PEREZ-GUERRERO TRUST FUND FOR ECONOMIC AND TECHNICAL COOPERATION AMONG DEVELOPING COUNTRIES

(G77 Project)

Final Report

on

Technical Seminar on Small Hydropower for ASEAN Countries

HANGZHOU REGIONAL CENTER (ASIA-PACIFIC) FOR SMALL HYDRO POWER

JANUARY 2015, HANGZHOU, CHINA

G77 PGTF Project Final Report

Introduction

The Group of 77 approved the project entitled "Technical Seminar on Small Hydropower for ASEAN Countries" for funding from Perez-Guerrero Trust Fund (PGTF)-Reference Number INT-13-K11 at the 36th Annual Meeting of Ministers for Foreign Affairs of the Group of 77, which was submitted by Hangzhou Regional Center (Asia-Pacific) for Small Hydro Power (hereinafter referred to as HRC). The duration of the project is 1 year, according to the original plan started on June 2013, and completed on June 2014. But later as the UNDP-signed Project Document had not been issued until Match of 2014 and the funding of the PGTF had not been allocated into implementing institution—HRC's account until June 12, 2014, the project duration was postponed until December 2014.

The Final Report included the project implementation activities and expenses and other related content.

I. Project Overview

1. **Project Title**: Technical Seminar on Small Hydropower for ASEAN Countries
2. **Abstract**: Most of the ASEAN (Association of Southeast Asian Nations) countries are now facing and constrained by the deficiency of electric power, and the local residents in remote regions are enduring blackout and darkness in their living environments. Small hydropower, as a proven and environmentally sound energy, presents one of the best approaches for addressing this problem. The project is designed to conduct a technical seminar with the objective to present the role of SHP in sustainable development of rural areas, as well as SHP planning, designing, equipment selection & completing and operating & administrative experience so as to improve SHP design, construction, and operation & management capability of the SHP technical and managerial personnel in ASEAN countries. The project will be very useful for the capacity building of the participants. After the Seminar, substantial cooperative projects will be planned and undertaken for those ASEAN member countries that mutually share water resources from the same river, and furthermore, the electric power can be marketed among various member countries etc. for balancing between power supply and demand in ASEAN region.
3. **Background Analysis**: Most of the ASEAN countries suffer from energy insufficiency. With the rapid development of economy, the shortage of electric power is getting more serious, and the power deficiency becomes a barrier for the further socio-economic development. Especially in remote, rural and hilly areas, the electrification rate is still low, which makes the local residents not accessible to power as a result of long-distance transmission and high power-tariff, thus finally restricting the local social and economic development. The underlying causes of the problem are mainly associated with the issue of technology. There is

lack of competent expertise for power sector in those ASEAN countries that are insufficient in electric power. The expertise not only includes the technology for project planning, design, consultation, R+D etc., but also includes the fine-of-the-art technology for equipment fabrication. For instance, there are few hydropower (including small and micro) professionals or equipment manufacturers in some ASEAN countries although there are rich in water resources and small or micro hydropower seems very suitable for the remote and disconnected areas. Even in some countries there is no certain definition about small or micro hydropower, either technical standard for its planning and designing etc.

In ASEAN countries, the problem is actually a regional issue, and most of the ASEAN countries are now facing and constrained by the deficiency of electric power, and the local residents in remote regions are enduring and complaining about the blackout and darkness in their living environments. Small hydropower (SHP), as a proven and environmentally sound energy, has been universally accepted by the international society and embraces obvious advantages of rich resources, proven technology, economic viability, easy dispatching and high return rate. By the end of 2013, China has constructed 46,879 SHP stations, with an installed capacity of 72GW and the annual power generation of 223 billion kWh, which accounts for 25.7% of the total installed capacity and 24.8% of the annual power generation of the country's hydropower stations. With the development of SHP and the construction of power grids, about half of the country's territory, one third of the counties and towns and a rural population of over 300 million people have access to electricity and the target of rural electrification has achieved. Thanks to small hydropower, so far, China has built up more than 1000 rural electrification counties. The electrification rate to household in rural hydropower supply areas has been raised from less than 40% in 1980 to 99.8% in 2013. The rural hydropower has made great contributions in increasing energy supply, improving energy structure, promoting local economy, bettering the rural production and living conditions, protecting the ecological environment, reducing the GHG emission, and guaranteeing the emergent power supply etc., thus achieving significant economic, social and environmental benefits.

Renewable small or micro hydropower is less risky in investment and lower in operation cost, and it can fully use the local manpower, materials and other natural resources for an integrated development & utilization (i.e. aquaculture, irrigation, tourism, flood control, recreational activity and water supply etc.), thus targeting remarkable economic benefit in rural areas. SHP-based rural electrification not only alleviates poverty and promotes economic growth, but also protects ecological environment, and accesses the remote regions with electric power. In general, it promotes local civilization, science & technology, and protects forests and improves local economy. Meanwhile, for the utilization of hydropower, increasing importance

is attached to the development of hybrid smart system of hydropower, solar energy and wind power, which not only optimizes PV power supply and wind power supply, but also improves the regulation capability of hydropower station to the power grid and the utilization rate of power transmission lines. A new era of renewable energy construction was also launched worldwide, which strongly requires to enhance the international exchange and cooperation, and China would like to spare no effort to make its contribution.

As the unique national research institute for rural hydropower and electrification in China, entrusted by Chinese Ministry of Commerce, HRC has hosted with success dozens of training workshops for Asian developing countries (including ASEAN member states), in order to disseminate SHP technology widely. Moreover, in July of 2014, an ASEAN cooperation project subsidized by China-ASEAN Cooperation Fund called "ASEAN-China Training Workshop on Small Hydropower and Solar Energy System for Rural Electrification" was concluded successfully, which promotes the establishment of a China-ASEAN cooperation platform in relevant areas. HRC has trained a large number of senior management personnel and professionals in the field of SHP and other renewable energy for ASEAN member countries. Meanwhile, with its technological advantages and industry influence, HRC has carried out a lot of bilateral and multilateral technical cooperation, joint research and demonstration projects, as well as the equipment trial-manufacturing and popularization, under the governmental cooperation framework. Gradually, good cooperative relationships have been built between HRC and many relevant departments of ASEAN member countries over the years, such as water conservancy, agriculture, energy, environment departments and so on.

II. Implementation

The project can be divided into four distinct stages; only the first three stages are relevant to this current project document, with the last stage representing ongoing strategies into the future.

Supporting and Partner Institutions:
★Indonesian Ministry of Energy and Mineral Resources
★ASEAN Secretariat
★Mission of China to ASEAN
★Indonesian State Electricity Company (PLN)
★ Indonesian PT PLN (Persero) Center for Electricity Maintenance (PLN PUSHARLIS)

• The first phase of the project involves the selection and compilation of training materials, allocation of lecturers and recruitment of participants from ASEAN Member States for the Seminar, as well as the collection of energy information of ASEAN countries.

•The second phase of the project involves the organization of the Technical Seminar on Small Hydropower for ASEAN Countries in Indonesia.

•The third phase of the project involves the signature of a Cooperative Initiative among HRC and participants and a MOU between HRC and Indonesian partner institution.

•The fourth phase of the project will involve substantial cooperation and promotion of potential projects on small hydropower and other renewable energies.

2. Benefits:

- an in-depth understanding of energy situation and facing problems of most ASEAN member states
- dissemination and sharing of experience, technology and research findings of China and ASEAN countries in relevant areas of renewable energy
- awareness of the great importance to develop SHP, wind, solar and other renewable energies technologies
- enhancement of understanding, communication and cooperation among relevant governmental authorities of China and ASEAN member states
- establishment of a China-ASEAN cooperation platform in the field of renewable energy and rural electrification
- promotion of technology transfer and cooperation on SHP and other renewable energies in order to meet common challenges caused in particular by on-going socio-economic development, urbanization and climate change

III. Completed Activities in the First Stage

Activity – 1: Selection and compilation of training materials, allocation of lecturers
Time: January – April 2014
Location: China, Indonesia, Thailand
Participants: HRC, PLN PUSHARLIS, TEAM Consulting Engineering and Management Co., Ltd of Thailand.
Implementation: Entrusted by Chinese Ministry of Commerce, Ministry of Water Resources, Ministry of Science & Technology, UNDP, UNIDO, FAO and ILO, etc., HRC has hosted with success more than 70 training workshops for about 1700 participants from over 100 countries. Based on the experience in training project implementation and considering the features of this project, HRC selected 4 experienced experts respectively good at the research on renewable energy and rural electrification, SHP development mode, old hydropower plant rehabilitation and new technology, overseas hydropower station project cooperation, etc. to give lectures on special topics for the coming Seminar after many discussions. Meanwhile, through extensive contact with HRC's cooperative sectors in ASEAN countries by email and telephone, HRC ultimately decided to invite two experts respectively from PLN

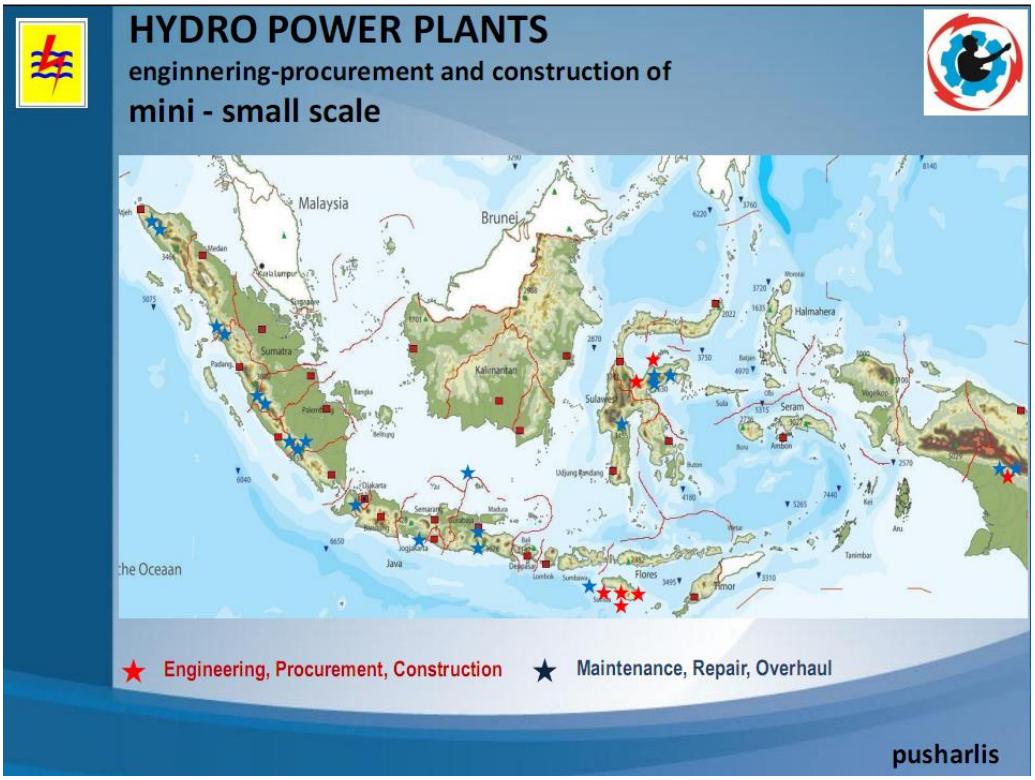
PUSHARLIS of Indonesia and TEAM Consulting Engineering and Management Co., Ltd. of Thailand to share their experience of their own research field in the Seminar. Training materials of all the lectures were well prepared, strictly checked, carefully translated, and seriously compiled.

All the lectures on special topics include:

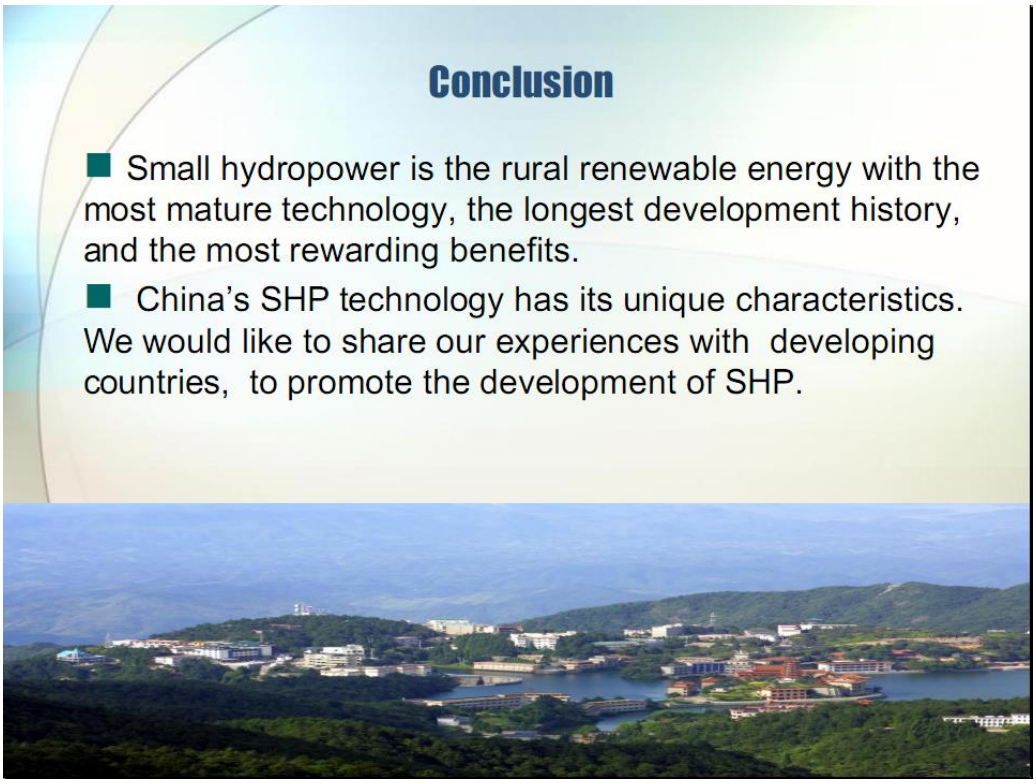
•SHP Development and Rural Electrification in China (by HRC)
•SHP Development Practice - Case Study in EPC (by PLN PUSHARLIS)
•China's Small Hydropower Development Types and Technical Features (by HRC)
•Case Study on Energy Consultation and Development (by TEAM)
•The Technology of Renewable Energy Applied in the Rural Areas (by HRC)
•Chinese SHP Equipment & HRC Overseas Practices (by HRC)
•Technological Rehabilitation and Container-type Mini Hydro Technology (by HRC)
•Operating and Maintenance of Hydropower Plant - Case Study (by PLN PUSHARLIS)

Excerpts of PPT Training Materials

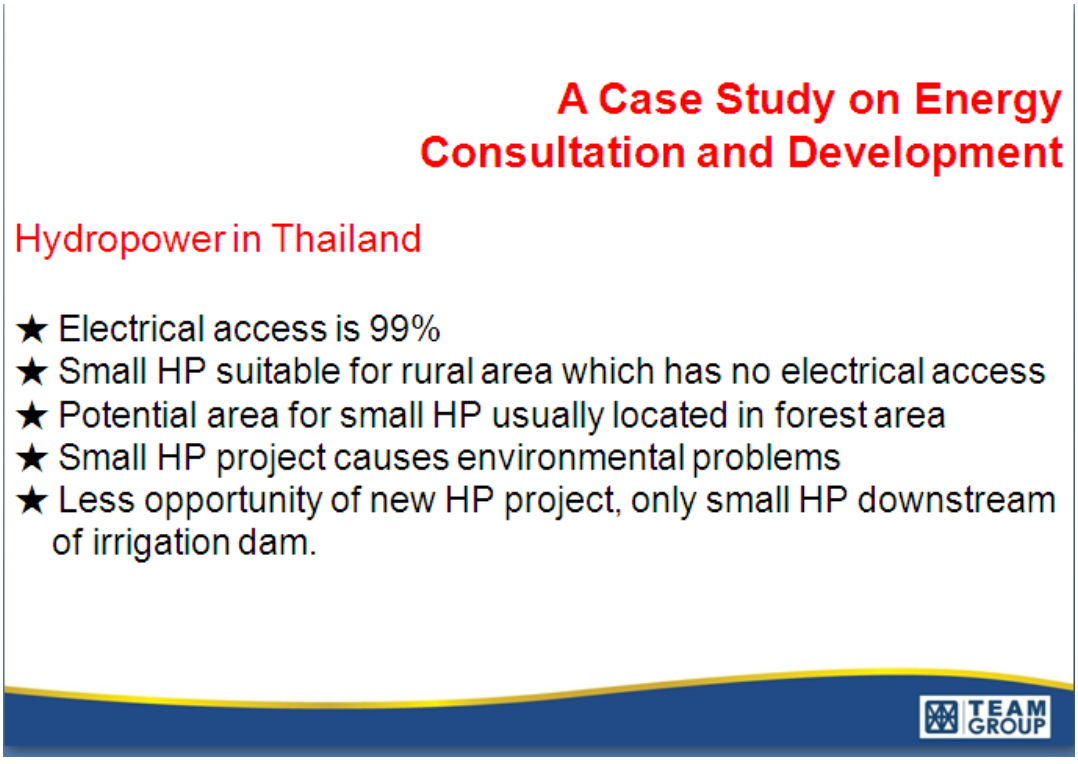
The contents of "SHP Development and Rural Electrification in China" mainly include SHP Background, Present Situation of SHP, Major Success of SHP Development, SHP Mechanism & Incentive Policies, SHP Development Schemes, SHP Technical Features, Current Barriers for SHP Development and Outlook for SHP Development.

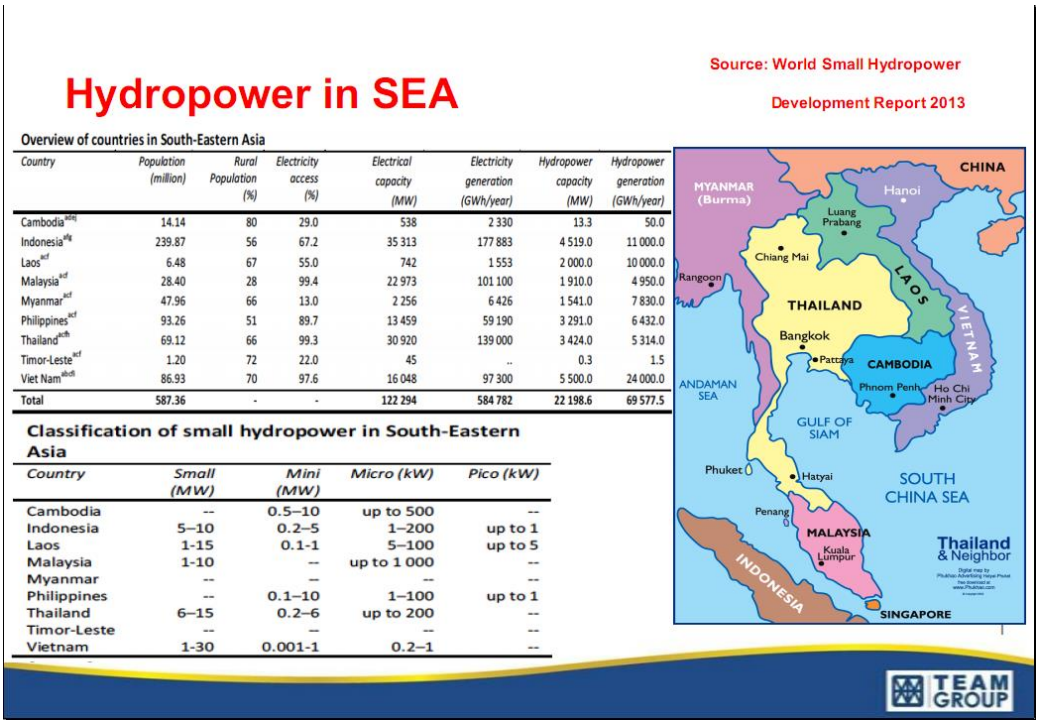


The contents of "SHP Development Practice - Case Study in EPC" cover Brief Introduction, Products, Reverse Engineering, Workshop Activities, Facilities, etc.



The contents of "China's Small Hydropower Development Types and Technical Features" include Definition of Small Hydropower, SHP Development Types, China's SHP Technical Planning, Ecological Protection, SHP Standard System and so on.





The contents of "Case Study on Energy Consultation and Development" cover Hydropower in Sea, Hydropower Compare to other Alternatives, Meteorological and Hydrological Study, Hydropower Development Plan, Cost Estimation, Preliminary Project Evaluation, etc.

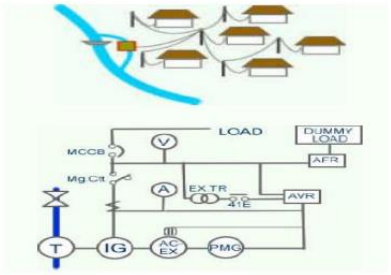
The Technology of Renewable Energy applied in the rural areas

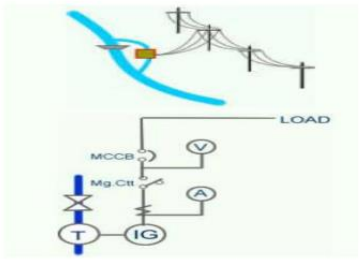
Xu JinCai

Hangzhou Regional(Asia-Pacific)Center For Small Hydro Power (HRC)
National Research Institute For Rural Electrification (NRIRE)

The utilization of renewable energy in rural area

People in rural and remote regions are acquiring improved access to energy in three ways:
(1) at the household level, using **isolated devices** and systems for power generation, heating, and cooking;
(2) through community-level **mini-grid systems**;
(3)through **grid-based** electrification, where the grid is extended beyond urban areas.





The contents of "The Technology of Renewable Energy Applied in the Rural Areas" concern Development of Clean and Renewable Energy in China, Utilization of Renewable Energy in Rural Areas, International Energy Landscape in Recent Years and so on.

Chinese SHP Equipment and HRC Overseas Practices

Presented by (Mr.) **Lin Ning**
Division Chief of Foreign Affairs and Training, HRC &
Deputy General Manager of Hangzhou Yatai Hydro Equipment Completing Co., Ltd.
nlin@hrcshp.org or frank5120@163.com
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HRC Overseas Practices

■ SHP Design and Consultation:

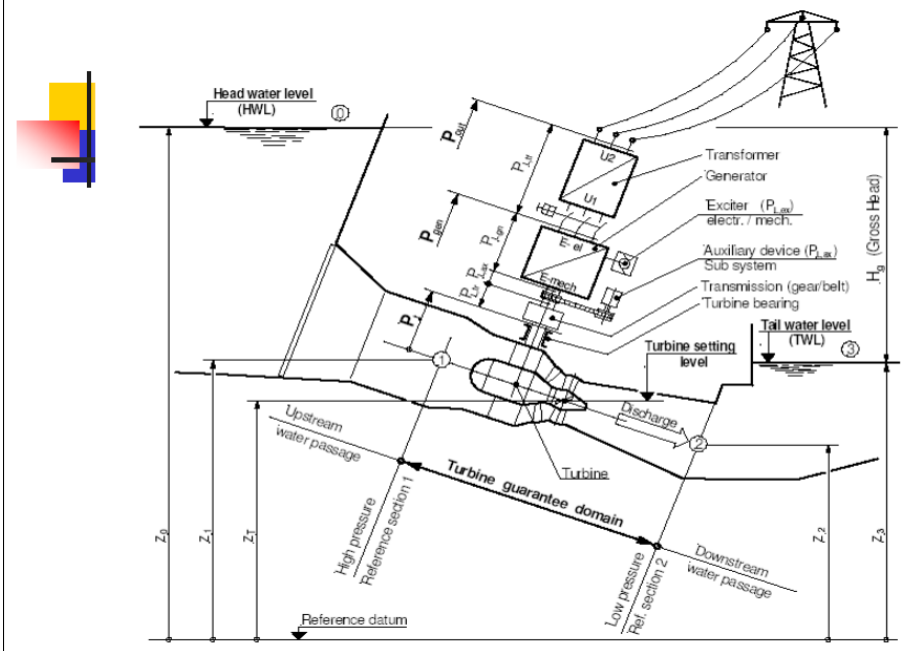
HRC has set up long-term cooperation with more than **30** countries in the world, and undertaken feasibility study, engineering design, consultation, supervision for over 200 projects including **India, Pakistan, Vanuatu, Nepal, Vietnam, Cuba, Kenya, Rwanda, Turkey, Indonesia, PNG, Mongolia** etc..

HRC has completed over **300** hydropower projects in China regarding the planning, design and consultation etc..

The contents of "Chinese SHP Equipment & HRC Overseas Practices" consist of three components: Chinese SHP Equipment, Project Financing and HRC Overseas Practices.

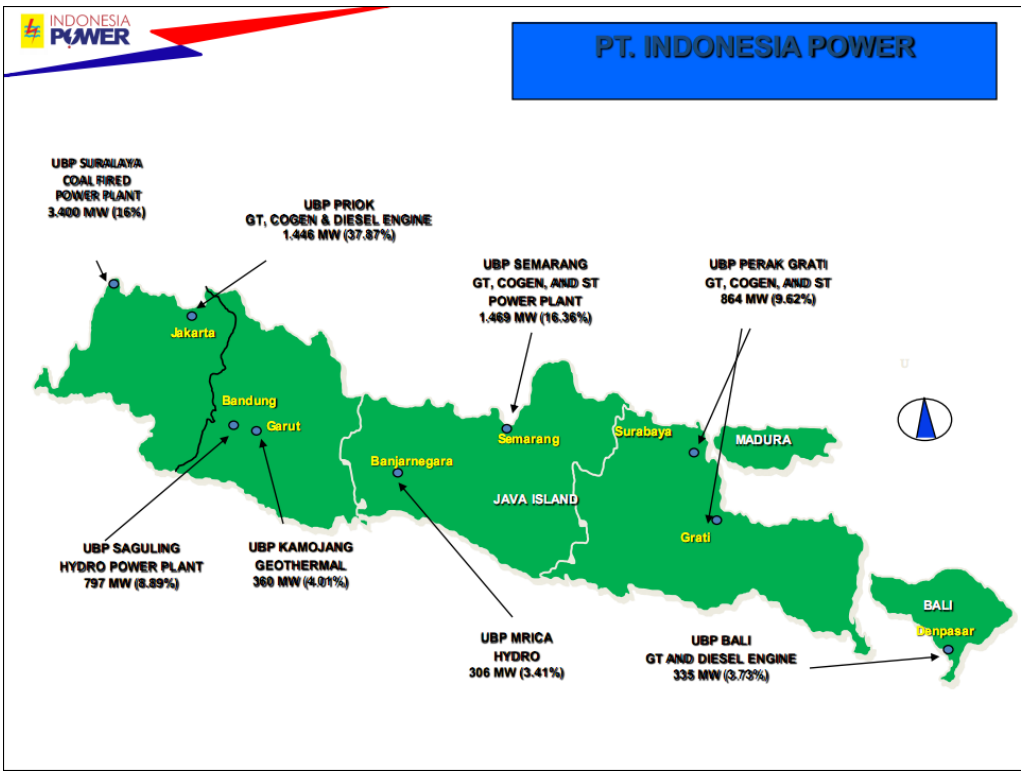
Technological Rehabilitation And Container-type Mini Hydro Technology

by XU Wei
Professorate Senior Engineer of Hydraulic Machinery，HRC
9 Dec. 2014
Bandung



Prototype Efficiency Test and Technical Refurbishment 16

The contents of "Technological Rehabilitation and Container-type Mini Hydro Technology" cover Basic Work for Technological Rehabilitation — Prototype Efficiency Test of Units, Some ways of Technological Rehabilitation for Small Hydropower Plant and Containerized mini hydro technology using in technological rehabilitation field.



The lecture of "Operating and Maintenance of Hydropower Plant - Case Study" takes the hydropower plants in Indonesia as examples.

Activity – 2: Recruitment of participants from ASEAN Member States
Time: May-July 2014
Location: China, Cambodia, Indonesia, Malaysia, Philippines, Laos, Myanmar, Thailand and Vietnam
Participants: ASEAN Secretariat, HRC
Implementation: With the great support of Science and Technology Division, Cross-Sectoral Cooperation Directorate ASEAN Socio-Cultural Community (ASCC) Department, ASEAN Secretariat, project information was disseminated to relevant departments of ASEAN member states. 15 officials from 8 ASEAN member countries are selected by ASEAN Secretariat to participate in the coming Seminar. After that, HRC sent special invitation letters and admission letters to all the selected participants for their visa application or going through the go-abroad formalities to Indonesia.

Participants' Information

Technical Seminar on Small Hydropower for ASEAN Countries

No	Name	Country	Working Institute/Company	Position	Specialty	Tel	Fax	E-mail	Photo
1	CHHIM CHHUNN	Cambodia	Renewable Energy Office of the Department of New and Renewable Energy, Ministry of Mines and Energy	Head of Renewable Energy Office	Renewable Energy	00855 12 983 935	/	chhunchhim@gmail.com chhunchhim@yahoo.com	
2	ROBERT SITUMORANG	Indonesia	CV.BINA HASIL ABADI, Coal Trading Company	Director	Business Administration	0062 21 4755717	/	bha_robert@yahoo.com	
3	SLAMET KASBI PERTONYAMAN	Indonesia	Unit research and development agency, Ministry of Energy and Mineral Resources	Researcher	Industrial control engineering	0062 08121858870	/	slam_ftui77@yahoo.com	
4	FANI ENDRWAN	Indonesia	PT PLN (Persero) Center for Electricity Maintenance	Deputy manager of workshop controlling	Electrical Engineering	0062 08136924545	/	fani.endrawan@pln.co.id	
5	AMITH PHOMPHIMPHA	Laos	Renewable Energy and New Materials Institute, Ministry of Science and Technology	Technical officer	Natural Science	00856 20 99747435	00856 21 737 268	amith.1988@hotmail.com	

6	TEANGORN HOMPOUVONG	Laos	Evaluation Division, Department of Planning and Cooperation Ministry of Science and Technology	Deputy Director	English	00856 20 98456323	00856 21 243312	th_pamy@yahoo.com	
7	KASIM BIN AHMAD	Malaysia	Renewable Energy Research Centre, SIRIM	Engineer	Mechanical engineering	0060 3-5544 5070/ 012-385 8707	0060 3-5544 5166	kasim@sirim.my	
8	MOHD FAUZI BIN ISMAIL	Malaysia	Renewable Energy Research Centre, SIRIM	General Manager	MBA	0060 3 55446038	0060 3-55445166	mfauzi@sirim.my	
9	EI EI MON	Myanmar	Technical Promotion training Center (BAELIN)	Lecturer	Mechanical engineering	0095 066 50418	0095 066 50418	eieimon79@gmail.com	
10	JOEL L. VOCES	Philippines	PROCLEAN Energy Consultancy and Development	President，PROCLEAN General Contractor & Supplies	Mechanical Engineer	0063 919 753 36 79	/	vocesjl@yahoo.com	

11	LORETO CARASI	Philippines	Philippine Council for Industry, Energy and Emerging Technology Research and Development (PCIEERD), Department of Science and Technology (DOST)	Mechanical Engineer	Mechanical engineering	0063 2 8372935	0063 2 8372925	lccarasi@yahoo.com.ph lccarasi@dost.gov.ph	
12	NATCHAPON VONGVISESSOMJAI	Thailand	TEAM Consulting Engineering and Management Co., Ltd.	Senior Hydraulic System Engineer	Water Engineering & Management	00662 509 9000	00662 509 9045	natchapon_v@teami.co.th	
13	SURASIT INTARAPRACHA	Thailand	Office of Design for Engineering and Architecture, RID	Director	Coastal Engineering	0066 2 2412685/ 084 7000 544	0066 2 241 2685	ridsurasit@hotmail.com	
14	TAWIN PRIKMAK	Thailand	International Business Unit, TEAM Consulting Engineering and Management Co., Ltd.	Senior Water Resources/Hydropower Engineer	Water Resource	0066 2-509-9000 ext 2103	0066 2-509-9045	tawin_p@teami.co.th	
15	NGUYEN THI LAN HUONG	Vietnam	Division of Environment Protection for River Basin and Coastal Zone, Waste Management and Environment Improvement Department (WENID), Vietnam Environment Agency (VEA), Ministry of Water Resources and Environment (MONRE)	Engineer	Environmental Engineering & Sustainable Infrastructure	0084 915869569/ 437868428	0084 437868431	nguyenhuong2112@gmail.com	

Activity – 3: Collection of energy information of ASEAN countries
Time: July-August 2014
Location: China, Cambodia, Indonesia, Malaysia, Philippines, Laos, Myanmar, Thailand and Vietnam
Participants: HRC, all the participants
Implementation: In order to grasp more information of energy current situation in most ASEAN member countries before the Seminar, HRC designed an energy survey and sent it to all the participants for seeking good ways to solve the main urgent problems and potential cooperation on rural electrification. The energy investigation work was made by the participants from 6 ASEAN member states according to the Survey and the findings were filled in the Survey.

Energy Survey for Potential Cooperation
in Rural Electrification of ASEAN Countries

Country	Cambodia 
Basic Information (Geographical, Meteorological and Economic Conditions, Population, etc.)	The Kingdom of Cambodia is located in the tropical region of Southeast Asia. It lies between the 10th and 15th degrees north latitude, and between the 102nd and 108th degrees east longitude. It has a tropical climate and receives monsoon rains. With an area of 181,035 square kilometers, approximately 49% remains covered by forest, about 2.5 million hectares of arable land and over 0.5 million hectares of pasture land, Cambodia is polygonal in shape, with its center located near Kampong Thom province. Thailand and Laos border is on the north, Vietnam on the east, Vietnam and the Gulf of Thailand on the south, the Thailand on the west. Land borders comprise five sixths of the 2,600 kilometers of Cambodia's international boundary with its neighbors. The current population is around 15 millions people. Cambodia's sound macroeconomic management is reflected in economic growth and investments. The investments increased from 22.7% of GDP in 2006 to 31% in 2012. Two key features of economic performance in recent years are the increasing diversity of the sectors contributing to economic growth and the robust contribution of the agriculture sector to economic growth. This performance is underpinned by the strong support extended to agriculture and the garment sector by the Royal Government of Cambodia.

Energy and Power Resources (Energy Structure, Energy Institution, Energy Strategy, etc)	The main institutions involving in the Energy sector in Cambodia are the Ministry of Mines and Energy (MME), Ministry of Economic and Finance (MEF), Electricité du Cambodge (EDC), the Electricity Authority of Cambodia (EAC), Provincial Electricity Utilities and private sector. EDC is owned and controlled by MME and MEF.
Percentage of Population with Access to Electricity (%)	Currently 900,982 or 40% of the total households in Cambodia have access to electricity and out of all the 13,898 villages 72.9% is electrified (EAC 2012).
General Situation of Rural Electrification	Upon promulgation of the Electricity Law in 2001, a privatization policy of the power sector has been clearly established. The Electricity Authority of Cambodia was created in 2001 by this electricity law. From that time, any person can participate in electricity supply business in Cambodia by creating their own private company under electricity law to supply the power in the area where it was not supply before. After having the policy of privatization participation of the power sector, many electric companies call Rural Electricity Enterprises (REE) have been created and participated in the market in Cambodia, where up to now is around 307 REE. Distribution licenses have been provided to Private service-providers for development of electricity supply to areas which could not be supplied by Government in the past. By the end of 2010, the areas for which licenses were provided to private service-providers covered almost 10,000 villages or 72.9% of all villages in Cambodia of all villages in the Kingdom of Cambodia.
Theoretical Potential of Hydropower (MW)	There is a potential of hydro project with total capacity is about 10,000 MW of which around 10% is under construction.
Definition of SHP in Your Country (MW) ***(e.g. in China, it's 50MW and below)***	< 15 MW
Exploitable Potential of Small Hydro Power	483 MW
Exploitable Potential of Solar Energy (MW)	N/A
Total Installed Capacity of Electric Power (MW)	1368 MW
Installed Capacity of	681 MW

Hydropower (MW)	
Installed Capacity of SHP (MW)	Ochum 1(1 MW)-Kiryrom 1 (12MW)-Omoleng (185KW)-Oromis (185KW)
Installed Capacity of Solar Energy (MW)	Around 5 MW
Power Price for End Users (US dollar)	20-30 Cents USD
Feed-in Tariff of SHP (US dollar)	N/A
Feed-in Tariff of Solar Energy (US dollar)	N/A
Hydropower Projects to be Constructed or Refurbished	Prior to 2009, the fuel oil participation in the generation of EDC was more than 90% whereas presently it has reduced to around 50% and will be reduced further in future. The reduction of share of fuel oil in the generation will automatically reduce the cost of the generation. The main factor of reduction in share of fuel oil is gradual addition of new sources of supply to the system such as 100 MW import from Vietnam in June 2009 to supply to Phnom Penh and Takeo province, which is expected to be increased up to 200 MW in the middle of 2010; the expected addition of generation from Kamchay Hydro (194.1 MW) and Kirirom III Hydro (18 MW) in 2011, Atay Hydro (120 MW) and 1st Coal plant (100 MW) in 2012, and the later additions of 2nd Coal plant (100 MW) and another coal power plant, Tatay Hydro (246 MW), Stung Russei Chrom Krom Hydro (338 MW), Chi A Reng Hydro (108 MW) between 2013-15. The Sesan II Hydro 400 MW is likely to be put in service after 2015.
Main Difficulties in Developing SHP	- Lack of budget , - Lack of Human Resources, experience knowledge - No, subsidy from Government/ incentive costs - High investment costs
Solar Energy Projects to be Constructed	- Stand alone system (solar home system, battery changing station, solar PV hybrid With biomass and diesel system.)

Main Difficulties in Developing Solar Energy	-Lack of budget, -Lack of Human Resources ,experience knowledge - No, subsidy from Government/incentive costs - High investment costs
Any Suggestion for Future Cooperation	-Should be continued next time -Should be more participants from each Country -This Training Workshop should be longer than this time

Country	INDONESIA	
Basic Information (Geographical, Meteorological and Economic Conditions, Population, etc.)	Geography: archipelago of 17,508 islands, of 1,919,440 square kilometers (741,050 sq-mi), between latitudes 11°S and 6°N, and longitudes 95°E and 141°E. Population: - average population density of 134 people per square kilometer (347 per sq-mi), 79th in the world, although Java, the world's most populous island, has a population density of 940 people per square kilometer (2,435 per sq-mi). Population: 253,609,643 (July 2014 est.), country comparison to the world: 5. Population growth rate: 0.95% (2014 est.), country comparison to the world: 124. Age structure: 0-14 years: 26.2% (male 33,854,520/female 32,648,568) 15-24 years: 17.1% (male 22,067,716/female 21,291,548) 25-54 years: 42.3% (male 54,500,650/female 52,723,359) 55-64 years: 7.9% (male 9,257,637/female 10,780,724) 65 years and over: 6.4% (male 7,176,865/female 9,308,056) (2014 est.) Economy: GDP (purchasing power parity): $1.285 trillion (2013 est.), 16th in the world; GDP - per capita (PPP): US$5,200 (2013 est.), 158th in the world; GDP - real growth rate: 5.3% (2013 est.), 49th in the world.	
Energy and Power Resources (Energy Structure, Energy Institution, Energy Strategy, etc)	Total Investment in Power Sector reached USD 7.16bn in 2012 Electricity: - production: 173.8 billion kWh (2011 est.), country comparison to the world: 23 - consumption: 158 billion kWh (2011 est.), country comparison to the world: 24, in 2013 reached 188 TWh (41% was used by household); Jawa-Bali consumed the largest of 144 TWh followed by Sumatra of 26 TWh, Demand Growth in 2013 was 7.8% and is expected to growth by	

average 8.4% p.a by 2022

- exports: 0 kWh (2012 est.), country comparison to the world: 150
- imports: 2.542 billion kWh (2011 est.), country comparison to the world: 51
- installed generating capacity: 39.9 million kW (2011 est.), country comparison to the world: 23; per March 2014 - 47,788 MW (74% of capacity runs by state co PLN)

Energy structure:

- from fossil fuels: 87% of total installed capacity (2011 est.), country comparison to the world: 86; in 2013 12.5% was still derived from oil, Coal made up 51.6% followed by Gas of 23.6% while geothermal stood at 4.4%
- from nuclear fuels: 0% of total installed capacity (2011 est.), country comparison to the world: 108
- from hydroelectric plants: 9.9% of total installed capacity (2011 est.), country comparison to the world: 114; 7.9% of total production in 2013
- from other renewable sources: 3.1% of total installed capacity (2011 est.), country comparison to the world: 60

Carbon dioxide emissions from consumption of energy: 426.8 million Mt (2011 est.)

Main energy institutions:

- Ministry of Energy and Mineral Resources, Directorate General of Electricity and Energy Utilisation of the MEMR (DGGEU);
- PLN (Perusahaan Listrik Negara, English: 'State Electricity Company'): an Indonesian government-owned corporation which has a monopoly on electricity distribution in Indonesia.
  - In the first half of 2011, the PLN generated 88 terawatt-hours (TWh). The firm generated around 24% of its output using oil-based fuel with plans to reduce the share to 3% by 2013 and 1.7% by 2014. The forecast for the full year (2011) is around 182 TWh (equivalent to around 760 kWh per capita).
  - In the end of 2011, the PLN's total generating capacity (produced by a large number of different plants across Indonesia) was estimated at around 28,500 MW. In 2012, a combined capacity of 3,351 megawatts came online from 23 new power plants.

PLN: Capacity and peak load, end-2011 (megawatts)

	Maximum capacity	Peak load
Java-Bali	21,257	16,150
Western Indonesia	4,602	4,299
Eastern Indonesia	2,603	2,484
Total	28,462	22,933

Energy Strategy on Renewable Energy:

Indonesia is striving to create a low-carbon economy and the government has taken a lead on committing to cut carbon emissions by 26% from

<table>
<tr><td></td><td>business as usual case by 2020, without international support, and up to 41% with the help of international donors. Indonesia has also committed to allocating 20% of the energy mix for renewable resources by 2025.
In the future, to prepare for fossil energy depletion and to support the national carbon reduction program, Indonesia must more actively engage in developing environment friendly energy supplies. The table below shows Indonesia’s renewable energy potential.
<table><tr><th>Renewable Energy Source</th><th>Potential</th><th>Installed Capacity</th><th>Installed to Potential Ratio (%)</th></tr><tr><td>Hydro Power</td><td>75.67 GW</td><td>4.2 GW</td><td>5.55</td></tr><tr><td>Geothermal</td><td>28.53 GW</td><td>1.19 GW</td><td>4.2</td></tr><tr><td>Micro/Mini Hydro</td><td>500 MW</td><td>86.1 MW</td><td>17.56</td></tr><tr><td>Biomass</td><td>49.81 GW</td><td>445 MW</td><td>0.89</td></tr><tr><td>Solar Power</td><td>4.8 kWh/m2/day</td><td>14.1 MW</td><td>--</td></tr><tr><td>Wind Power</td><td>3 – 6 m/2</td><td>1.4 MW</td><td>0.015</td></tr><tr><td>Nuclear (Uranium)</td><td>3 GW</td><td>--</td><td>--</td></tr></table></td></tr>
<tr><td>Percentage of Population with Access to Electricity (%)</td><td>Per September 2013: electrification ratio of Indonesia (national): 80.51%, with the lowest in Papua (35%) and Nusa Tenggara Timur (56%) . The Government will establish 10 micro-hydro power plants each with capacity of 5 MW in the central region of Papua (Baliem valley). At this time the construction of the access road is being implemented and planned to be ready in 2018, so that the Central Papua, Baliem valley area and 10 surrounding counties will be energized with 10x5 MW plants. It has been planned that at the end of 2014 the national electrification ratio will be 90%, and 99% in 2020.</td></tr>
<tr><td>General Situation of Rural Electrification</td><td>Over 80% of the population live in rural areas and over half live outside of the dominant economic centers. Rural electrification is a challenge mainly due to geography and infrastructure.
National power provider Perusahaan Listrik Negara (PLN) and large IPPs are not well suited to rural areas with low population due to high capital and operating costs. Lack of price flexibility excludes many rural customers. On the other hand, Small IPPs are often lacking resources and unable to provide track record to build confidence with investors.
Indonesia has a comparatively low overall rate of electrification for a middle-income country. Figures and interpretations diverge, but as much as 30- 35% of the population representing 75 million people does not have access to electricity. Around 50% of un-electrified people in Indonesia are actually living in (already) electrified areas and would need grid densification programmes.
World Bank Regional Electrification Master Plan for Indonesia :
▪ Grid expansion is the least-cost means of electrification up to distances of around 7 km where good micro-hydro resources are available (assuming that sufficient grid-connected generation capacity is available)
▪ Where this is not the case, grid expansion is least-cost up to</td></tr>
</table>

	distances of around 16 km, where biomass isolated grids become lower-cost ▪ In cases where good micro-hydro, biomass (and geothermal) resources are not available, then grid expansion remains least-cost at distances up to 28 km, where diesel isolated grids are to be preferred ▪ Household level solutions are only to be preferred where practical constraints on access prevent the use of isolated grids or for smaller villages where it is not economic to install isolated grids. Villagers in non-electrified areas rely on candles, kerosene lamps, dry cells and car batteries to satisfy part of their energy needs. Rural households typically spend a significant share of their income on these energy sources – despite the inconvenience and the environmental and health hazards associated with them. The strategy pursued by PLN for the future electrification of rural areas is based on the following principles of 1. empowerment of the rural population to secure electricity according to their own conceptions, 2. utilization of local energy resources, in particular renewable, and 3. increasing the involvement of the private sector and of rural cooperatives. Part of that strategy is the "community-based rural energy development" concept, according to which cooperatives, municipal institutions, non-governmental organizations and/or private actors, with the technical assistance of PLN, serve as power providers in rural areas. PLN provides assistance at two different levels: either for establishing a stand-alone (isolated) grid including power generation, or for establishing a village network for connection to the PLN-operated central power grid. However, the program has been criticized as inefficient and too bureaucratic. Rural electrification is generally not financially attractive to PLN because Indonesia's off-grid areas are sparsely populated, have very low load factor, and are dominated by low-end household consumers who are charged a heavily subsidized tariff
Theoretical Potential of Hydropower (MW)	Indonesia has a great potential for the development of mini hydro power plant businesses ranging from 1MW to 10MW capacity. The country has a potential of 16 - 26 GW in producing power using this run-off river mechanism. The government, realizing the country's low electrification rate, has issued a very supportive policy which should foster the investment in the sector.
Definition of SHP in Your Country (MW) (e.g. in China, it's 50MW and below)	- 10 MW and below. In Indonesia there is no agreed general consensus on the small hydropower definition, with the terms small, mini, micro and pico hydropower used interchangeably. Current installed small hydropower capacity is about 100 MW; however, the potential is much higher.

Exploitable Potential of Small Hydro Power	Indonesia's hydro power potential is 76,000 MW and 10% of 76,000MW can be developed as small hydro-power project(below 10MW)
Exploitable Potential of Solar Energy (MW)	Indonesia has wind energy potential of 9 GW, solar energy potential of 4.8 kWH/m2/day and biomass potential of 49GW electricity equivalent.
Total Installed Capacity of Electric Power (MW)	Total Installed Capacity per March 2014 - 47,788 MW (74% of capacity runs by state co PLN) Electricity Consumption in 2013 reached 188 TWh (41% was used by household) Jawa-Bali consumed the largest of 144 TWh followed by Sumatra of 26 TWh Demand Growth in 2013 was 7.8% and is expected to growth by average 8.4% p.a by 2022 National Electrification Ratio has reached 80.51% in 2013 Hydro Power Plants Contributes 7.9% of total production in 2013; 12.5% was still derived from oil Coal made up 51.6% followed by Gas of 23.6% while geothermal stood at 4.4% Total Investment in Power Sector reached USD 7.16bn in 2012
Installed Capacity of Hydropower (MW)	5,705.29 MW
Installed Capacity of SHP (MW)	217.89 MW – "small" means less than 10MW capacity
Installed Capacity of Solar Energy (MW)	13.5 MW Indonesia's other renewable energy goals: 2,000 MW of solar PV by 2014 300 MW of wind by 2014 1,300 MW of new hydro by 2015 400 MW of new biomass by 2015
Power Price for End Users (US dollar)	8.75 US cents/kWh (Feb 1, 2013), from July 1 in order to reduce the burden on the budget for energy use each year the price will increase by 5-11 percent every two months till the end of 2014. Ultimately, it will go up 34.7 percent for industries and 34 percent for households.
Feed-in Tariff of SHP (US dollar)	Feed-in tariff for renewable energy: The tariff was set up base on the electricity production and delivery cost (HPP) of PLN and therefore every region of PLN has different HPP. The tariff was 60% of the HPP in the low voltage interconnection and 80% of the HPP in the middle voltage interconnection.

No	REGION	FEED IN TARIFF (CENT USD / kwh)			
		Hydro & Wind < 10MW		Solar PV	
		MV	LV	Maximum tariff	>40% local content
1	Sumatera	7.87	12.05	25.00	30.00
2	Java, Madura and Bali	6.56	10.04	25.00	30.00
3	South Sulawesi, West Sulawesi and South East Sulawesi	7.87	12.05	25.00	30.00
4	North Sulawesi, Central Sulawesi and Gorontalo	7.87	12.05	25.00	30.00
5	West Nusatenggara and East Nusatenggara	8.53	13.05	25.00	30.00
6	Maluku and Papua	9.84	15.06	25.00	30.00
7	Kalimantan	8.53	13.05	25.00	30.00

Agreement (PPA)

In the PPA, The FIT is stated at:

a. The first eight years: Rp 1,075 per kwh x Regional Factor (F); The F is 1x for Java, Bali, & Madura; 1,1xfor Sumatra; 1.2x for Kalimantan & Sulawesi; 1.25x for NTT & NTB; 1.3x for Maluku and North Maluku; 1.6x for Papua and West Papua
b. Year 9 until year 20: Rp 750 per kwh x Regional Factor as similar to above F
c. No negotiation & no escalation on FIT in PPA

A new higher tariff for electricity purchased from mini-hydropower plants has been set by the Energy and Mineral Resources Ministry to make the sector more attractive for industry players.

The new tariff has been set at Rp 1,075 (9 US cents) per kilowatt hour (kWh) from the previous level of Rp 656, nearly a 64 percent increase.

Mini-hydro plants are those considered to have less than a 10-megawatt (MW) capacity.

The new price will be applicable for the first year until the eighth year, while after the power tariff will be reduced to Rp 775 per kWh until the 20th year starting this year.

Mini-hydro projects already established but that have yet to sign power purchase agreements are allowed to negotiate with an average tariff of Rp 880 per kWh.

Feed-in Tariff of Solar Energy (US dollar)

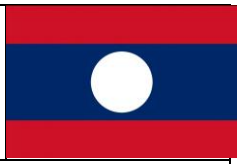
The Minister of Energy and Mineral Resource ("MEMR") recently issued Regulation of MEMR No. 17 of 2013 (Reg. 17/2013) to stipulate among other things: (i) new procedures for purchase of power from solar photovoltaic power projects in Indonesia which require developers to bid in capacity quota tenders; and (ii) feed-in-tariff for solar photovoltaic power projects at the cap of

US$0.25/kWh, or US$0.30/kWh if the photovoltaic module contains 40% or more local components.

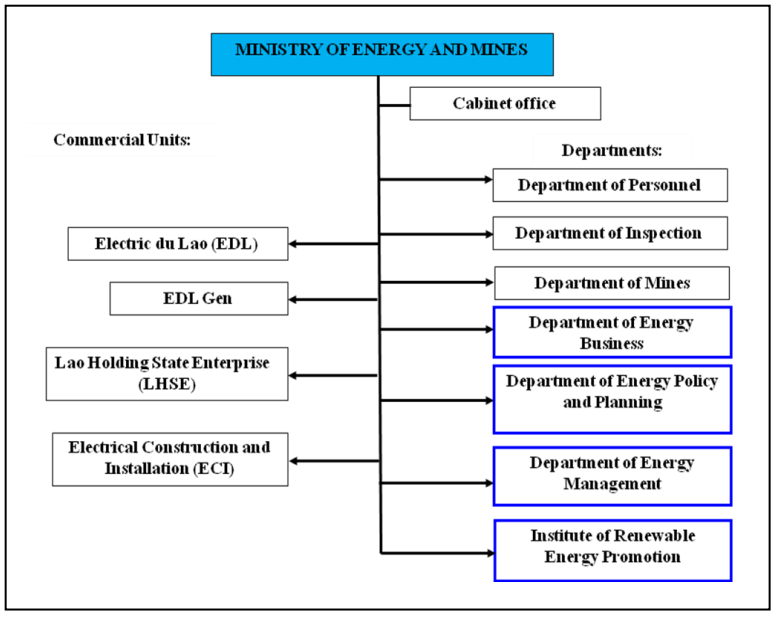
Hydropower Projects to be Constructed or Refurbished	Electricity demand in the country is estimated to grow around 8.4 percent per year from 2013 to 2022. To meet demand, the country will have to have an additional capacity of 60 gigawatts during this period. Under the long term plan, around 6.5 gigawatts are expected from hydro and mini-hydro power plants. Indonesia is estimated to have a 75,000-MW hydropower potential, but the utilization of resources remained low, with a total 3,935-MW hydropower plant capacity in operation as of the end of last year. Of the total hydro plant capacity, 67.6 MW mini-hydropower plants operate in the country, according to figures from the ministry. As many as 37 mini-hydro projects, with a combined capacity of 172 MW, are being constructed. Meanwhile, 55 projects with a total capacity of 286.5 MW are still at the funding stage.
Main Difficulties in Developing SHP	Even though there are huge renewable sources potential in the country, in order to implement the good regulation which part of solving the energy crisis situation is not easy as what we can imagine. Unfavorable framework conditions for stand-alone systems and on-grid schemes, lack of specialist know-how and a basic lack of awareness of the available potential have been the main reasons for this sluggish progress in the past. First thing in mind is to get financing for the project itself. Until now renewable business is still remain a high risk and not common business practice for the banker or financial lender. Second thing is to get the contract or power purchase agreement (PPA) from utility itself is another big challenge. It could take more than a year in practice and might be longer to get the PPA. Even though utility has obligation to purchase it, but in reality still need high effort to make it happen and not as what had written in the regulation. A number of barriers still have to be overcome such as lack the capacity to design, implement and manage small hydropower schemes and absence of appropriate financial resources. Another problem is that small hydropower schemes are site specific and are built individually. That makes them unattractive to large companies interested in mass energy production and fast market penetration
Solar Energy Projects to be Constructed	The Ministry of Energy has issued a tender for the construction of solar installations at 80 locations in Indonesia, most of them located in the eastern part of the country. The solar energy will be bought by PLN for a maximum rate of $0.25 cents per kilowatt hour. Without the tender, solar energy would mainly remain of interest for NGOs, small companies and hotels in remote areas. By 2025, Indonesia wants solar energy to account for 0.3 percent of its energy mix - equivalent to 1 GW of new installations. The country is one of the emerging solar photovoltaic markets in Southeast Asia, set to become the second largest in the region by 2017, following

	Thailand. The government is targeting to have 80 solar power plants operating in 2014. All of the plants will generate 142MW of electricity. Of the 80 power plants, 50 will be built in the eastern parts of Indonesia. Once the solar power plants begin to operate, solar consumption in East Indonesia is expected to drop by 20 percent. The total investment of all plants probably reached Rp3 trillion (approx. $ 26.4 billion). In addition to cutting back on production cost, building solar plants in remote areas can help increase electrification ratio there. At the end of last year, the national electrification ratio only reached 75.9 percent. This year, the government set a target of 79.3 percent. Meanwhile, the current installed capacity of solar power is 132 MW, very low when compared to its full potential of 50,000 MW. Most of the solar power plants would be located in eastern Indonesia, such as in Papua, West Papua, Maluku, Sulawesi and Nusa Tenggara. Most of the power plants will have a 1 MW capacity while the biggest project will be located in Jayapura, Papua, with a 6 MW capacity. At least nine units of power plants would be offered for development in East Nusa Tenggara (NTT) with a total capacity of 14 MW. He said seven locations in Papua would host solar power plants with a 14.5 MW capacity, six locations in North Maluku with a combined capacity of 7.5 MW, six developments in Maluku with 9.5 MW and another six projects in North Sulawesi with 13 MW. There will also be three locations in Aceh hosting 4 MW solar power plants, six units in Riau with a 8.5 MW capacity, seven units in West Kalimantan with a 9.5 MW capacity, five unit plants in West Nusa Tenggara (NTB) with 17 MW and four units in East Java with a 4 MW capacity. The government inaugurated the largest capacity solar power plant in Karangasem, Bali. The plant has a 1 MW capacity and cost Rp 26 billion in investment. The country’s solar power plants’ installed capacity had reached 59 MW as of early November. The country had a solar energy potential of 50,000 MW. Attempting to boost solar power plant development, the Energy and Mineral Resources Ministry issued last June Ministerial Decree no. 17 2013, which regulates the purchasing of electricity produced by photovoltaic solar power plants by state-owned electricity company PT Perusahaan Listrik Negara (PLN). The allocated funds, Rp 660 billion (US$58 million), included Rp 510 billion channeled to solar power plant projects and Rp 150 billion to develop mini-hydro power plants. About 133 solar power plant units will distribute electricity to 18,000 households, while the development of mini-hydro plants will cover 3,400 households in 21 locations. the 133 locations for solar power plants would consist of 31 in outer islands, 27 in

	border areas and 75 in isolated areas. "The total electricity generated will be around 6 MW [megawatts]," Last year, the Energy and Mineral Resources Ministry developed 5.27 MW solar power plants, which distributed electricity to 17,246 households, with funds from the 2013 state budget. The ministry also developed 11 mini-hydro plants with a total peak capacity of 1.3 MW for 2,345 households. In 2013 were inaugurated renewable energy power plant projects — Samalewa-Pangkajene Islands solar plant in South Sulawesi with 1 MW in peak capacity; West Tianyar solar plant in Karangasem, Bali with 15 kilowatt (kW) in peak capacity; and a mini-hydro power plant in South Central Timor in East Nusa Tenggara with 35 kW in peak capacity.
Main Difficulties in Developing Solar Energy	- Individual development cost for rural population - Lack of maintenance skills Other renewable energy technologies like Solar Home Systems, small wind turbines or biogas plants and other bioenergies are spread to a different extend in rural areas, but lack for the technical maturity or sustainable operation and service models that are necessary for large scale dissemination. Solar energy is still relatively expensive. The biggest challenge is still the competition with diesel and coal. Residential rooftop solar PV is not yet profitable, as PLN doesn't buy back excess electricity produced by the solar panels. This means it takes over 10 years before the investment of a small installation will repay itself. If PLN would buy the oversupply of electricity, this could be less than 8 years. To further boost solar energy development across the country, plans were earlier announced to launch a feed-in tariff scheme as high as $0.25 per kilowatt hour applicable for 20 years.
Any Suggestion for Future Cooperation	- Consultancy - Training - Development cooperation

Country	Lao PDR	
Basic Information (Geographical, Meteorological and Economic Conditions, Population, etc.)	The Lao People's Democratic Republic (Lao PDR) is a small landlocked country located in the Indochina Peninsula. It is increasingly being recognized that landlocked can be interpreted as land-linked and change the emphasis from regional exclusion to regional inclusion. The country's total area is 236,800 km^2 of which about 20% is flatland (70-200 msl) and the other 80% is sloping hillsides and mountains (200-2,820 msl). The country has 17	

	provinces, capital city. The population is about 6.5 million people with a growth rate of about 2.2-2.5% per annum. The average population density is 19-21 people per square kilometer. Lao PDR is a multi-ethnic country which has some 48 ethnic groups. Lao PDR is predominantly rural in character and has a potentially cultivable land area of about 5 million hectares. Out of this, 16 per cent or 800,000 hectares are cultivated for rice or secondary crops under both lowland terrace and upland shifting cultivation systems. 750,000 hectares (15 per cent) are pasture while about 50,000 hectares (1 per cent) are in aquaculture production. In present days, Lao PDR and many countries in the world are facing very high fossil derived fuels prices. As the country is not petroleum and LPG producing country; Lao PDR has strongly relied on imported fuels, so the country would be very prone to high energy price and supply shortage related crisis. Effective energy strategy must be in place in order to make the country the energy self-sufficient and to secure in energy supply. The first step is to promote more energy saving and then turn to the development and utilization of inexhaustible and environmental friendly renewable energy resources. With the above consideration, strategy on the energy of Lao Government is to develop and to sustain renewable energy sources such as hydropower, biomass, bio-fuel, biogas, solar, wind, etc. Lao population is around 6.7 million averages per capita GDP is 960 USD/year. The average domestic GDP growth rate is about 7.8% for 2006-2010. During the same duration, 2006-2010, growth rate of industrial sector reached 13-14% and the economic growth rate is between 7.5-8%. Recently, although economic growth has slowed down due to international financial crisis, energy demand of the country continues to rise. On the consumer side, the demand of energy for transportation is high due to rapid increase of personal vehicle ownership. Lao PDR lacks of conventional energy resources (e.g., oil or Natural gas) but has some reserve of coal, which, in case used, creates harmful effect to the environment, particularly greenhouse gas emission being responsible for global climate changes. Anyway, the country has abundant renewable energy resources such as biomass, hydropower and solar energy. In some part of the country, there are some potential of wind and geothermal energy. In view of the importance of agriculture in terms of both income and employment generation, and the competitive advantage of Lao hydropower in the region, the water sector is a key for the development strategy of Lao PDR. To date, about 20% of the cultivated land is provided with reliable irrigation water and less than

	2% of the currently estimated 26,000 MW hydropower (including Mekong River) potential capacity has been developed.
Energy and Power Resources (Energy Structure, Energy Institution, Energy Strategy, etc)	**Electricity sector overview:** The responsibility for the energy sector is divided among various organizations with the Ministry of Energy and Mines or MEM (formerly the Ministry of Industries and Handicrafts or MIH), being the most prominent as it manages the electricity sector through the Department of Electricity (responsible for power sector development) and Electricité du Laos (EDL), which is a state owned enterprise responsible for electricity supply to the domestic sector. Under the Electricity Law (Article 43), MEM has the primary responsibility for policy formulation and strategic planning, jointly undertaken with the Science, Technology and Environment Agency, the Committee of Investment Management and Foreign Economic Cooperation and other relevant agencies **Organization of Lao P.D.R Energy Sector**  Target of the GOL • Improve the National Energy Policy for Power Development planning, the Ministry of Energy and Mines has targeted to fulfill the GOL's goal on the rural electrification that at least 80% of total country households shall be electrified by 2015 and 90% by 2020 respectively. • Increase a share of renewable energies to 30% by 2025 of the total energy consumption. • Establish a National Policy of Renewable Strategic Policy;

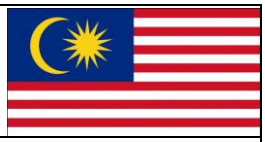
<table>
<tr><td></td><td>• Establishing the National Policy for Energy Efficiency and conservation,
• To promote the energy saving for the next Generation.</td></tr>
<tr><td>Percentage of Population with Access to Electricity (%)</td><td>Provinces below 50%: Phongsaly 16%, Houaphanh 39%, Oudomxay 42.6%, Attapeu 42%
Overall electrification ratio: 71.3%</td></tr>
<tr><td>General Situation of Rural Electrification</td><td>In the past, small hydropower development was not sustainable due to natural disaster, lack of management, lack of technical and budget for maintenance. To promote the development of small hydropower resources, the government will implement measures to address the existing technical, financial, procedural and institutional barriers for small hydropower development in the country.</td></tr>
<tr><td>Theoretical Potential of Hydropower (MW)</td><td>estimated 26,000 MW hydropower</td></tr>
<tr><td>Definition of SHP in Your Country (MW)
(e.g. in China, it's 50MW and below)</td><td>In the Lao PDR, hydropower projects with capacity below 15 MW are classified as small-scaled hydropower.</td></tr>
<tr><td>Exploitable Potential of Small Hydro Power</td><td>2,000 MW</td></tr>
<tr><td>Exploitable Potential of Solar Energy (MW)</td><td>Rural Electrification (Solar)
<table><tr><th>Year</th><th>Number of operational system (watts)</th></tr><tr><td>1999</td><td>257</td></tr><tr><td>2000</td><td>392</td></tr><tr><td>2001</td><td>392</td></tr><tr><td>2002</td><td>1,207</td></tr><tr><td>2003</td><td>3,531</td></tr><tr><td>2004</td><td>5,107</td></tr><tr><td>2005</td><td>6,357</td></tr><tr><td>2006</td><td>6,183</td></tr><tr><td>2007</td><td>9,431</td></tr><tr><td>2008</td><td>8,728</td></tr><tr><td>2009</td><td>13,339</td></tr></table></td></tr>
<tr><td>Total Installed Capacity of Electric Power (MW)</td><td>1,804 MW</td></tr>
<tr><td>Installed Capacity of Hydropower (MW)</td><td></td></tr>
<tr><td>Installed Capacity of SHP (MW)</td><td>The government intends to develop around 650 MW of small hydropower capacity between 2010 and 2025 by private and community.</td></tr>
<tr><td>Installed Capacity of Solar Energy (MW)</td><td>The rural electrification system company, Sunlabob, has installed over 5600 solar home systems in 450 different</td></tr>
</table>

<table>
<tr><td></td><td>villages since their start in 2001 (Sunlabob, a 2006).

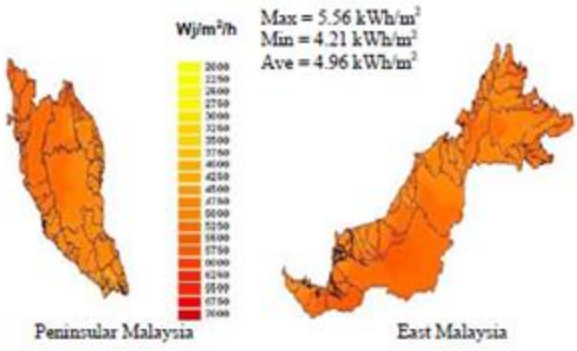
For the period 2010-2020, the government under the rural electrification master plan (REMP) aims to upscale the program covering additional 19,000 households within 331 villages in 11 provinces.</td></tr>
<tr><td>Power Price for End Users (US dollar)</td><td>
Electricity Tariff in Lao PDR
<table>
<tr><th colspan="2">Month, Year</th><th>Lao Kip/kWh</th><th>Jan-08</th><th>Jan-09</th><th>Jan-10</th><th>Jan-11</th></tr>
<tr><td colspan="2">Residential</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">0-25 kWh</td><td>Lao Kip/kWh</td><td>175</td><td>201</td><td>231</td><td>266</td></tr>
<tr><td colspan="2">26-150kWh</td><td>Lao Kip/kWh</td><td>290</td><td>298</td><td>307</td><td>316</td></tr>
<tr><td colspan="2">>150 kWh</td><td>Lao Kip/kWh</td><td>765</td><td>765</td><td>765</td><td>765</td></tr>
<tr><td rowspan="2">Business</td><td>Low Volt.</td><td>Lao Kip/kWh</td><td>826</td><td>826</td><td>826</td><td>826</td></tr>
<tr><td>Med. Volt.</td><td>Lao Kip/kWh</td><td>702</td><td>702</td><td>702</td><td>702</td></tr>
<tr><td colspan="2">Intertratement</td><td>Lao Kip/kWh</td><td>1,095</td><td>1,095</td><td>1,095</td><td>1,095</td></tr>
<tr><td rowspan="2">Government</td><td>Low Volt.</td><td>Lao Kip/kWh</td><td>677</td><td>667</td><td>658</td><td>649</td></tr>
<tr><td>Med. Volt.</td><td>Lao Kip/kWh</td><td>575</td><td>567</td><td>559</td><td>551</td></tr>
<tr><td colspan="2">Inter. Organization</td><td>Lao Kip/kWh</td><td>1,066</td><td>1,066</td><td>1,066</td><td>1,066</td></tr>
<tr><td rowspan="2">Industry</td><td>Low Volt.</td><td>Lao Kip/kWh</td><td>610</td><td>601</td><td>593</td><td>584</td></tr>
<tr><td>Med. Volt.</td><td>Lao Kip/kWh</td><td>518</td><td>511</td><td>504</td><td>497</td></tr>
<tr><td rowspan="2">Irrigation</td><td>Low Volt.</td><td>Lao Kip/kWh</td><td>341</td><td>359</td><td>377</td><td>395</td></tr>
<tr><td>Med. Volt.</td><td>Lao Kip/kWh</td><td>290</td><td>305</td><td>320</td><td>336</td></tr>
</table>
Exchange rate 1$=8000 kip
</td></tr>
<tr><td>Feed-in Tariff of SHP (US dollar)</td><td></td></tr>
<tr><td>Feed-in Tariff of Solar Energy (US dollar)</td><td></td></tr>
<tr><td>Hydropower Projects to be Constructed or Refurbished</td><td></td></tr>
<tr><td>Main Difficulties in Developing SHP</td><td>The main problems from rural electrification are: high initial investment with the rate of return, no actual tools for management and technical inspection standards. Currently, small hydropower development that provincial is responsible were not sustainable due to natural disaster, lack of management and lack of technical and budget for maintenance.

Difficulties currently faced in formulating energy policies
➢ Lack of an integrated national energy policy,
➢ Lack of data and information of all sub-sectors of energy,
➢ There is a lack of an integrated national energy policy and no</td></tr>
</table>

	clear or existing vision to cover all energy sub-sectors. ➢ In the area of baselines and scenarios, the main gap is lack of data and information of all sub-sectors of energy. ➢ The limitation of manpower with the knowledge of know-how, experience and skills in strategic planning and implementing.
Solar Energy Projects to be Constructed	
Main Difficulties in Developing Solar Energy	In addition, the government also encourages the development off-grid connected solar PV systems and solar PV hybrid system, such as the integration with small hydropower and wind power, to sustain supply of electricity during the dry season. In addition to power generation, the government also promotes the use of solar energy for thermal application for individual households, commercial buildings and industrial.
Any Suggestion for Future Cooperation	

Country	MALAYSIA	
Basic Information (Geographical, Meteorological and Economic Conditions, Population, etc.)	It consists of thirteen states and three federal territories and has a total landmass of 329,847 square kilometres (127,350 sq mi) separated by the South China Sea into two similarly sized regions, Peninsular Malaysia and East Malaysia (Malaysian Borneo). As of  the 2010 census, the population of Malaysia was 28,334,135, making it the 42nd most populated country. The population of Malaysia consists of many ethnic groups. In 2010, Malaysian citizens, of which *bumiputera* were 67.4%, made up 91.8% of the population. As of the 2010 census, the population of Malaysia was 28,334,135, making it the 42nd most populated country. The population of	

	Malaysia consists of many ethnic groups. In 2010, Malaysian citizens, of which *bumiputera* were 67.4%, made up 91.8% of the population.
Energy and Power Resources (Energy Structure, Energy Institution, Energy Strategy, etc)	Total electricity installed capacity in 2012 was 29,143 MW. The power station input are mainly: i. Coal and coke (26.3%), ii. Natural gas (53.3%), iii. Hydro power (11.4%), iv. Diesel and fuel oil (6.1%) and v. Renewable energy (2.9%).
Percentage of Population with Access to Electricity (%)	Targeted 100% in Peninsular Malaysia and 99% in Sabah and Sarawak by 2015
General Situation of Rural Electrification	The rural electrification are mainly supply by the solar PV technology, mini hydro and diesel genset. There also a hybrid system for the rural electrification such as solar PV with diesel genset and mini hydro with diesel genset.
Theoretical Potential of Hydropower (MW)	Malaysia has a total land mass of 332,000 km2 and its mean elevation is about 300m. The average rainfall is slightly more than 2,600mm per year. The total gross hydro potential is 414,000GWh/year, of which about 85,000 GWh/year is available in Peninsular Malaysia. Hence, whilst Peninsular Malaysia has 39% of the land area, its share of hydropower resources is only slightly more than 20%. Of the 85,000 GWh/year gross potential, the utilized resources amount to 4,900 GWh/year (6%) whilst another 5,000 GWh/year (6%) has been identified. The Sg. Perak river basin is the most developed in terms of hydropower development utilization (2,500 GWh/year), and it is reaching the limit of hydropower potential development. For Peninsular Malaysia, it has been estimated that the economic limit of hydropower utilization is unlikely to exceed 10,000 GWh/year.
Definition of SHP in Your Country (MW) ***(e.g. in China, it's 50MW and below)***	Small mini hydro is defined as 10 MW and below
Exploitable Potential of Small Hydro Power	
Exploitable Potential of Solar Energy (MW)	Malaysia is characterized with a high potential for solar energy application due to its high level of solar radiation throughout the year, especially in the northern region and in some areas of East Malaysia. The annual average daily solar irradiation for Malaysia

	Exhibit 6 Solar irradiation, Malaysia  Source: Ayu Wazira et al, A New Approach For Predicting Solar Radiation In Tropical Environment Using Satellite Images – Case Study Of Malaysia, 2008 ranges from 4.21 to 5.56 kWh/m^2/day (see Exhibit 6).
Total Installed Capacity of Electric Power (MW)	Total installed capacity is 29,143 MW in 2012. The share of the : Natural gas (53.3%), Coal (26.3%), Hydro (11.4%), Diesel (5.5%), Biomass (2.7%), Fuel oil (0.6%) and others (0.2%)
Installed Capacity of Hydropower (MW)	Installed capacity of Major Hydro Power Station as 2012: i. Peninsular Malaysia – 19301MW ii. Sabah- 66 MW iii. Sarawak – 844 MW Total – 2841 MW Installed capacity on mini hydro power station as 2012: i. Peninsular Malaysia – 6.5 MW ii. Sabah – 8.4 MW iii. Sarawak – 7.3 MW Total – 22.2 MW
Installed Capacity of SHP (MW)	The total of small hydro power installed capacity as 2014 is 11.7 MW in Peninsula Malaysia. Total solar PV generation as June in 2014 is 24,353 MWh.
Installed Capacity of Solar Energy (MW)	The total of solar PV installed capacity as 2014 is 116 MW. The target by 2020 is 175 MW. Total solar PV generation in as June 2014 is 41,900 MWh.
Power Price for End Users (US dollar)	**TARIFF CATEGORY-DOMESTIC** | **RATES**

<table>
<tr><td></td><td>1.<table>
<tr><td>For the first 200 kWh (1 - 200 kWh) per month</td><td>0.066 USD/kWh</td></tr>
<tr><td>For the next 100 kWh (201 - 300 kWh) per month</td><td>0.1035 USD/kWh</td></tr>
<tr><td>For the next 100 kWh (301 - 400 kWh) per month</td><td rowspan="3">0.160 USD/kWh</td></tr>
<tr><td>For the next 100kWh (401 - 500 kWh) per month</td></tr>
<tr><td>For the next 100 kWh (501 - 600 kWh) per month</td></tr>
<tr><td>For the next 100 kWh (601 - 700 kWh) per month</td><td rowspan="3">0.169 USD/kWh</td></tr>
<tr><td>For the next 100 kWh (701 - 800 kWh) per month</td></tr>
<tr><td>For the next 100 kWh (801 - 900 kWh) per month</td></tr>
<tr><td>For the next kWh (901 kWh onwards) per month</td><td>0.177 USD/kWh</td></tr>
</table></td></tr>
<tr><td>Feed-in Tariff of SHP (US dollar)</td><td>The Feed in Tariff for the small hydro:
i. Up to and including 10 MW is USD 0.0744 per kWh
ii. Above 10 MW and up to including 30 MW is USD 0.0713 per kWh</td></tr>
<tr><td>Feed-in Tariff of Solar Energy (US dollar)</td><td>The Feed in Tariff for the solar PV:
i. Up to and including 4 kW is USD 0.3157 per kWh
ii. Above 4kW and up to including 24 kW is USD 0.3080 per kWh
iii. Above 24kW and up to including 72 kW is USD 0.2633 per kWh
iv. Above 72kW and up to including 1000 kW is USD 0.2544 per kWh
v. Above 1MW and up to including 10 MW is USD 0.2120 per kWh</td></tr>
</table>

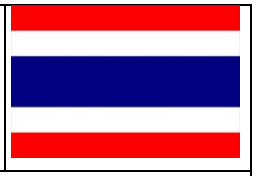
	vi. Above 10 MW and up to including 30 MW is USD 0.1897 per kWh
Hydropower Projects to be Constructed or Refurbished	On going in various state of Malaysia
Main Difficulties in Developing SHP	Approval from the state government, extreme weather such as flood and dry season and logistic.
Solar Energy Projects to be Constructed	Many based on FiT approval project.
Main Difficulties in Developing Solar Energy	i) Cost of the solar PV (USD 3500 -5000 per kW) ii) Drop of efficiency based on the temperature iii) Power quality
Any Suggestion for Future Cooperation	i) Setup demo plant in selected ASEAN member state for CHINA technology ii) Provide financial assistance iii) Capacity building

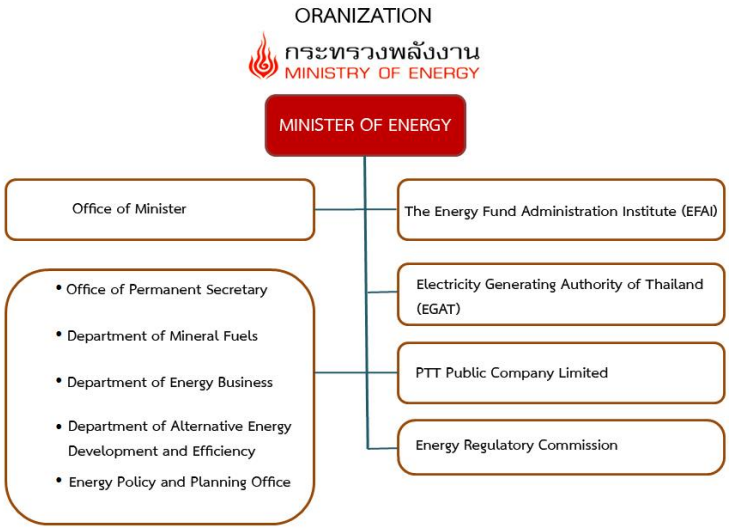
Country	PHILIPPINES 
Basic Information (Geographical, Meteorological and Economic Conditions, Population, etc.)	The **Philippines** is an archipelago comprising 7,107 islands with a total land area of 300,000 km^2. The 11 largest islands contain 94% of the total land area. The largest of these islands is Luzon at about 105,000 km^2. The next largest island is Mindanao at about 95,000 km^2. The archipelago is around 800 km from the Asian mainland and is located between Taiwan and Borneo. The Philippines' roaring economy cooled in the first quarter of 2014 as the impact of Super Typhoon Yolanda (Haiyan) and other natural disasters hit harder than expected, the government said Thursday, May 29. Philippine growth slowed to 5.7% in January to March from 6.3% in the fourth quarter and 7.7% in the first quarter of last year. With a population of at least **99 million people**, the Philippines is the seventh-most populated country in Asia and the 12th most populated country in the world. An additional 12 million Filipinos

	live overseas, comprising one of the world's largest diasporas.
Energy and Power Resources (Energy Structure, Energy Institution, Energy Strategy, etc)	Increase RE-based capacity by 100% by 2013 • Be the number one geothermal energy producer in the world • Be the number one wind energy producer in Southeast Asia • Double hydro capacity by 2013 • Expand contribution of biomass, solar and ocean energy by 131 MW Increase non-power contribution of RE to the energy mix by 10 MMBFOE in the next ten years Diversify energy mix in favour of indigenous RE resources Promote wide-scale use of RE as alternative fuels and technologies Transform Negros island as a model of RE development and utilization Make the Philippines a manufacturing hub for PV cells to facilitate development of local manufacturing industry for RE equipment and components Encourage greater private sector investments and participation in RE development through market-based incentives Establish responsive market mechanisms for RE-generated power Formulate an effective management program for fuelwood utilization with the view of reducing environmental impact
Percentage of Population with Access to Electricity (%)	**76.9 %**
General Situation of Rural Electrification	As of 30 November 2006,the national electrification level stood at 94.58 percent (39.671 0ut of the 41,945(2000 census) barangays), Luzon has the most number of electrified barangays (19,892 out of 20,476 barangays) While Visayas is 96.24 percent electrified (11,013 out of 11,443 barangays) Mindanao has the lowest of barangays electrified with 8,766 out of 10,026 barangays , which un-electrified barangays comprises a little more than 50 percent of the country’s remaining un-electrified barangays.
Theoretical Potential of Hydropower (MW)	Current installed capacity of 2,518 MW

<table>
<tr><td>Definition of SHP in Your Country (MW)
(e.g. in China, it's 50MW and below)</td><td>Hydro plants are classified based on their capacities, as follows: (i) micro-hydro - 1 to 100 kW; (ii) mini-hydro - 101 kW to 10 MW; and (iii) large hydro - more than 10 MW. The total untapped hydropower resource potential of the country is estimated at 13,097 MW, of which 85 percent are considered large and small hydros (11,223 MW), 14 percent (1,847 MW) are classified as mini-hydros while less than 1 percent (27 MW) are considered micro-hydros. Some projects in Luzon are available for private financing, while 20 are undergoing feasibility studies and 82 are in the pre-feasibility stage.</td></tr>
<tr><td>Exploitable Potential of Small Hydro Power</td><td>SMALL HYDROS 11,223 MW</td></tr>
<tr><td>Exploitable Potential of Solar Energy (MW)</td><td>285 MW</td></tr>
<tr><td>Total Installed Capacity of Electric Power (MW)</td><td>TOTAL INSTALLED CAPACITY 16,359 MW</td></tr>
<tr><td>Installed Capacity of Hydropower (MW)</td><td>Current Installed capacity of 5,46 8 MW</td></tr>
<tr><td>Installed Capacity of SHP (MW)</td><td>1,518 MW</td></tr>
<tr><td>Installed Capacity of Solar Energy (MW)</td><td>21 MW</td></tr>
<tr><td>Power Price for End Users (US dollar)</td><td>US$ 0.26/KWH</td></tr>
<tr><td>Feed-in Tariff of SHP (US dollar)</td><td>US$ 0.137/KWH</td></tr>
<tr><td>Feed-in Tariff of Solar Energy (US dollar)</td><td>US$ 0.225/KWH</td></tr>
<tr><td>Hydropower Projects to be Constructed or Refurbished</td><td>2,950 MW</td></tr>
<tr><td>Main Difficulties in Developing SHP</td><td>a. Obtaining Permits & Licenses from Government Agencies
b. Financing of Hydro-Power Projects
c. High Interest rate</td></tr>
<tr><td>Solar Energy Projects to be Constructed</td><td><table><tr><td>2015</td><td>2020</td><td>2025</td><td>2030</td></tr><tr><td>269 MW</td><td>5 MW</td><td>5 MW</td><td>5MW</td></tr></table></td></tr>
</table>

Main Difficulties in Developing Solar Energy	a. Obtaining Permits & Licenses from Government Agencies b. Financing of Solar -Power Projects c. High Interest rate
Any Suggestion for Future Cooperation	Ensure sufficient, stable, secure, accessible and reasonably-priced energy supply Pursue cleaner and efficient energy utilization and clean technologies adoption Cultivate strong partnership and collaboration with key partners and stakeholders Empower and protect welfare of various energy public

Country	Thailand	
Basic Information (Geographical, Meteorological and Economic Conditions, Population, etc.)	**Location** : Southeastern Asia, bordering the Andaman Sea and the Gulf of Thailand, southeast of Burma **Area** : 513,120 sq km **Climate** : tropical; rainy, warm, cloudy southwest monsoon (mid-May to September); dry, cool northeast monsoon (November to mid-March); southern isthmus always hot and humid **Economic Conditions** **GDP per capita (PPP)**: $9,900 (2013 est.) **Agriculture products:** rice, cassava (manioc, tapioca), rubber, corn, sugarcane, coconuts, soybeans **Industries:** tourism, textiles and garments, agricultural processing, beverages, tobacco, cement, light manufacturing such as jewelry and electric appliances, computers and parts, integrated circuits, furniture, plastics, automobiles and automotive parts; world's second-largest tungsten producer and third-largest tin producer **Population** : 64,785,909 (2013) **Religions** : Buddhist (official), Muslim, Christian, other	

Energy and Power Resources (Energy Structure, Energy Institution, Energy Strategy, etc)	**Primary Energy Supply** : Coal & Its Product, Crude oil & NGL, Condensate, Natural gas, Petroleum products, Electricity, Renewable energy, Biofuels  **Energy Strategy** 1. Supply energy to achieve the national consumption 2. Support national energy stability and generate value-added of national energy 3. Monitor and supervise energy industry and energy price control 4. Develop alternative energy for sustainability and eco-friendly 5. Be leading organization with good governance
Percentage of Population with Access to Electricity (%)	99.3% (2011)
General Situation of Rural Electrification	There is still people living in remote areas without electricity; however, government agencies attempt to access those areas in order to install other alternative electric generators and supply electricity for them.
Theoretical Potential of Hydropower (MW)	
Definition of SHP in Your Country (MW) ***(e.g. in China, it's 50MW and below)***	10 MW and below.
Exploitable Potential of Small Hydro Power	324 MW.
Exploitable Potential of Solar Energy (MW)	The combine solar potential area accounts are around 14.3% of the country's overall areas. Mostly, the result of average daily solar exposure is around 19 – 20 MJ/m2–day, while the rest of country

	gains around 18 – 19 MJ/m2–day.
Total Installed Capacity of Electric Power (MW)	32,600 MW (2013)
Installed Capacity of Hydropower (MW)	3515.20 MW (2013)
Installed Capacity of SHP (MW)	108.80 MW (2013)
Installed Capacity of Solar Energy (MW)	823.46 MW (2013)
Power Price for End Users (US dollar)	11.67 USCent/kWh (3.50 Baht/kWh) (2013)
Feed-in Tariff of SHP (US dollar)	Adder : capacity 50-200 kW = 2.67 USCent/kWh (0.80 Baht/kWh) capacity < 50 kW = 5 USCent/kWh (1.50 Baht/kWh)
Feed-in Tariff of Solar Energy (US dollar)	- Household (0-10 kWp) = 23.20 USCent/kWh (6.96 Baht/kWh) - Small Enterprise (10-250 kWp) = 21.83 USCent/kWh (6.55 Baht/kWh) - Medium & Large Enterprise/Factory (250-1,000 kWp) = 20.53 USCent/kWh (6.16 Baht/kWh) (2013)
Hydropower Projects to be Constructed or Refurbished	- Small hydropower project (on-grid) - Hydropower project at village level (off-grid)
Main Difficulties in Developing SHP	- Regulations and laws. - NGOs
Solar Energy Projects to be Constructed	- PV grid connect (PV roof top and PV community) - PV off-grid for rural area - Mini grid hybrid with other renewable energy
Main Difficulties in Developing Solar Energy	- The cost of electrical produce from solar energy is quite high compared to the normal unit cost. - Regulations and laws.
Any Suggestion for Future Cooperation	

IV. Completed Activities in the Second Stage

Activity – 1: Preparations of the Seminar
Time: August- December 2014
Location: China, Indonesia
Participants: HRC, PLN PUSHARLIS
Implementation: HRC established cooperative relationship with PLN PUSHARLIS. The two Centers made considerable preparations for the Seminar together, including:

1. Round-trip international airline tickets and relevant insurances purchasing for all the participants, lecturers and organizers;
2. Invitation to Indonesian Ministry of Energy and Mineral Resources, ASEAN Secretariat, Mission of China to ASEAN, Indonesian State Electricity Company (PLN), etc.;
3. Establishment of working team for implementing the Seminar and submission of work reports to the related authority on the preparation to launch the project;
4. Selection and determination of the Seminar venue, a hotel to live in, a hydropower station and a small E/M manufactory to visit during the Seminar;
5. Arrangement of the necessary meeting facilities, all the meals, meeting room decoration, seminar material packages for the participants, diplomatic gifts, etc.;
6. Arrangement of airport and point-to-point pick-up & see-off services for all the participants, lecturers and officials from relevant departments who will attend the Seminar;
7. Completion of the speeches on the opening ceremony of the seminar and the draft cooperative initiative.

On December 6th, 2014, a working meeting was held between HRC and PLN PUSHARLIS in the office of PLN PUSHARLIS to settle down the details of seminar schedule.

f

Meeting rooms

Working Meeting at PLN PUSHARLIS

Activity – 2： Implementation of the Seminar
Time: December 8th -10th, 2014
Location: Bandung, Indonesia
Participants: Indonesian Ministry of Energy and Mineral Resources, ASEAN Secretariat, Mission of China to ASEAN, PLN, PLN PUSHARLIS, HRC
Implementation: Sponsored by Perez-Guerrero Trust Fund (PGTF) for South-South Cooperation, HRC organized and fulfilled successfully the Technical Seminar on Small Hydropower for ASEAN Countries which was held in Bandung, Indonesia

from 8th to 10th December. 14 officials (Mr. NATCHAPON VONGVISESSOMJAI from Thailand was absent because of personal reasons) from 8 ASEAN member countries, i.e. Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Thailand and Vietnam attended this significant event. A 6-member delegation headed by Deputy Director Dr. Xu Jincai of HRC went to Indonesia for undertaking all the work concerned. Much attention and great support have been attached to the seminar by Indonesian Ministry of Energy and Mineral Resources, ASEAN Secretariat, Mission of China to ASEAN, PLN. All the participants from the ASEAN member countries were selected by ASEAN Secretariat. Mr. Sun Yan, Counsellor of the Mission of China to ASEAN, and Mr. Djoko, Division Chief of New and Renewable Energy of the State Electricity Company of Indonesia were present at the grand opening ceremony and delivered a speech respectively. The only regret is that Dr. Alexander A. Lim, Division chief of Cross-Sectoral Cooperation Directorate ASEAN Socio-Cultural Community (ASCC) Department of ASEAN Secretariat and Mr. Abdi Dharma Saragih, Head of Sub-Directorate Investment and Cooperation of Various New and Renewable Energy of Indonesian Ministry of Energy and Mineral Resources were absent the opening ceremony due to the time conflict with their respective annual meeting.

The seminar aimed at providing a platform for the ASEAN member countries and China to fully share technologies and experience for the development of small hydropower, solar energy, and wind power, so as to promote in-depth communication and extensive cooperation among China and the ASEAN member countries in the field of rural electrification and renewable energy. During the seminar, the informative presentations were delivered, and a field visit was paid to a small hydropower station in the suburb of Bandung. The countries reports were made by the participants, and the in-depth discussions have been carried out cordially about the status quo, problems and prospect of SHP and other renewable energies.

Group Photo

Speech at the Opening Ceremony of Technical Seminar on Small Hydropower for ASEAN Countries

(Dr. Xu Jincai, Deputy Director of HRC)

Good morning!

Distinguished Mr. ABDI;
Distinguished Mr. SUN Yan;
Distinguished Mr. DJOKO;
Distinguished Mr. EMAN;

Dear participants,
Ladies and gentlemen,

Today, the Technical Seminar on Small Hydropower for ASEAN Countries, supported by the Mission of China to ASEAN and the ASEAN Secretariat, and organized by HRC and PLN, has its grand opening in Bandung, the beautiful "City of Flowers". I would like to take this opportunity, on behalf of HRC, to extend my warmly welcome to all distinguished guests and friends attending this opening ceremony.

In China, Hangzhou Regional Center (Asia-Pacific) for Small Hydro Power (domestically called National Research Institute for Rural Electrification), since its establishment in 1981 under the co-sponsorship of UNDP and the Chinese Government, has spared no effort in undertaking the long-term extensive cooperation with ASEAN countries in the field of renewable energy, inclusive of human resources training, international cooperation on science and technology, engineering design,

consultation and supply of SHP equipment and so on. The bilateral cooperation on small hydropower has been successfully carried out between China and ASEAN members, greatly promoting the local utilization of water resources and the development of rural electrification.

Entrusted by Chinese Government and international organizations, HRC has been honored to host the training programs. Until now, 70 international training workshops or seminars on small hydropower and rural electrification have been successfully held in HRC, with more than 1,500 officials or technicians from over 100 countries involved in, among which, 199 participants were from ASEAN countries. In July of this year, under the sponsorship of the ASEAN Secretariat and with the support from the Mission of China to ASEAN, the one-week ASEAN-China Training Workshop on Small Hydropower and Solar Energy System for Rural Electrification was held in Hangzhou, China, with the participation of 9 officials and experts from the fields of energy and power in 7 ASEAN members, which was also proven to be very productive. Although remarkable achievements were scored, we will make unremitting efforts to well fulfill more programs in future.

Here, the subject of the seminar kicking off today is small hydropower. As we know, small hydropower is a renewable energy which has been universally accepted by the international society and embraces obvious advantages of rich resources, proven technology, economic viability, easy dispatching and high return rate. In China, the government has attached great importance to the development of SHP, which plays a significant role in rural electrification. Thanks to small hydropower, so far, China has built up more than 1000 rural electrification counties. The electrification rate to household in rural hydropower supply areas has been raised from less than 40% in 1980 to 99.8% in 2013.

Our seminar is designated to provide a platform for China and the ASEAN member countries to fully discuss and communicate in the field of small hydropower, focusing on the sharing and exchange of updated technology and management practice. In the coming two days, not only the special presentations and the in-depth discussions will be arranged, but also the study tour will be scheduled to the local SHP station and the workshop of PLN. It is highly expected that all of these activities will be really beneficial to future cooperation among China and the ASEAN countries.

Finally, I want to express my deep gratitude to the Mission of China to ASEAN and the ASEAN Secretariat for their great support; to the Ministry of Energy and Mineral Resources of Indonesia and PLN, for their kind assistance; and to all of our dear participants for their active involvement. It is highly expected that this seminar will further strengthen the intensive communication and extensive cooperation in the field of SHP, and promote rural electrification for all the participating countries. I would like to wish this rewarding event a great success.

Thank you very much!

Remarks by Counselor Sun Yan at the Opening of Technical Training Workshop on Small Hydro Power for ASEAN Countries

（Bandung, December 8, 2014)

Respected Deputy Director Xu Jincai,

Representatives from ASEAN countries,

Welcome you all to Bandung to attend the Technical Training Workshop on Small Hydro Power. On behalf of the Chinese Mission to ASEAN, I would like to extend our warm congratulations on the opening of the workshop.

China and ASEAN are strategic partners. Energy is one of our prioritized cooperation areas. From traditional fossil energy to hydropower, wind energy, biomass energy and other clean and renewable energy, the two sides have carried out extensive cooperation in energy trading, technology exchanges, projects construction to jointly maintain energy security and support economic development.

Hydropower has an important place in China-ASEAN energy cooperation, not only because both China and ASEAN

countries are rich in hydropower resources, but also thanks to its mature technology, low cost and stable supply, hydropower plays an important role in rural electrification and comprehensive development, which meets the urgent needs of China and ASEAN countries in areas of rural poverty reduction, urbanization and narrowing rural-urban development gap.

By the end of 2013, China has constructed more than 46000 small hydro power stations, with an installed capacity of 72GW that annually generates electricity of 223 billion KWH. With the development of small hydro power and the construction of power grids, about half of the country's territories covering one third of the counties and towns and a rural population of over 300 million people have access to electricity. It has saved 76 million tons of standard coal, reduced 190 million tons of CO2 emission and generated very substantial economic, social and ecological benefits. In developing hydropower resources, China upholds the idea of comprehensiveness, environmental friendliness and sustainability, adheres to the principle of taking from nature and protecting nature.

China and ASEAN have carried out deep cooperation in hydropower development. By exploiting the advantages in

technology and management, the Chinese companies have undertaken many projects in Thailand, Cambodia, Myanmar, Vietnam, Lao and Indonesia, including the Jatigede Dam in Indonesia, Bakun Hydropower Plant in Malaysia and Namlik 1-2 Hydropower Project in Lao. With the projects delivered and technology and management expertise transferred, the cooperation has improved the hydropower capacity in ASEAN countries, and made positive contributions to the regional social and economic development.

ASEAN Community is expected to reach a mile stone by the end of next year. China is committed to increasing its support to ASEAN in infrastructure construction, narrowing development gaps and etc. The Chinese side has initiated to establish Lancang-Mekong River Dialogue of Cooperation, set up China-ASEAN infrastructure special loans of 10 billion USD, provide under-developed ASEAN countries with aid of 3 billion RMB to support ASEAN narrowing development gap. All these initiatives will present more opportunities and resources for China-ASEAN cooperation in hydropower development.

Having small hydro power as the theme of the training is very pragmatic and well-directed. The exchanges between officials and experts from different countries will transfer not

only the technology but also the development mentality and cooperation confidence, which is doomed to make great contribution to China-ASEAN hydropower cooperation.

I wish the workshop a great success. Thank you all!

Speech at the Opening Ceremony of Technical Seminar on Small Hydropower for ASEAN Countries

(Mr. DJOKO R. ABUMANAN, Head of New Energy and Renewable Energy Division, PLN)

The Honorable from Embassy of Republic of China to ASEAN, Mr. Sun Yan.
The Honorable from National Research Institution for Rural Electrification – Hangzhou Regional Center, Prof. XuJincai.
The Honorable from Pusharlis Mr. Eman.
The Honorable ASEAN delegations.
The committee members our beloved ladies and gentlemen.

Good morning.
Selamatdatang.
WilujengSumping.

Welcome to Bandung.
Bandung city is the new destination in Asia and culture City.

First of all let us express our gratitude to good mighty due to this blessing the all come together here in the special members.

The follow members of technical seminar of small hydropower plant for ASEAN Countries.

In the associate I would like to express our appreciate the gratitude of your coming in workshop especially best practice in workshop
Now ASEAN countries included Indonesia have a good relationship as

development country and have similarity culture and custom.

Ladies and gentlemen nowadays our word is in globalization era. We often here in the globalization is the process transformation of a local or regional phenomena included global or international phenomena. This process is a combination of economic, technology, and information, social, culture and political force, included performance learning in our world can influence other country so the board of the PLN policy is inline. The board of PLN always open the corporate other parties and institutional relation to electrical power but domestically and abroad is the field of development of operation, telecommunication, information and operation technology system supported by quality and human resources of development.

We hope that to the exchange of information experience after workshop of small hydropower plant the added valuable benefit to each other. I do sincerely hope that we can expand our relationship some joint cooperation in the future to achieve our mutual goals as progressive, reliable and capable world class company in electricity business.

Finally once again we would like to thank you very much for your coming. Please enjoy your time during your stay and done meet the wonderful and family culture in Bandung.

Especially the culinary.

Thank you very much your attention.

Terimakasih.

Speech at the Closing Ceremony of Technical Seminar on Small Hydropower for ASEAN Countries

(Mr. MOHD FAUZI BIN ISMAIL, Malaysia)

Thank you Madam Chairperson,

Dr. Xu Jincai, Deputy Director fo HRC

Mr. Lin Ning , Chief of Foreign Affairs and Training Division, HRC

Mr. Eman Prijono Wasito Adi of PLN PUSHARLIS

Dear colleagues from ASEAN Countries

Good afternoon to all of you.

Ladies and Gentlemen,

It gives me a great pleasure to be here this afternoon, on the ocassion of the closing ceremony, to deliver a short speech, on behalf of my dear colleagues from ASEAN member countries.

First of all, I would like to congratulate and thank the organizing committee, HRC and its counter part here in Indonesia, PLN for successfully completed 3 days Technical Seminar on Small Hydropower for ASEAN countries.

It is indeed very informative to know the development of small and minihydro system in China and Indonesia, which I considered are at the advanced stage, in terms of technology development, technology deployment and utilization of Hydropower, especially in this part of the world.

The contribution of hydropower to rural electrification certainly cannot be denied with the availability of water resources and suitable geographical conditions, hydropower provide cost effective, sustainable energy for rural areas.

I do believe there are still many remote areas in our countries which are deprived of electricity. In the case of Malaysia, remote area in Sabah, Sarawak and mountainous areas in Peninsular Malaysia are potential community which can benefit from hydropower in the future.

Similarly to my dear colleagues from ASEAN Countries, I believe we can share the experience and knowledge gained in this 3 days seminar to further promote this technology. I do hope HRC would be able to extent its technical assistance in the form of :

1. capacity building of human resource through training and seminars
2. technology transfer
3. technology deployment and
4. project implementation

So that we can realize hydro potential in our countries.

I am sure with HRC vast experience in project implementation at various countries world wide, HRC is indeed well positioned to provide those expertise to help develop to actual potential in hydropower in all ASEAN countries.
In the spirit of ASEAN economics community which will be realized next year 2015, I do believe the existing cooperation will be further enhanced to achieve greater economic cooperation among ASEAN member countries and similarly ASEAN plus China.

Ladies and Gentlemen,

We have gathered here for almost 3 days and we do learn a lot through sharing of experience, we understand the subject matter better and the most important,

we began to know each other and in directly develop networks of people who share similar interest in small hydropower system. ↵

↵

We do hope that through exchange of name cards, we will continue and be in contacts in the future. If anyone of you today happen to be in Kuala Lumpur in the future, do let us know. We are more than happy to show you around what Kuala Lumpur has to offer, more than just our Petronas Twin Tower.↵

↵

1. beuatiful beaches in Malaysia↵
2. shopping paradise↵
3. beautiful landscape in the remote area, such as National Park & Wild Life↵

↵

Finally, once again I would like to congratulate for the successful completion of this technical seminar on Small Hydro for ASEAN Countries. Special thanks to HRC and PLN who has been working hard to ensure a smooth program, and taking care of our well being and hospitality from the day we reached Bandung until our departure from Bandung later. ↵

↵

THANK YOU, TERIMA KASIH, XIÈ –XIÈ↵

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Excerpts of PPT Country Reports

Current Status of New and Renewable Energy in Cambodia

By Mr. CHHUNN CHHIM
Head of Renewable Energy Office
Department of New and Renewable Energy
MINISTRY OF MINES AND ENERGY (MME)

Technical Seminar on Small Hydropower for ASEAN Countries from 07-10 December 2014, Bandung, Indonesia

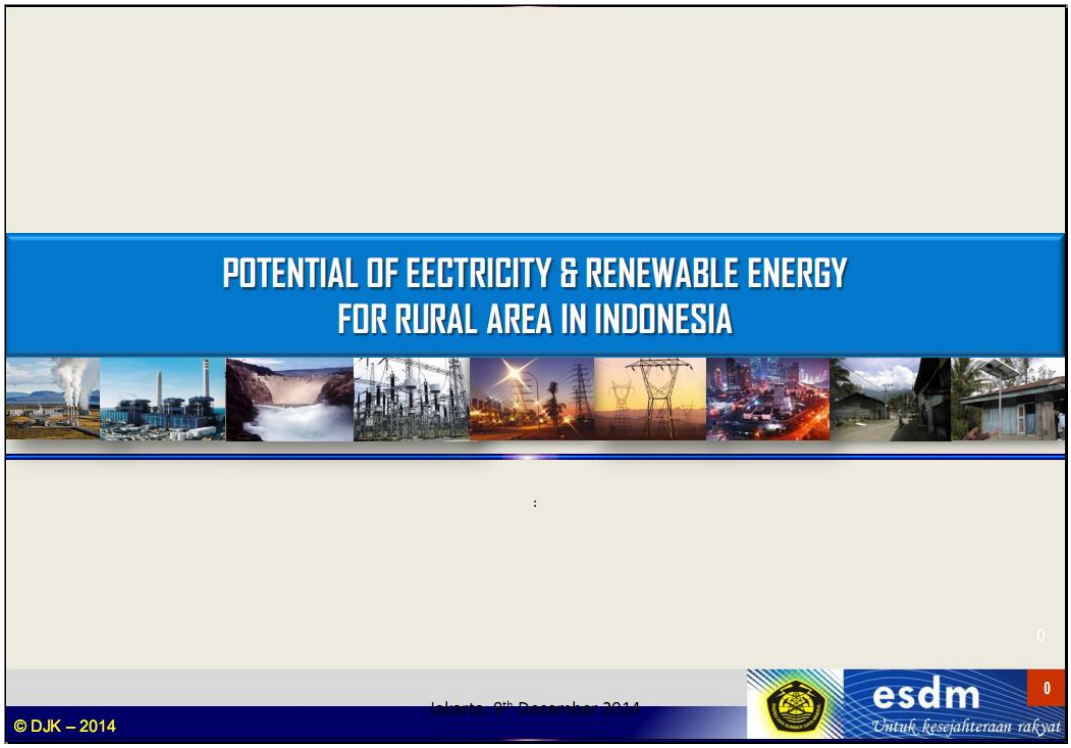
1

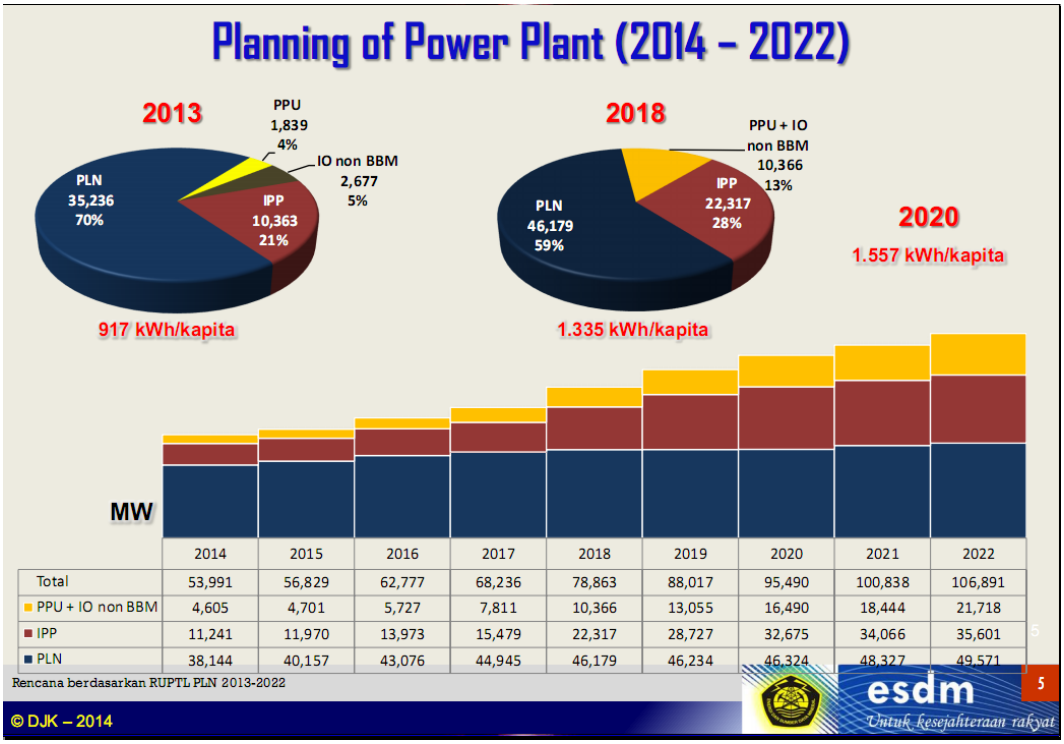
Completed and On Going Activities Related to Renewable Energy projects

I- HYDROPOWER POTENTIAL

- Cambodia is a rich of water resources for hydropower development;
- Development of hydropower projects will help the Kingdom of Cambodia to develop its socio-economic condition and reduce poverty;
- Total hydropower potential is about 10,000 MW as the following:
  - 50% in the Mekong River mainstream,
  - 30% in the tributaries of Mekong River and
  - 20% in the South-western coastal area outside the Mekong Basin.

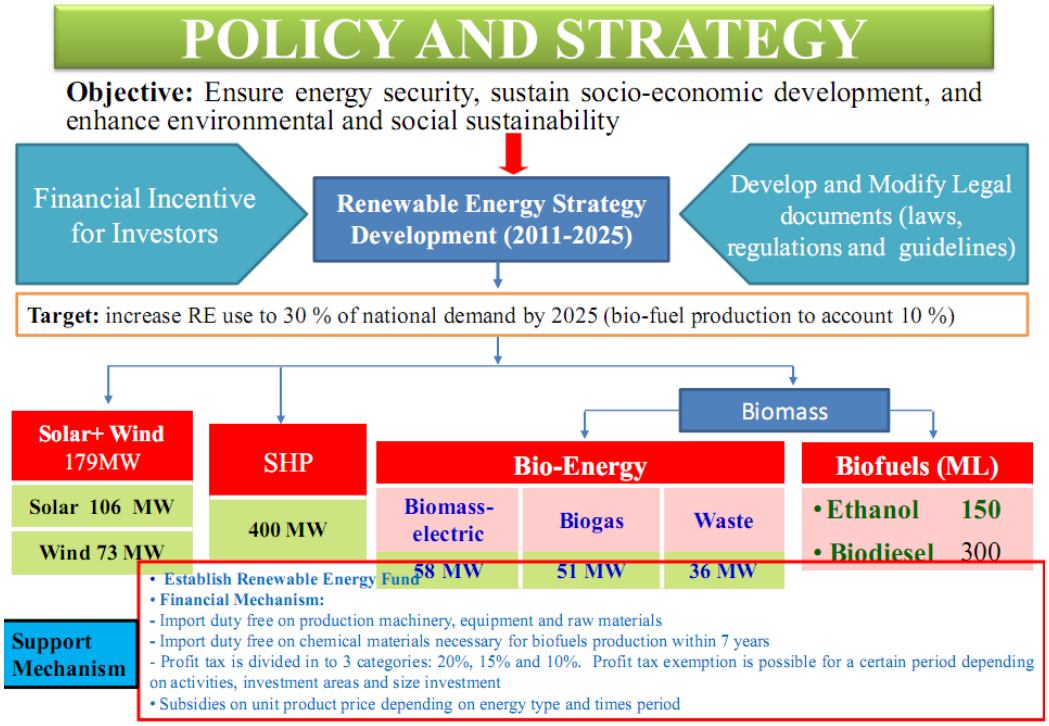
Country Report by Cambodian Delegate





	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total	53,991	56,829	62,777	68,236	78,863	88,017	95,490	100,838	106,891
PPU + IO non BBM	4,605	4,701	5,727	7,811	10,366	13,055	16,490	18,444	21,718
IPP	11,241	11,970	13,973	15,479	22,317	28,727	32,675	34,066	35,601
PLN	38,144	40,157	43,076	44,945	46,179	46,234	46,324	48,327	49,571

Country Report by Indonesian Delegate



Country Report by Lao Delegate

COUNTRY REPORT: MALAYSIA

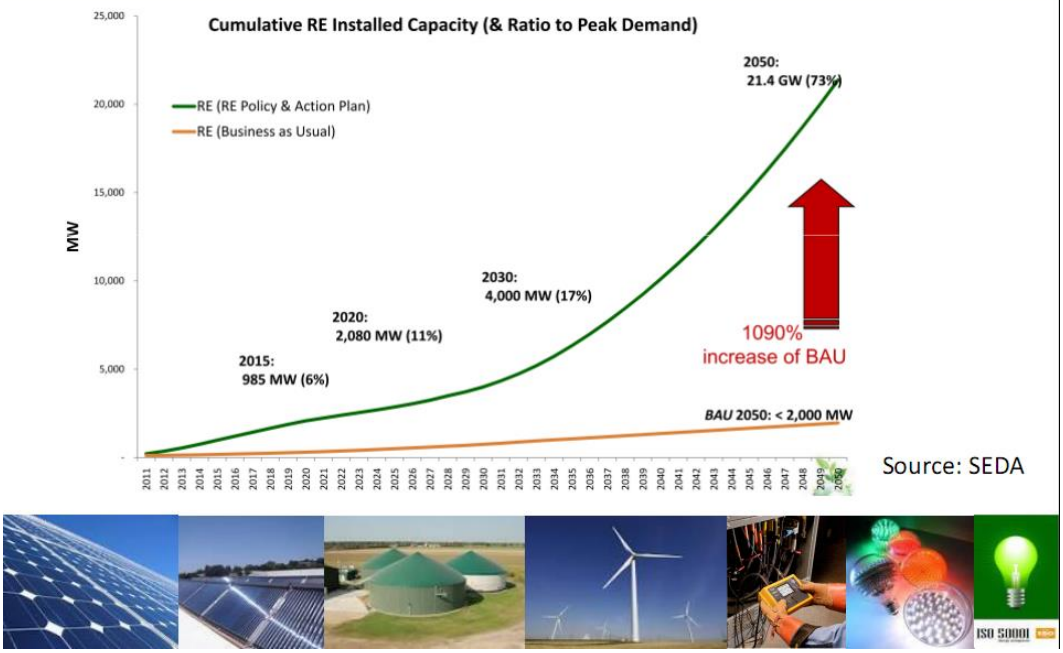
MOHD FAUZI ISMAIL
GENERAL MANAGER,
RENEWABLE ENERGY RESEARCH CENTRE,
SIRIM, MALAYSIA

Presentation Outline

SIRIM

RE Policy & Action Plan: Targets

SIRIM



Country Report by Malaysian Delegate

Technical Seminar on Small Hydropower for ASEAN Countries
(Indonesia)

Rural Renewable Energy in Myanmar

Ei Ei Mon

Ministry of Science and Technology

Republic of the Union of Myanmar

Barriers to Develop RE

- ✓ Lack of statistical information and data collection of RE sources;
- ✓Many initial stages in PV and Wind Generation;
- ✓ Weak of cooperation among Organizations regarding RE sector development;
- ✓ Awareness of RE technologies;
- ✓ Weak of private sector participation in RE;
- ✓ High Initial Cost for Villagers of Low-income (Financial Problem);
- ✓ Weak in transferring Technologies of RE.

Country Report by Burmese Delegate

The Government of the Philippine Republic

HYDROPOWER Energy Development: The Philippine Experience

Technical Seminar on Small Hydropower for ASEAN Countries
07-10 December 2014, H Clarity Champelas, Bandung, Indonesia

By: Engr. Loreto C. Carasi[1]
Engr. Joel L Voces[2]

Philippine Council for Industry, Energy and Emerging Technology Research and Development
Department of Science and Technology[1]

PROCLEAN Energy Consultancy and Development[2]

Overview of HYDROPOWER Sector

- Identified as dominant source of RE-Based Capacity
- Untapped Potential= 13,097 MW

Location	Hydropower Resource Potential (MW)	% Share
Large hydro	11,223	85.7
Mini-hydro	1,847	14.1
Micro-hydro	27	0.2
Total	13,097	100.0

Source: DOE

Country Report by Philippine Delegate

Overview of Thailand

- **Geography**: Area 513,120 km^2, mountain in the North, river floodplain in Central and coastal area in the South
- **Climate**:Tropical characterized by Monsoon with 3 seasons; summer(Feb-Apr), rainy season (May-Oct) and Winter (Nov-Jan)
- **Population**: 69.12 Million
- **Economy**: GDP (Purchasing Power Parity as of 2013)
  - Total = 964.50 Billion US$
  - Per Capita = 14,136 US$

TEAM GROUP

problems

- Less opportunity of HP project in Thailand

TEAM GROUP

Alternative Energy Development Plan 2012-2021 (Ministry of Energy)

Goal – Committed to the development of low-carbon society

Target – 25% of AE in total energy consumption by 2021

Promote AE Community uses	Encouraging Private Investment	Improve Support infrastructure	Promote R&D As a tool for RE industry	Publicly Promote better understanding	Supporting Law and regulations

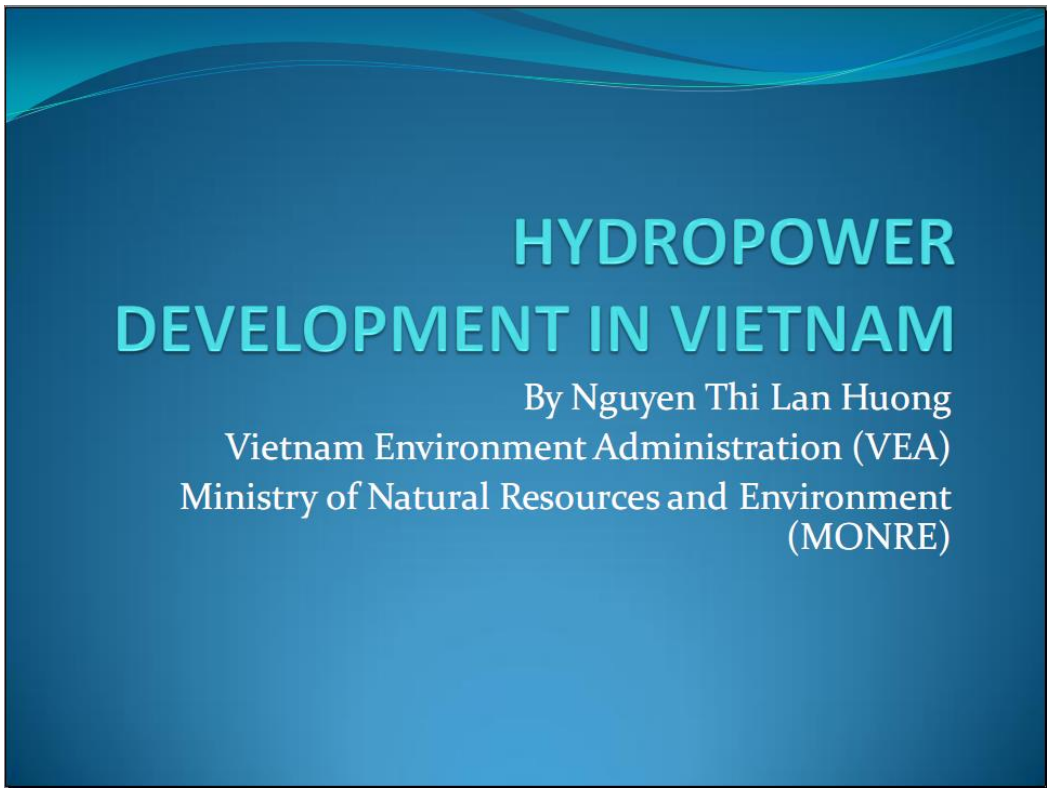
Solar	Wind	Hydro Power Plant	New Energy
2,000 MW (141.97 MW)	1,200 MW (7.28 MW)	1608 MW (95.70 MW)	Geothermal 1MW (0.3 MW)
			Tidal and Current 2 MW (0 MW)

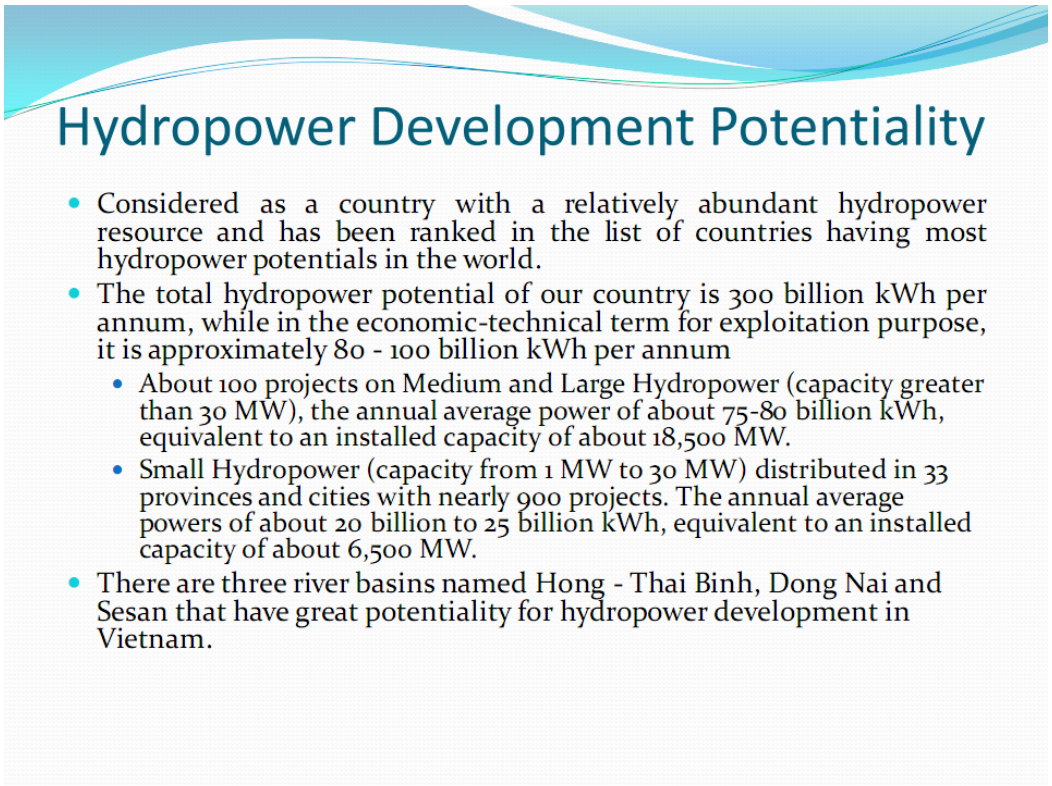
Bio-energy		
Biomass	Bio-gas	MSW
3,630 MW (1,790 MW)	600 MW (169.54 MW)	160 MW (27.48 MW)
4,390 MW (1,987.02 MW)		

Total 2021 Target = 9,201 MW

(2012 = 2232.27 MW)

Country Report by Thai Delegate



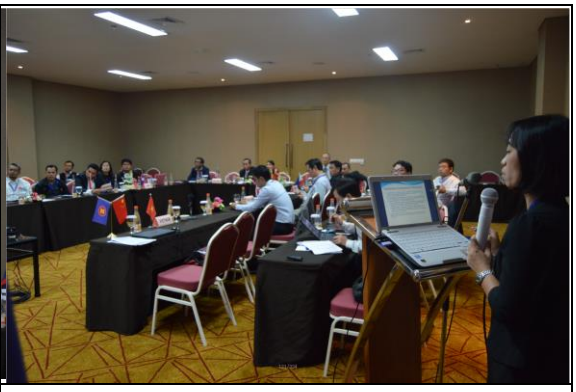


Country Report by Vietnamese Delegate

Photos of Main Activities

Opening Ceremony

Self-introduction



Country Report

Lectures on Special Topic

Thank-you Speech at Closing Ceremony

Delivering Certificates

Visiting Bengkok Hydropower Plant

Group Photos in the Hydropower Plant

Meeting in the Hydropower Plant

Visiting the Workshop

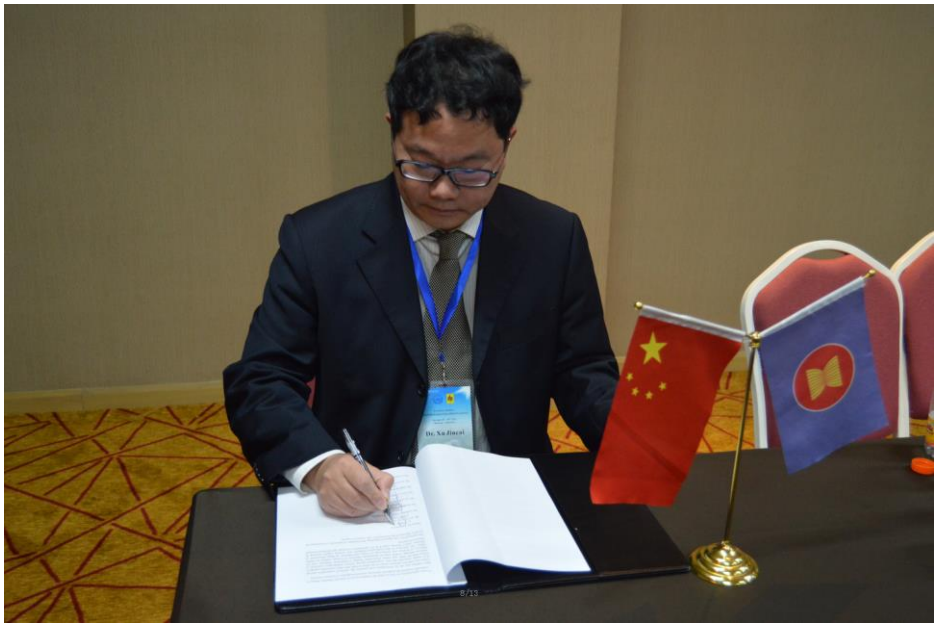
Farewell Party

On the Sightseeing Bus

Tangkubanperahu Mountain Sightseeing

V. Completed Activities in the Third Stage

Activity – 1： Signature of a Cooperative Initiative among HRC and participants
Time: December 9th, 2014
Location: Bandung, Indonesia
Participants: HRC and all the participants
Implementation: On 9th December, base on technical presentations, field study, in-depth communications and discussions, the Cooperative Initiative on Small Hydropower and Other Renewable Energies between China and ASEAN Member States was agreed unanimously and signed jointly, laying a good foundation to promote the concrete cooperation on renewable energy in near future.



Initiative Signing

Cooperative Initiative

on

Small Hydropower and Other Renewable Energies

between

China and ASEAN Member States

During December 8th-10th 2014, "Technical Seminar on Small Hydropower for ASEAN Countries" was held successfully in Bandung, the Republic of Indonesia.

Under the support of Perez-Guerrero Trust Fund (PGTF) for South-South Cooperation, the significant event was organized through the Mission of the People's Republic of China to ASEAN and ASEAN Secretariat by Hangzhou Regional Center (Asia-Pacific) for Small Hydropower (domestically called 'National Research Institute for Rural Electrification') (hereinafter referred to as 'HRC/NRIRE') together with PT PLN (Persero) Pusat Pemeliharaan Ketenagalistrikan and attended by fourteen (14) participants from eight (8) ASEAN Member States, including Cambodia, Indonesia, Malaysia, Philippines, Laos, Myanmar, Thailand and Vietnam (as shown in the attachment and hereinafter referred to as 'the Participants').

Based on various technical presentations, site visits and in-depth exchange of information from HRC/NRIRE experts and the Participants the following were highlighted:

Recognizing energy insufficiency, low electrification rate and deficiency of competent expertise for power sector, and residents living in remote, island, rural and hilly areas of most of the ASEAN Member States, electric power are still not accessible, thus restricting social and economic development;

Considering small hydropower (hereinafter referred to as 'SHP'), as proven and environmentally sound energy, can be operated independently for the remote areas to start-up, establish and promote local industries, thus contributing to improvement of living facilities, and to achieve a sustainable development;

Recalling in past 20 years, most of the ASEAN Member States and China recognized great importance to develop SHP, wind, solar and other renewable energies technologies (RETs). In addition, appropriate policies, acts or regulations were

formulated and pragmatic measures and approaches are taken accordingly to promote and encourage SHP development and other renewables;

Acknowledging the importance of experience sharing and multilateral cooperation among the Participants and People's Republic of China in the field of renewable energy development for rural electrification;

Noting a good political and business environment for the development of SHP and other renewable energies are now in-placed, although the result is still far from expected;

Seeking to strengthen the cooperation among the Participants' organizations and other related sectors by establishing a China-ASEAN Cooperation Platform in the field of renewable energy and rural electrification under the principle of equal dialogue, mutual understanding, sustainable development and practical cooperation;

As results of the Seminar, the following set of recommendations were considered and endorsed by the participants from both China and ASEAN Member States to further promote SHP and other renewable energy cooperation, aiming at achieving the cooperative objectives based on reciprocity and mutual benefit as follows:

- Synergize and develop the existing and future bilateral and multilateral cooperation and integrate SHP and other renewable energy cooperation platforms in the field of rural electrification;
- Carry out resource assessment and study on the development mode of renewable energies to intensify the synthetic management of renewable energy, and improve the capacity of all member states for SHP development and rural electrification;
- Enhance mutual understandings through focused & efficient exchange of expertise and best practices in sustainable, environmentally sound and integrated SHP and other renewable energy development & utilization;
- Promote technology transfer through the exchange of knowledge, technology and information on SHP and other renewable energies in order to meet common challenges caused in particular by on-going socio-economic development, urbanization and climate change;
- Tackle technical problems on rural electrification through effective use of renewable & clean energy;

- Create opportunities as well as unite the related sectors in ASEAN Member States to undertake business development and joint research programs of common interest;

HRC/NRIRE and all the Participants will promote the practical cooperation among China and ASEAN Member States in the field of SHP and other renewable energies. It is highly expected that the cooperation among various stakeholders involved in China-ASEAN SHP and Other Renewable Energy Cooperation Platform will be explored through UNDP, ASEAN Secretariat, Ministry of Foreign Affairs of China, Ministry of Science and Technology of China and Ministry of Water Resources of China. The activities of the Cooperation Platform may include regular meeting & dialogue, policy sharing, joint R & D, information exchange and business-oriented projects if required.

The INITIATIVE was signed in Bandung, the Republic of Indonesia on December 9th of 2014. The text of the INITIATIVE was written in English.

Signed by: (Signature)

Mr. XU JINCAI, Deputy Director of HRC/NRIRE, China

Mr. CHHIM CHHUNN, Cambodia

Mr. ROBERT SITUMORANG, Indonesia

Mr. SLAMET KASBI PERTONYAMAN, Indonesia

Mr. FANI ENDRWAN, Indonesia

Mr. AMITH PHOMPHIMPHA, Laos

Ms. TEANGORN HQMPOUVONG, Laos

Mr. KASIM BIN AHMAD, Malaysia

Mr. MOHD FAUZI BIN ISMAIL, Malaysia

Mr. EI EI MON, Myanmar

Mr. JOEL LORENZO VOCES, the Philippines

Mr. LORETO CANTIL CARASI, the Philippines

Mr. NATCHAPON VONGVISESSOMJAI, Thailand

Mr. TAWIN PRIKMAK, Thailand

Ms. NGUYEN THI LAN HUONG, Vietnam

Activity – 2： Signature of a MOU between HRC and Indonesian partner institution
Time: December 11th, 2014
Location: Bandung, Indonesia
Participants: HRC, PLN PUSHARLIS
Implementation: On 11th December, HRC delegation led by Deputy Director Dr. Xu Jincai paid a visit to PLN PUSHARLIS in Bandung, which, as a center for electricity maintenance under the leadership of the State Electricity Company of Indonesia, focuses on manufacturing and maintenance of mechanical equipment for power stations, technical rehabilitation and the engineering service. It is highly expected that the cooperation between HRC and PLN PUSHARLIS will be strengthened in the field of SHP R+D, equipment fabrication and supply, technical innovation and training, etc. With all the advantages of both sides, HRC and PLN PUSHARLIS will enjoy a prosperous prospect for widening cooperation in many areas such as the research and application of decentralized power supply technology and the development of renewable energy resources on islands, inclusive of marine energy, solar energy and wind power. On the basis of the in-depth discussion and exchange, a MOU was signed for future bilateral cooperation.

Signing MOU

MEMORANDUM OF UNDERSTANDING (MOU)

Between

Hangzhou Regional Center (Asia & Pacific) for Small Hydro Power (HRC)/
National Research Institute for Rural Electrification (NRIRE),
Ministry of Water Resources, People's Republic of China

And

PT PLN (PERSERO) PUSAT PEMELIHARAAN KETENAGALISTRIKAN,
The Republic of Indonesia

(Hereinafter collectively known as **HRC** and
PLN PUSHARLIS accordingly)

I. BACKGROUND

The delegation of 6 persons from Hangzhou Regional Center (Asia & Pacific) for Small Hydro Power (briefed as HRC) of Ministry of Water Resources, P. R. China paid a visit to Bandung, The Republic of Indonesia during December 4th-11th, 2014 for conducting Technical Seminar on Small Hydropower for ASEAN Countries. During the period of the Seminar, a visit was paid from HRC to PLN PUSHARLIS, and a friendly discussion was held on mutual cooperation among the attendants as follows:

***Chinese side*:** Mr. XU JINCAI (Deputy Director General), Mr. LI ZHIWU (Division Chief), Mr. LIN NING (Division Chief), Mr. XU WEI (Vice Division Chief), Ms. SHEN XUEQUN (Senior Engineer) and Ms. ZHANG TIAN (Project Manager);

Hangzhou Regional Center (Asia-Pacific) for Small Hydro Power (briefed as HRC), is the leading institute engaged in promoting the development of hydropower and rural electrification by training, R&D, consultancy, planning, design, E/M equipment supply, information dissemination etc. HRC was established in 1981 under joint sponsorships of Chinese government and the United Nation's organizations such as UNIDO and UNDP, and located at 122 Xueyuan Road, Hangzhou 310012, China.

***Indonesian side*:** Mr. EMAN PRIJONO WASITO ADI (Head), Mr. ISWAN PRAHASTONO (Manager of Technical), Mr. R. KARYANA (Assistant to Manager of Planning), Mr. SUHARTO (Manager of Workshop & Maintenance Unit IV);

PT PLN (Persero) Pusat Pemeliharaan Ketenagalistrikan (in English called PLN Center for Electricity Maintenance, briefed as PLN Pusharlis), is one of PLN units and its business is in field of Maintenance, Repair and Engineering Services for electricity equipment especially owned by PLN and its subsidiary units, and located at Jalan Banten No. 10, Bandung 40272, Jawa Barat, Indonesia.

Recognizing the existing friendly relation between the two countries, and the fact that both are facing common challenges with respect to the utilization & sustainable development of small hydropower (hereinafter referred to as 'SHP') and other renewable energies;

Desiring to strengthen and further enhance cooperation between both countries in the field of SHP and other renewable energies development;

Believing such cooperation serves their common interests and contributes to the enhancement of renewable energy development in China and Indonesia;

Have reached common understanding on cooperation in capacity building, R&D, information exchange etc. in the field of renewable energies.

II. THE AGREEMENT

HRC and PLN PUSHARLIS, subject to the terms of this Memorandum of Understanding

(hereinafter referred to as "this MOU") and the laws, statutes, rule and regulations as well as national policies in each country, agree to extend cooperation in the development of SHP and other renewable energies in Indonesia and other ASEAN countries on the basis of equality and mutual benefit.

1. To jointly apply for cooperative projects in the field of renewable energy development from the respective governmental authorities to seek the financial support;
2. To conduct the cooperation in the evaluation & research on the development of the renewable energy resources on islands;
3. To establish a joint venture in technical R&D, project designing and the manufacturing of SHP equipment;
4. To join into the construction of hydropower projects, including the popularization of containerized mini hydropower plant (CMHP), and undertaking the technical rehabilitation on SHP stations in Indonesia.

III. DURATION

This MOU shall be in effect from the date of signing for one (1) year and can be extended by mutual agreement of both Parties.

The Parties agree that regular contacts shall be maintained between the relevant offices of both sides to facilitate consultations on the exchanges and cooperation as well as matters of common concern.

The Parties hereby declare that they are competent within their respective jurisdiction/rules to enter into this MOU and the terms and conditions of the MOU have been settled in a transparent manner.

IV. SIGNATURE

This MOU drawn up in duplicate in English of equal effectiveness is herewith signed on December 11, 2014 in Bandung, The Republic of Indonesia.

IN WITNESS WHEREOF, parties have executed this MOU in the manner and the date set for the herein above.

Mr. XU JINCAI
(Deputy Director General)

Hangzhou Regional Center (Asia & Pacific) for Small Hydro Power (HRC), National Research Institute for Rural Electrification (NRIRE), P.R. China

Mr. EMAN PRIJONO WASITO ADI
(Head)

PT PLN (PERSERO) PUSAT PEMELIHARAAN KETENAGALISTRIKAN, The Republic of Indonesia

VI. Work Plans in the Fourth Stage

1. On 6th December, 2015, Mr. Eddy, former HRD Director of PLN and Mr. Eman, Head of PLN PUSHARLIS paid a return visit to HRC and visited a hydropower E/M manufacturer accompanied by HRC's staff, Indonesian side discussed in details with HRC's experts regarding to the technical scheme and financing program of several potential hydropower projects in Indonesia. There are great possibilities for cooperation between HRC and PLN PUSHARLIS.

Meeting at HRC

Manufactory Visit

2. HRC shall take advantage of the “Sharing of Rural Electrification Mode and Technology Based on Clean Energy” project subsidized by China-APEC Cooperation Fund to promote the establishment of a mutual benefit mechanism for balancing regional electricity supply and demand among ASEAN member countries relying more and more on clean energy;

3. By virtue of good international environment between China and ASEAN member countries and with the backing of incentive policies of all countries in the field of renewable energy, HRC shall make efforts together with relevant departments in ASEAN countries to win the financial support from respective government and international organizations which shall be the powerful guarantee for substantive cooperation in the future;

4. HRC shall actively apply for the Indo-China Peninsula Poverty Reduction Cooperation Fund to launch the bilateral and multilateral projects, in order to popularize the Containerized Mini Hydropower Plant (CMHP) technology and equipment to ASEAN member countries and then build the demonstrative hydropower stations, to promote SHP reasonable development, preserve the ecological environment for these countries and intensify the mutual beneficial cooperation, and to effectively raise the rural electrification level of ASEAN countries;

5. According to the actual situation in ASEAN member states, HRC shall set up a simulation demo platform on SHP, wind energy and solar energy hybrid system based on the existing research in selected countries, and carry out the research on multi renewable energy hybrid and energy-storage technologies;

6. In response to the national “One Belt and One Road” construction strategy, HRC shall strengthen the research on ocean energy, island distributed power supply mode and renewable energy development, and jointly apply for a China-ASEAN Offshore Fund project with relevant research institutes of Malaysia, Indonesia, the Philippines and other ASEAN member countries.

VII. Financial Costs and Expenses

The project costs for activities are strictly based on the financial budget. HRC organized financial staffs specifically for evaluation and review of the economy for the project. Project leaders are also responsible for monitoring of cost for each activities regarding to the project and required for submission of periodical report to the General Director of HRC for processing and stage of the project.

No.	Items	PGTF Fund	HRC Fund	Total
1	Training materials	1,500 USD	1,840 USD	3,340 USD
2	International round travel	14,000 USD	12,800 USD	26,800 USD
3	Accommodation and food	8,000 USD	9,800 USD	17,800 USD
4	Allowances for lecturers	1,700 USD	4,800 USD	6,500 USD
5	International consultants	1,500 USD	3,000 USD	4,500 USD
6	Local insurance	500 USD	1,500 USD	2,000 USD
7	Seminar	2,000 USD	2,300 USD	4,300 USD
8	Local transportation	500 USD	1,700 USD	2,200 USD
9	Unpaid PGTF fund	3,300 USD	0	3,300 USD
	Total	33,000 USD	37,740 USD	70,740 USD

Bank Information:

Organization：水利部农村电气化研究所

Bank Account：1202026209008801954

Bank Name：工行杭州高新支行

VIII. Conclusion

The project is implemented by the Hangzhou Regional Center (Asia-Pacific) for Small Hydro Power (HRC). The rewarding event, designated to provide a platform for China and the ASEAN member states to fully discuss and communicate in the field of small hydropower, has achieved a complete success. The officials and experts from different countries shared not only the technology, but also the development methodology and cooperation confidence, which is deemed to make great contribution to economic and technical China-ASEAN cooperation in the field of hydropower and rural electrification. It is expected that the participants, as the direct beneficiaries, can apply the knowledge gained during the seminar and at the same time, transfer the knowledge to other people in their respective country.