PEREZ-GUERRERO TRUST FUND Project

ACCELERATION OF SMALL HYDRO POWER DEVELOPMENT AND CARBON FINANCING IN AFRICAN AND ASIAN COUNTRIES

FINAL REPORT

Submitted by

International Center on Small Hydro Power

136 Nanshan Road 136

Ⅰ. Project Overview

1. **Project Title:** Acceleration of Small Hydro Power (SHP) Development and Carbon Financing in African and Asian Countries
2. **Abstract:** This project is designed to accelerate SHP construction in Africa and extending hydro CDM practice in both Africa and Asia by providing SHP technical assistances and CDM capacity building. Ultimately, SHP promotion in the two continents will be further facilitated by replicating this project across continents.
3. **Background Analysis:** Small Hydro Power (SHP) is a proven, clean, environmentally sound form of energy which provides solutions to rural electrification and promotes poverty-alleviation in remote rural areas. By supplying the vast majority of affordable and adequate electricity to rural areas particularly in developing countries, SHP leads to poverty alleviation, economic development, increase of employment opportunities and improvement of local living standards with minimal impact on the ecological environment given appropriate management. Due to the advantages of SHP, governments across the world are refocusing on this renewable energy for sustainable development particularly in light of the energy crisis and concerns over environmental pollution. Even in developing countries, SHP is supported by governments as a priority due to its low cost and economy compared with other sources of renewable energy such as solar and wind.

   Africa is endowed with a wide range of renewable sources of energy, yet the contribution of electricity generation from modern renewable sources is still relatively small. Although it is one of the most abundant resources, only 7% of the continent's hydropower potential has been exploited so far. The livelihood of Africans continues to be critically impaired by energy poverty, seriously slowing down socioeconomic development of the continent. Lack of expertise, technology and funding is the core issue for SHP development in Africa. Similarly, Asia is also a continent endowed with abundant hydro resources. Compared with Africa, SHP development in Asia is much more progressive with approximately 22% of the hydropower potential exploited. However, SHP development in particular Asian countries is still encountering the same issues of lack of expertise and funding.

   In addition to lack of technical expertise, financing is a key obstacle that impedes development of SHP particularly in most African and some Asian countries with poor economics. The Clean Development Mechanism (CDM) provides an innovative and attractive approach for carbon financing of SHP project. By selling the certified emission reduction (CER) credits which are earned by an SHP project, funds are guaranteed for making the project financially viable and allowing construction of more SHP projects that will produce more CERs for financing. Through this circle, SHP can theoretically become well developed.

However, the number of registered or proposed CDM projects in Africa remains small. In 2004, only two countries across the entire continent were accessing the CDM—Morocco and South Africa. As of 2010, a large range of African countries now have projects up and running or in the pipeline but Africa still only accounts for 2% of all CDM projects. Furthermore, the least developed countries such as Sierra Leone have none and in general across Africa there are very few SHP-related CDM projects. In Asia, China and India are the leading countries in CDM project development, accounting for 36% and 24% respectively of all registered CDM projects, but other Asian countries such as Thailand have seen much less activities. The energy sector accounts for 60% of all registered CDM projects globally.

It is concluded that there is great potential for development of SHP projects in Africa and Asia with associated poverty alleviation benefits, but without technical support and knowledge of how to overcome financial barriers this potentials is not yet being realized. Technical assistance in SHP and hydro CDM projects from the international community are essential to stimulate the market.

Ⅱ. Implementation

For implementation, the project can be divided into four distinct stages; only the first three stages are relevant to this current project report, with the remaining stage representing ongoing strategies into the future for replicating the system nationwide in the target countries and continents.

- **The first stage** involves extensive survey and site reconnaissance in Africa and Asia. Information on the current extent of SHP development in the target continents and emerging trends will be collected by IC-SHP and its sub-centers.
- **The second stage** will involve selection of 1 or 2 target countries both in Africa and Asia respectively for demonstration. In the targeted African countries, IC-SHP will emphasize technical support for SHP construction. In the Asian countries, hydro CDM studies will be the priority. Preliminarily, Zambia and Sierra Leone have been selected as target countries. IC-SHP will help construct one SHP station in each under collaboration with local counterparts. In Asia, Thailand will be the target country in which IC-SHP plans to carry out hydro CDM studies and assist one local project to make use of the CDM with cooperation from the Vietnamese authorities.
- **The third stage** is to provide training workshops for African and Asian countries on SHP promotion and hydro CDM practice. A seminar on small hydropower and sustainable development of rural communities for officials of developing countries will be organized by IC-SHP in China. In addition, a training workshop on hydro CDM practice is planned to be held in Thailand by IC-SHP and local counterparts.
- Although **the fourth stage** is not directly relevant to this current proposal, it represents ongoing strategies in the future for replicating the project in target

continents. IC-SHP will conduct in kind consulting activities on SHP and hydro CDM practice in Africa and Asia.

Beneficiaries:

1. African and Asian countries involved SHP and CDM will be accelerated through promotion by learning, including how the CDM can benefit SHP.
2. Zambia and Sierra Leone

Construction of one SHP station in each country will be supported with technical assistance provided by IC-SHP.

3. Vietnam and Thailand

Successful experiences with the CDM will be shared and one selected local project will be guided by IC-SHP to make use of the CDM.

Ⅲ. Completed activities

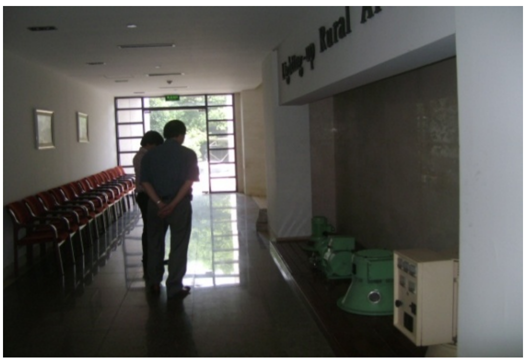
Activity-1

Time：July 2011

Location：Hangzhou，Zhejiang Province of China

Implementation: two experts from Vietnam were invited to visit IC-SHP, learning CDM policies and successful experience of China. CDM officials of IC-SHP shared typical CDM practices of China, which presented a development direction for Vietnam. Finally, we reached an agreement to hold a training workshop on hydro CDM for Vietnam

Participants: IC-SHP and IHR of Vietnam.


Activity-2

Time: July-September 2011

Location: Sierra Leone, Liberia and Zambia

Implementation: reconnaissance visits and site surveys on local SHP stations as well as questionnaire survey for local SHP information were conducted by IC-SHP. General SHP development information including technologies and financing conditions of Africa were collected.

Participants: IC-SHP and local partners in Sierra Leone, Liberia and Zambia





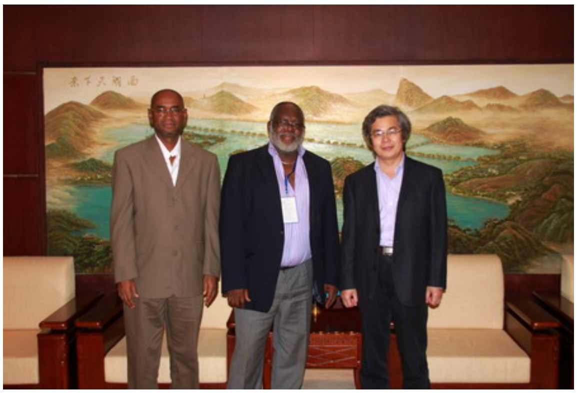
Activity-3

Time: November 2011

Location: Hangzhou, Zhejiang province of China

Implementation: Mr. Davidson, Sierra Leone Minister of Energy and Water Resource was invited to visit ICSHP on 4th November 2011, discussing the technical and financing issues for three SHP projects of Sierra Leone in the preliminary work and hoping to promote them into construction stage as soon as possible.

Participants: IC-SHP and MEWR of Sierra Leone.



Activity-4

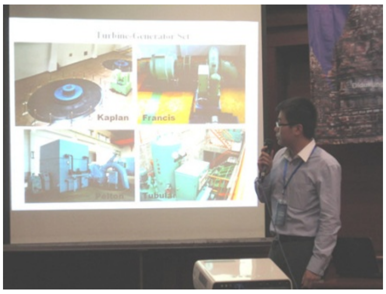
Time: December 2011

Location: Indonesia

Implementation: participating scientific and technical exhibition held by China and Indonesia to present advanced technologies of China on SHP for local enterprises, which will be benefit for forthcoming technical cooperation with Asian countries. Initial intent letters have been signed between local partners and manufacturers of China for future technical exchange and cooperation.

Participants: IC-SHP, MOST of China and local partners of Indonesia.







Activity-5

Time: March 2012

Location: Thailand

Implementation: IC-SHP successfully held a training workshop on hydro CDM practice on the Asia 2012 in Thailand. IC-SHP CDM experts and invited carbon financing experts gave a two-days training that attracted 20 experts from Bhutan, Cambodia, India, Indonesia, Thailand, Vietnam and so on. The courses and lectures mainly included introduction of China CDM experience and current status, initial preparation for CDM application, process for CDM projects developing, development modes and financing opportunities for hydropower CDM projects, impacts of Durban conference on future carbon market and international negotiation and new rules for CDM and main challenges for CDM development.

Participants: IC-SHP, Vietnam and Thailand

Activity-6
Time: March-April 2012
Location: Zambia and Sierra Leone
Implementation: site survey and topographic survey were conducted. One station of each country was selected for feasibility study report and design report compilation.
Participant: ICSHP and local partners of Zambia and Sierra Leone.

Activity-7
Time: April-May 2012
Location: Hangzhou, China
Implementation: as the stations in Zambia and Sierra Leone were selected, feasibility study report and design report were compiled during this period. Some SHP construction experts were invited to give guide suggestions for the reports and the implementation of following-up activities.
Participants: IC-SHP and local partners of Zambia and Sierra Leone.

Activity-8
Time: May 2012
Location: Hangzhou, China
Implementation: a seminar on SHP development and hydro CDM practice was held to

strengthen technical communication and cooperation. 21 experts from China, Congo, India, Liberia and so on were invited to attend the seminar on SHP promotion and the study tour for SHP case survey in China. This event is a unique and significant one as it brings together experts from the academic, public and the private sectors as well as decision makers from the government to discuss and share experiences on how best to integrate the abundant SHP energy resources in Africa and Asia into the various nations' energy supply mix, especially for rural electricity generation.

Participants: IC-SHP and representatives of Asian and African countries



Ⅳ. Activities costs

Activities costs of this project were strictly based on the financial budget. IC-SHP referred specialized accountants to manage the economic evaluation and review for this project. Project leaders were also responsible for monitoring of cost for each activities regarding to the project and required for submission of periodical report to the Director General of IC-SHP for processing and stage of the project. Details are shown below:

No.	Items	PGTF Fund	ICSHP Fund	Total
1	International travel	16,000 USD	25,000 USD	41,000 USD
2	International consultants	8,500 USD	8,000 USD	16,500 USD
3	Training workshop	267 USD	12,000 USD	12,267 USD
4	Seminar	7,400 USD	2,500 USD	9,900USD
5	Domestic travels	280 USD	1,500 USD	1,780 USD
6	Unpaid PGTF Fund	3600USD	0	3600 USD
	Total	36,047 USD	49,000 USD	85,047 USD

Ⅴ. Project management arrangements

The project is implemented by the International Center on Small Hydropower (IC-SHP). IC-SHP has appointed a project coordinator. All project staff is appointed by IC-SHP with UNDP contracts. IC-SHP is responsible for producing and submitting a report to the UNDP China Office following allocation of 90% of the budget resources. The IC-SHP Director General (DG) bears the ultimate responsibility for overall management of the project.

IC-SHP has executed the project under UNDP National Execution modality (NEX). As executing agent for the project, IC-SHP is responsible for the reporting and financial requirement foreseen under the UNDP's national execution procedures and guidelines.

Progress monitoring is mastered by the China International Center for Economic and Technical Exchange, Ministry of Commerce. However, any staff from the UNDP or Perez-Guerrero Trust Fund undertakes monitoring activities in line with managerial roles above. All lessons learned will be written into a report after the project has been implemented.

Ⅵ. Appendix

Executive summary of feasibility study report and design report and the programs of the training workshop and seminar are shown following:

Appendix-1

Feasibility study report of Moyamba small hydropower plan (4×630KW) in Sierra Leone

<u>General Description</u>

Sierra Leone lies in west coast of Africa, with Guinea to the north and east, Liberia to the southeast, and a coastline on the Atlantic Ocean. Its land area is 72,300 km^2. It has a terracing landform, high in the east and low in the west. Most of the territory is mountains and plateaus. The Bintumani Mountain in the northeast, with an elevation of 1,945m, is the highest mountain. There are plains in the west, and swamps in its coastal areas.

Owing to a backward economic development, Sierra Leone is listed as one of the world's least developed countries by UN. The nation's economy is based on agriculture and mining. Long years of war caused enormous damage to the national economy and severe destruction to the infrastructure. The country's electricity industry lags behind, with a few diesel generators scattered only over the capital and towns.

The MOYAMBA hydropower plant is located in the South Province of Sierra Leone, which is 39km far away from the downtown of MOYAMBA District. (See the map of Sierra Leone)

<u>Power Supply Area</u>

MOYAMBA hydropower plant will mainly supplies electricity for the downtown of MOYAMBA District and NJALA University, These three places form a triangle shape, with a distance of 39km from the plant site to the downtown of MOYAMBA District and 30km to NJALA University. Now diesel generators with capacity of 500kW are used at NJALA University. There are about 50 villages around Moyamba plant. To meet the electricity demand of local residents, near-by Power Supply System is applied for the nearby villages, while Step-down Power Supply System with T-connecting mode for the others along the transmission line.

Industry

By now there are few Industrial projects in this region except some small repair shops. It has several shops, bars and some entertainment facilities. It is proposed to develop some industrial projects, such as the plants for food processing (fruits, vegetables, tapioca, rice milling, palm oil, etc.), fish cold storage, canned fish processing, mineral processing (rutile, bauxite), etc. The electricity shortage hinders local industry development. After the completion of this hydropower plant, some processing industries will get developed by making use of local natural resources, and thus local economic development will get promoted.

Agriculture-stock Production

Agriculture and animal husbandry are, such as the production of bananas, cassava, palm oil, etc. But the abundant natural resources are not well developed due to a low productive level. Local natural conditions are suitable for livestock industry. However, the lack of electricity and refrigeration equipment restricts the development of livestock industry. The completion of this hydropower plant will greatly enhance the development of local agriculture and animal husbandry.

Population

The Moyamba District has a population of 245,000, 35,000 people in central Moyamba, and 1700 students at NJALA University. Most local residents are self-employed in animal husbandry and agriculture. The rest are governmental employees or engaged in commercial and service activities. 80% of the local households use firewood for cooking, 18% use Charcoal; 2% use gas.

Infrastructure

The downtown of MOYAMBA District is 237km away from the capital Freetown. The highroad with asphalt pavement to the capital provides a better traffic condition. However, there is only a dirt road from the downtown of MOYAMBA District to the plant. Some road sections are of poor conditions, some need to be renovated and widened, and a new section will be built as entrance road.

Load

The downtown of Moyamba District and NJALA University are currently generating electricity by their own diesel generators. The electricity produced is mostly used for lighting, but less for industrial load, air-conditioning or household electrical appliances. Once the plant is built, the loads for industrial use and household electrical appliances will increase greatly. That means power load in this region is potentially big, but the current situation is that no electricity results in a low load; when electricity is supplied, the load will increase. As there are many villages around

Moyamba hydropower plant, after the completion of the plant, electricity will be supplied mainly for lighting.

Appendix-2

Design report of Shiwang’andu mini hydro project (2×500 KW) in Zambia

Introduction

Zambia is noted for the river of Zambezi which means big river in the ancient language of Africa. The country territory covers an area of 752,610 km^2, with a population of 10.1 million according to statistics in 1999. Zambia has 9 provinces with 68 counties. The 9 provinces include Luapula, Northern, Northwestern, Copperbelt, Central, Eastern, Western, Southern, and Lusaka.

The economy of Zambia relies mainly on mining. The copper deposit is about 900 million tons, accounting for 6% of world’s deposit. The initial estimate of the hydropower potential in Zambia is around 6765 MW, among which 1715 MW have been developed, amounting to 25.4%. The major hydropower resources are scattered in the canyons and waterfalls along the Zambezi river, with a capacity of 4860 MW, accounting for 72%. The rest of the hydropower resources are in Kafue river and Luapula river, with a capacity of 1832 MW, accounting for 27%.

There are 4 small hydropower stations already in operation in northeast part of Zambia, with total installed capacity of 24 MW. These SHP stations supply electricity to the grid.

Shiwang’andu station is located in Northern Province in north-east part of Zambia, 770 km from the capital, Lusaka. The geographical location of site is 31.7° E longitude and 11.2° S latitude, as illustrated in the following figure:

Natural Conditions

Zambia is located in the inland plateau in central Southern Africa. Altitude ranges between 1000m to 1500m for most of the region, sloping from Northeast to Southwest. The proposed site is located in the East African Great Rift Valley. The region falls into the tropical grassy climate, mild and cool, with annual average temperate between 18-20℃. One year composes of 3 seasons, namely dry and cool season from May to August with temperature between 14-32℃; dry and hot season from Sept to Oct with temperature from 26-32℃; and the warm and rainy season from Nov to Apr with temperature lower than the dry and cool season. Most of the rainfall in a year occurs during that season. The annual rainfall in the northern part is about 1400mm and gradually reduces towards the southern part to 700mm.

There is no any rain-gauge station near the site. However, there are rainfall records for MPIKA, more than 100km south to the project site. MPIKA has an altitude of 1402m, which is almost the same as that of Shiwang'andu. There are no mountains between two places, therefore, the two places can be generally considered in the same climate zone. MPIKA rain-gauge station has 38 years rainfall records from 1960 to 1998. The mean average rainfall is 1010mm. The rainfall ratio between wet year and dry year is 2.1. The dry season is from May to September. During that period, rainfall is little, accounting for only 0.25% of the total annual rainfall. 69.7% of the total annual rainfall concentrates in the period from December to February. The rainfall pattern has an uneven distribution throughout a year.

Shiwang'andu flow-gauge station has 27 year records on water flow from 1964 to 1991. The mean average flow is 9.54m^3/s. The flow is equally distributed in a year. The maximum monthly average is 16.42% of the total annual flow, and the minimum monthly average is 2.88% of the total annual flow. The runoff in the catchment area has a depth of 290mm.

Since there is no recorded data available for flood calculation, after analysis it is recommended that the maximum average flow per day within record is 27.5m^3/s, and the design flood is identified as 120m^3/s as per the report from ZESCO in June 2003.

<u>Project Task and Scale</u>

The original upstream river bed level is 1400m and 1402m for the normal water level after the diversion weir is built. The diversion system is placed on the left side, the power house is at the end of the river out flow, and the normal tail water level is 1388.5m. The gross head is13.5m and the net water head is 12.8m.

If the guaranteed ratio is 75%, the guaranteed flow is 5.5m^3/s, we have firm output N_g=563kW, when the design flow is10.2m^3/s, the installed capacity N=1000kW. The annual water available for electricity generation is 2.4×10^8 m^3 and the annual electricity output is 682×10^4kWh.

<u>Civil Works & Hydraulic Works</u>

The installed capacity of this project is less than 10000kW. According to the China’s classification, it belongs to rank V, small (Ⅱ) project. Both the major and related structures of the project rank V. The repeat period of design flood and check flood of permanent hydraulic structures is estimated to be p=5% and p=1% respectively. The repeat period of design flood and check flood of powerhouse is estimated to be p=5% and p=2% respectively. The temporary flood standard of dam construction period is estimated to be p=10%.

The project construction composes of weir site, sand cleaning gate, intake gate, canal, forebay, penstock, power house and switch yard. Considering the water flow features and the geological conditions at the dam site, the weir is located in the middle of the river; the dam axis is in the vertical line of the river main stream; the intake is placed on the right bank; the canal diverting water from the mountain in the left bank 120m to the forebay; the water is diverted through the penstock from the forbay to the powerhouse. The sand removing gates are located in the left side of the dam and the right side of the forebay. The sand removing gate at the forebay also functions as the sluice gate. The switchyard is located in the upstream side of the central control room.

Electro-Mechanical Equipment and Metal Structures

The turbine unit proposed for the project is an axial flow tubular turbine type: GDJ530-WZ-120 and the generator is SFW500-14/1430 (horizontal shaft). The YWT-1000 PLC hydraulic governor (an automatic air supply appliance included) is proposed with regulation capacity of 1000kg.m.

According to the existing grid scheme and to the requirement of the ZESCO, the hydropower station will adopt a primary loop of 33kV outlet (enlarged unit connection). One 1250kVA transformer will be equipped for the two units. The voltage of power supply within the station is 380/220V, and the power supply is from the 400V busbar of the generators.

The metal structure includes the dam intake gate and trash rack, the forebay intake gate and trash rack and the penstock. The proposed gates will be purchased and the trash rack will be fabricated on site.

Fire Protection System

The fire protection system proposed for the powerhouse will consist of the following:

a) fire detection alarm system
b) portable fire extinguishers

Construction Organizing and Planning

The main purpose of the project is power generation. Navigation and water supply are not considered. Since the project is to adopt a low weir to divert the water, the river will generally be kept almost unchanged and no significant impact will be made to the surrounding ecological environment. There are no residents around the proposed site. A simple access road will be built to facilitate the project construction activities.

The project belongs to the small (II) Class project, the main building is classified as Grade 5, and the temporary hydraulic building is Grade 5 also. As per the *Design Standard for Hydropower Engineering Project Construction*（SL 03-2004）, the flood standard is 5 years' repeat flood. However, due to the unavailability of historical flood records, it is unlikely to determine the flood discharge. So it is suggested that the project be conducted during the dry season, the existing 30m^3/s discharge is adopted for the weir design. Considering that the river bed around the dam site is relatively wide and the dam gravity is relatively low, the weir system will be conducted in two phases. The power house is along the river bank. Since the proposed elevation of the powerhouse is lower than the river bed elevation, it is necessary to construct a cofferdam around the powerhouse to ensure that the site will not be submerged.

The main part of project construction consists of dam, diversion canal, forebay,

penstock and powerhouse.
8 months are planned considering funds availability, construction quality, etc. (Preparation period excluded).

Environmental Protection
Shiwang'andu hydropower station is a small (Ⅱ) project mainly for electricity generation. The construction of this project will bring significant benefit to the local economic development.

Main environmental problems in construction: (1) Engineering waste; (2) Environmental impact; (3) Local people's health.

The project is located at a remote and uninhabited area; hence, the impact on the surrounding residents can be ignored. Yet, the river flow will have some impacts on residents downstream. The dam will cause about 2m water level increase in the upstream, yet the dam is low so the impacts are insignificant. Accordingly, necessary measures are required to protect the river. After the project is constructed, it will promote the local economic and social development.

Project Management
The project includes dam, diversion canal, intake forebay, penstock, power house, switch yard, etc. The project developer is ZESCO. ZESCO will be responsible for construction management of the project. The station staff size will be 20. The permanent housing facilities include meeting room, documents room, storehouse, staff dormitory, etc. For 30 m^2 per capita, total area is 600 m^2. The project's management area: 100 m extending along the dam axis from up and down stream and 100 m apart from each side of the dam, including management of cannel, penstock, road to powerhouse, powerhouse, booster station, transmission lines, facilities at production and residential areas. The management office takes an area of 0.667 hectare. The project's management mainly involves safety examination, operation, maintenance and operation of dam, diversion system, station structures and E&M equipments, as well as documents filing, etc.

Cost Estimates
This project is located on the Mansha River in the Northeast of Zambia, which is 770 km away from the Capital Lusaka. There are no residents nearby the project site, hence, emigration will not occur. The construction budget is estimated around USD 3,098,285, the basic reserve is USD309, 828 and the total project static investment is USD3, 408,113.

Appendix-3
Programs of training workshop on hydro CDM practice
Organizer: International Center on Small Hydropower
Location: Chiang Mai, Thailand

MONDAY 26 MARCH-Morning

10:30-12:00 Impacts of Durban conference on future carbon market
Hu, Ms. Xiaobo, Chief of Multilateral Development Division
ICSHP

12:30 *Lunch*

MONDAY 26 MARCH- Afternoon

14:30-16:00 Initial preparation for CDM application
Zhang, Ms. Yingnan, Program Officer of ICSHP
ICSHP

16:00 Coffee break

16:30-17:50 Process for CDM Projects Developing
Puhl, Mr. Ingo, Chief Growth Officer & Managing Partner
South Pole Carbon Asset Management

17:50 *First day training close*

TUESDAY 27 MARCH- Morning

09:00-10:30 Development modes and financing opportunities for hydropower CDM projects
Atem S. Ramsundersingh, CEO/Member Board of Directors
WEnergy Global PTE Ltd.

10:30 *Coffee break*

11:00-12:30 China CDM experience and current status
Wang, Ms.Xianlai, Program Officer of ICSHP
IC-SHP

12:30 *Lunch*

TUESDAY 27 MARCH- Afternoon

14:30-16:30 International negotiation and new rules for CDM and main challenges for CDM development
Butarbutar, Mr. Paul Patar Maruli, Country Director
South Pole Carbon Asset Management

16:30 *Coffee break*

17:00 Question & Discussion

17:50 *Training course close*

Appendix-4

Programs of seminar in Hangzhou, China

Day 1 (14th May, 2012)		
Time	Topic	
08:00 - 09:00	Registration	
09:00 - 10:30	Opening Ceremony Speeches of representatives of ICSHP and MWR	ICSHP, MWR
10:30 - 11:00	*Tea/Coffee break*	
11:00 - 12:00	Global Overview on SHP Project Development and Management	Prof. Liu Heng, Director-General of ICSHP
	Introduction of Lighting-up Rural Africa Program	
12:00 – 14:00	*Lunch*	
14:00 – 15:00	Carbon Finance for Small Hydro Projects Development	ICSHP
15:00 – 16:00	Risk Management of Hydro Investment	Prof. Liu Deshun, Tsinghua University
16:00 - 17:00	Discussion and Question	
Day 2 (15th May, 2012)		
09:00 – 10:00	Improve Hydro CDM Management and Promote a Sound Development for SHP	Mr. Tian Zhongxing, Director General of BRHED, MWR
10:00 – 11:00	SHP CDM Development and Practice in China	Prof. Liu Deyou, Managing Director of ICSHP
11:00 -11:30	*Team/Coffee Break*	
11:30 – 12:30	Current Status and Future of CDM Market	Prof. Lin Jian, CEO of Shanghai Environment Energy Exchange
12:30 – 14:00	*Lunch*	
14:00 – 15:00	Project Construction, Implementation and Management/New Technologies for Operation and Maintenance of	Prof. Tan Xiangqing, Senior Engineer of ICSHP

	SHP Plants	
15:00 – 16:00	New and Advanced Technologies in the Development of SHP Projects	Prof. Li Zhiwu, Senior Engineer of HRC
16:00 – 17:00	Discussion and Question	
Day 3 (16th May, 2012)		
All day	Study Tour to ICSHP Hydropower Equipment Manufacturing Base in Jinhua City, Zhejiang Province	
Day 4 , 5(17th – 18th 2012)		
All day	Study Tour to ICSHP Hydropower Base in Chenzhou City, Hunan Province	
16:00 – 16:30 (18th May)	Closing	ICSHP