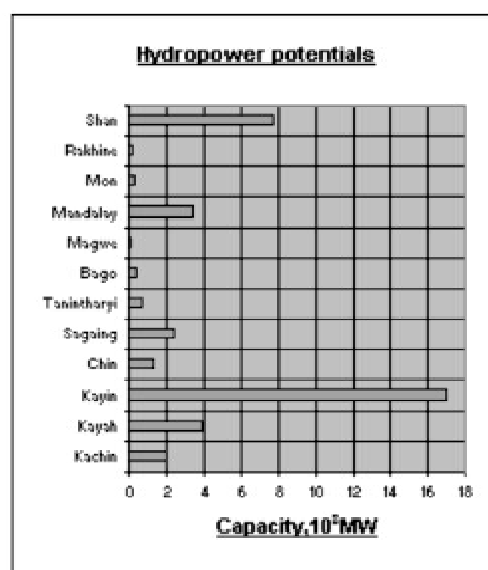
### 2.3 Hydropower Resources

According to the preliminary studies, the total hydropower resources of Myanmar identified to date is about 40,000 MW, of which about

25,000 MW is of large scale and the remaining is of medium & small scale projects. In addition to large scale hydropower sites, mini and micro hydropower sites are formulated to ful-

fill the local electricity requirement of remote area. Regional hydropower potentials are graphically presented in Fig.

State / Division	Places	Pontential (MW)
(1) Kachin	39	2061
(2) Kayah	7	3909
(3) Kayin	21	17021
(4) Chin	22	1312
(5) Sagaing	21	2399
(6) Tanintharyi	14	692
(7) Bago	11	483
(8) Magwe	8	123
(9) Mandalay	17	3482
(10) Mon	10	292
(11) Rakhine	14	247
(12) Shan	83	7699
<b>Total</b>	<b>267</b>	<b>39720</b>



## 2.4 Completion Status of Hydropower at 2006

Since hydropower project require significant lead time for field investigations, planning, design and implementation, Myanmar was rather reluctant to implement in the past.

The Classification of hydropower project in regard to their size, has generally been referred to a large, medium and small hydropower plant.

### 2.4.1 Completion Status of Small Hydropower

In area of supply outside the Grid System, the sources of electricity are mostly small hydropower stations. Majority of these are operated as isolated rural electrification stations and only a few operate as a central station distributing to neighboring towns and village. Potential of small hydropower is 2.05% of total electricity supply in Myanmar.

At present, 32 small hydropower stations were in operation to fulfill local and regional electricity requirement.

Generations of those power stations are summarized as follows:

Sr. No	Name of Power Station	Location	Installed Capacity	Completion Year
1	Za Lui	Chin State	400 kW	1984
2	Daung Va	Chin State	400 kW	1984
3	Zin Kyeik	Mon State	198 kW	1984
4	Nga Seik Va	Chin State	1 MW	1986
5	Putao	Kachin State	160 kW	1987
6	Hpa-pon	Kayin State	62 kW	1987
7	Tat Gyi	Shan State	1.2 MW	1987
8	Hpa = zaung	Kayar State	108 kW	1988
9	Namkhang	Shan State	200 kW	1988
10	Muse	Shan State	225 kW	1988
11	Paletwa	Chin State	50 kW	1988
12	Kattalu	Thanintharyi State	150 kW	1991
13	Galaing Chaung	Kachin State	1260 kW	1991
14	Mogoke	Mandalay State	4 MW	1989
15	Namshang Chaung	Shan State	150 kW	1991
16	Namlup Chaung	Shan State	495 kW	1991
17	Pakyethaw	Shan State	200 kW	1995
18	Yedagon Chaung	Thanintharyi State	192 kW	1992
19	Namlaung Chaung	Chin State	200 kW	1992
20	Kenghrankha	Kachin State	2520 kW	1993
21	Laiva	Chin State	600 kW	1994
22	Nammyaw	Shan State	4 MW	1994
23	Namwop	Shan State	3 MW	1994
Sr. No	Name of Power Station	Location	Installed Capacity	Completion Year
24	Namsaung Ngaung	Shan State	4 MW	1996
25	Namkhankha	Kachin State	5 MW	1992
26	Hiwee Saung	Chin State	200 kW	1993
27	Che Chaung	Chin State	200 kW	1994
28	Zi Chaung	Sagaing State	1.26 MW	1996
29	Wetwun	Mandalay State	450 kW	1993
30	Pachethaw	Shan State	100 kW	1992
31	Namsaung Chaung	Shan State	500 kW	1996
32	Mepan	Shan State	1200 kW	1995

#### 2.4.2 Completion Status of Medium Hydropower

Hydropower stations are continuously in operation as base load stations taking major share of the system peak demand. Generations of 10 hydropower stations are summarized as follows.

Sr. No	Power Station	Installed Capacity (MW)	Completion Year
1	Baluchaung (2)	168	1960
2	Baluchaung (1)	28	1992
3	Sedawgyi	25	1989
4	Kinda	56	1985
5	Zawgyi (1)	18	1995
6	Zawgyi (2)	12	1994
7	Zaungtu	20	1994
8	Thaphenzeik	30	1996
9	Monechaung	75	2004
10	Paunglaung	280	2004
Total Capacity		712 MW	

#### 2.5 Status of 16 On-going Hydropower Projects

The following 16 hydropower projects were under various stages of implementation at 2006, consisting of 9 projects between 20 to 100 MW ; 3 projects between 100 to 400 MW, 2 project between 600 to 800 MW and 1 project above 800MW. Among these projects, Yenwe Project was planned to be completed by 2006.

Installed capacity of these on-going hydropower projects were summarized in below. Some of which were implemented by Ministry of Electric Power No. (1) only and some of which were implemented in co-operation with other governmental organization to meet

the planned completion date.

### 3. Future Plan

#### 3.1 Plan for Small Hydropower

To fulfill the electricity demand for the rural and urban re-

ing the domestic requirement, MOEP (1) planned to implement many medium and large scale hydropower. Localized electricity grids were also planned for the respective transmission and distribution system to satisfy ever increasing regional electricity demand all over the country. Reconnaissance & preliminary survey had been started for some projects and the planning works are being carried out for all projects.

### 4. Conclusion

In order to meet the political, economic and social objectives of the country, electricity is an infrastructure much needed for industrial growth as well as for progress of economy, education, health, productivity and social sectors. With the country becoming more and more modernized and developed, the demand for electricity will be on the rise. To meet the growing demand for electricity, concerted efforts should be made to implement hydropower projects, both large and small, as well as thermal power station projects in a balanced proportion.

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gions of the country, 185 small hydropower projects were also planned to be implemented. Map study had finished for all the projects and reconnaissance & preliminary survey works are being carried out for some of these projects.

#### 3.2 Plan for Medium and Large Scale Hydropower

To fulfill the electricity demand for the industries of the country with cheap, reliable and sustainable form of energy, hydropower is the only alternative to be considered at this moment when the price of oil is at its highest.

With an objective to export the surplus electricity after fulfill-