Asia-Pacific
Economic Cooperation

Mapping out of Solar PV Training Institutions in APEC Developing Economies

FINAL REPORT

APEC Secretariat

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1. INTRODUCTION

1.1 BACKGROUND

Installations of solar photovoltaic (PV) systems have enjoyed a tremendous and steady growth for over a decade worldwide, addressing the need for renewable sources of energy. Solar PV systems are one of the strategic solutions perfectly adapted to developing economies in order to meet the objectives of reducing emissions of greenhouse gases (GHG) related to electricity production. Solar PV rooftop installation is becoming a viable solution to reduce the burden on electricity grid for households, especially in cities with under capacity and/or growing electricity needs. The adoption of pro-active policies combined with incentives and the development of safety and efficiency standards in this regard are confirming the opportunities and needs for such applications.

This fast and steady growth has however highlighted several problems that start to affect the reliability and efficiency of such systems, especially for rooftop installations. In developing economies in particular, installers and system designers are lacking proper skills which result in: 1) a lower performance (or efficiency) of the system: lower output-efficiency; higher operation and maintenance cost: lower return on investment (ROI) for investors; 2) safety issues during installation (Occupational Health and Safety (OHS) issues) and operation (rooftop solar PV systems modify the fire safety conditions of the roof), resulting in increasing numbers of accidents, sometimes fatal, and fires with huge consequences on humans and buildings; and 3) grid-connection issues. This lack of competency in most installers and system designers seriously: 1) reduces the overall performance/output of solar PV systems; 2) increases risks of fire and other safety issues for human and equipment; and 3) make distribution utilities reluctant to connect such systems to their grid.

Addressing the problems mentioned above, the APEC Secretariat would like to develop training curriculums and training materials for installers and system designers for solar PV rooftop systems, as well as for trainers, to map out and conduct evaluation of training institutions in APEC economies, and to transfer of training curriculums and training materials to selected training institutions in APEC economies via capacity building workshop. Castlerock Consulting, in association with Advancing Engineering (AE) Consultants was selected to undertake this “Capacity Building for Installers and System Designers for Solar PV rooftop installations” project.

1.2 OBJECTIVES

The long-term objective of this project is to increase the performance/output of solar PV rooftop systems and facilitate connection to the grid for rooftop solar PV systems, as a means to support APEC economies’ efforts in increasing the share of electricity from renewable energy sources. The project is expected to increase the reliability and safety of solar PV rooftop systems. One of the task of the project is to identify training institutions in APEC economies and to transfer the training curriculums to the potential training institutions.

1.3 METHODOLOGY

The step to determine the potential training institutions is delineated below:

- Step 1: Identification of Training Institutions In APEC Developing Economies
- Step 2: Capacity And Motivation Evaluation of Training Institutions
- Step 3: Recommendation of Potential Training Institutions

2. IDENTIFICATION OF TRAINING INSTITUTIONS IN APEC DEVELOPING ECONOMIES

Identification of training institutions in Southeast Asian APEC developing economies is done through information retrieval on the Internet. Based on the internet research, 13 potential training institutions identified to held PV installers and designers training. These training institutions are as follows:

1. TEDC (Technical Education Development Centre), Indonesia.
2. Center for New and Renewable Energy Research, Institut Teknologi Bandung, Indonesia.
3. Education and Training Center For Electricity, New Energy, Renewable Energy and Energy Conservation, Ministry of Energy and Mineral Resources, Indonesia.
4. Sustainable Energy Development Authority (SEDA), Malaysia
5. Universiti Kuala Lumpur - British Malaysia Institute (UniKL BMI), Gombak, Selangor, Malaysia.
6. Green Energy Research Center, Faculty of Electrical Engineering, Universiti Teknologi MARA (UiTM), Malaysia.
7. Selangor Human Resource Development Centre (SHRDC), Malaysia.
8. Philippines Technical Education and Skill Development Authority (TESDA), Philippines.
9. National Engineering Center, University of The Philippines, Philippines.
10. Thailand School of Renewable Energy Technology (SERT), Naresuan University, Phitsanulok, Thailand.
11. Vietnam Renewable Energy Research Centre (RERC), Hanoi University of Technology, Vietnam.
12. Solar Laboratory of Institute of Physic (Solarlab), Vietnam Academy of Science and Technology, Vietnam.
13. Institute of Energy under the Ministry of Industry and Trade, Vietnam.

Detailed information of each training institutions can be found in Annex 1.

3. CAPACITY EVALUATION OF TRAINING INSTITUTIONS

These 13 training institutions being evaluated qualitatively, in terms of potential capacity and motivation. Potential capacity of training institutions evaluated based on the following criteria[1]:

- Training Program on Solar PV Personnel
- Availability of Training Curriculum
- Availability of qualified trainers
- Administrative staffs
- Linkages with other organizations
- Experience in delivering PV training
- In-class training facilities
- PV laboratory and equipment facilities

The evaluation table of each training institutions based on the above capacity criteria can be seen in Annex 2.

[1] "Solar Energy Education and Training Best Practices: The Series | Interstate Renewable Energy Council," accessed August 25, 2014, http://www.irecusa.org/publications/best-practices-the-series/.

4. RECOMMENDATION OF POTENTIAL TRAINING INSTITUTIONS

Based on the capacity evaluation of the training institutions identified in this assignment, the preliminary recommendation is as follows:

1. In Indonesia, TEDC is identified as the institutions that has most capacities to conduct training on Solar PV installer and system designer and it is recommended to work with them for disseminating APEC Solar PV Installer and System Designer
2. In Malaysia, Sustainable Energy Development Authority (SEDA) provides training on Grid-Connected photovoltaic (GCPV) system design, Grid-Connected Photovoltaic for Wireman and Chargeman and Solar PV installer and maintenance. It is recommended to work with SEDA disseminating APEC Solar PV Installer and System Designer
3. The Philippines Technical Education and Skill Development Authority (TESDA) has issued competency-based curriculum, self-assessment guides and training regulations for PV system design, PV system installation and PV system servicing. Therefore it is recommended to work with them in disseminating this training curriculum in the Philippines
4. More contacts and research are needed to identify eligible training institutions to work with in Thailand and Vietnam.

Annex 1 Detailed Information of Potential Training Institutions

Economies	Training Institutions	Contact Address	Short Description
Indonesia	TEDC (Technical Education Development Centre).	JL. Pesantren km.2 Cibabat Cimahi, Bandung, Indonesia Telp. 022-6652326. Fax: 022-665 4698 http://www.tedcbandung.com/	Carrying out the development and empowerment of teachers in Machinery and Industrial Engineering, through: (1) Preparation of program development and empowerment of teachers and educators (2) Management of data and information to increase the competence of teachers , (3) Facilitation and implementation of competency improvement teachers and educators, (4) Program evaluation and improvement facilitation competencies teachers and educators , (5) Facilitating the development of educational curriculum (6) Facilitating the development of management of education units
	Center for New and Renewable Energy Research, Institut Teknologi Bandung	4th Floor, Gd. Litbang Integrasi dan Aplikasi (PAU) Jl. Tamansari No. 126, Bandung 40132, Indonesia Email : aryadi@termo.pauir.itb.ac.id http://www.itb.ac.id/	
	Education and Training Center For Electricity, New Energy,	Jalan Poncol Raya No. 39, Ciracas, Jakarta Timur 13740	Increasing competence in the field of Human Resources Electricity, Renewable Energy and Energy Conservation;

	Renewable Energy and Energy Conservation, Ministry of Energy and Mineral Resources	Telepon : (021) 8729101 S.D. 06 Faksimile : (021) 8729109 e-mail : kebt@pusdiklatkebtke.esdm.go.id; Pusdiklatkebt@gmail.com website http://pusdiklatkebt.esdm.go.id	Develop training and education standards that support competency-based training program to create professional who is certified both nationally and internationally in the field of Electricity, Renewable Energy and Energy Conservation; Improving education and training infrastructure Electricity, Renewable Energy and Energy Conservation; Build networks with a whole range of training institutions and partners and consumers both within and outside the country in the field of Electricity, Renewable Energy and Energy Conservation
Malaysia	Sustainable Energy Development Authority (SEDA) Malaysia	Galeria PjH, Aras 9, Jalan P4W, Persiaran Perdana, Presint 4, 62100 Putrajaya, Malaysia. Phone : +603-8870 5800 Fax : +603-8870 5900 Website : www.seda.gov.my	The Sustainable Energy Development Authority of Malaysia (SEDA Malaysia) is a statutory body formed under the Sustainable Energy Development Authority Act 2011 [Act 726]. The key role of SEDA is to administer and manage the implementation of the feed-in tariff mechanism which is mandated under the Renewable Energy Act 2011 [Act 725]. SEDA Malaysia provides training on the Grid-Connected Photovoltaic (PV) System Course for Wireman and Chargeman, Grid-Connected Photovoltaic (PV) Systems Design and Solar PV Installer and Maintenance.

	Universiti Kuala Lumpur - British Malaysia Institute (UniKL BMI), Gombak, Selangor	Universiti Kuala Lumpur British Malaysian Institute,Batu 8, Jln Sg Pusu 53100 Gombak, Selangor Phone:03-61841000 Fax:03-61864040 http://www.bmi.unikl.edu.my/	UniKL BMI providing entrepreneurial technopreneurs in the Electrical, Electronics, Medical Engineering and Telecommunication sectors.
	Green Energy Research Center, Faculty of Electrical Engineering, Universiti Teknologi MARA (UiTM)	Kompleks Teratai 1 Universiti Teknologi MARA 40450 Shah Alam, Selangor, Malaysia Tel: +603 5521 1994 Fax: +603 5521 1990 Email: gerc.fke.uitm@gmail.com http://pvmc.uitm.edu.my/gerc/gerc.php	Green Energy Research Centre (GERC) is established under Faculty of Electrical Engineering, Universiti Teknologi MARA (UiTM), Malaysia. Established in August 2011 provide consultancy, research and development and training in green energy, particularly in the area of photovoltaic systems .
	Selangor Human Resource Development Centre (SHRDC).	Selangor Human Resource Development Centre No. 1, Ground Floor, Block 2, Pusat Perniagaan Worldwide, Jalan Tinju 13/50, Section 13, 40100 Shah Alam, Selangor, MALAYSIA. Tel: 603 – 5513 3560	SHRDC offers a wide range of courses and certifications for specific competencies in the areas of Electronics and Electrical, Information and Communications Technology, Microsystems, Plastics Technology and Soft skills / Essential Skills and Solar Photovoltaic Technology

		Fax: 603 – 5513 3490 Email: info@shrdc.org.my http://www.shrdc.org.my/	
Philippines	Technical Education and Skill Development Authority (TESDA)	East Service Road, South Superhighway, Taguig City, Philippines http://www.tesda.gov.ph/	The Technical Education and Skills Development Authority (TESDA) is the government agency tasked to manage and supervise technical education and skills development (TESD) in the Philippines. TESDA provides direction, policies, programs and standards towards quality technical education and skill development.
	National Engineering Center University of The Philippines	Juinio Hall, corner Agoncillo St. and Osmena Avenue University of the Philippines Diliman Quezon City 1101, PHILIPPINES Voice: 632-927-1581 UP Trunkline: 981-8500 (Local) 3003 (Admin), 3005 & 3048 (Training),	Provide Basic Solar Photovoltaic Training

		3004 & 3008 (Marketing), 3006 (Publications) Fax: (632) 929-1710 Email: nec.training@upd.edu.ph www.upnec.com	
Thailand	School of Renewable Energy Technology (SERT), Naresuan University, Phitsanulok	School of Renewable Energy Technology, Naresuan University, Tel.&Fax. +66 5596-3180, +66 5596-3182 E-mail: sert@nu.ac.th http://www.sert.nu.ac.th/index_eng.php	The School of Renewable Energy Technology (SERT) was established in 1995. As an autonomous institute within Naresuan University, SERT works flexibly to develop renewable energy technologies to meet the energy demands of developing economies in South East Asia and to promote the industrial applications of renewable energy. There are several activities in which SERT has participated are: to offer professional training programs at both master and doctorate's degree level, to research on new approaches of renewable energy generation, and to identify feasible areas in Thailand where the renewable energy technologies could effectively be utilized. All of SERT's activities lead to the energy conservation and the reduction of environmental impacts from the use of fossil fuels, which result in improving and sustaining the life quality.
Vietnam	Renewable Energy Research	RERC Building Hanoi University of	The centre has total of 18 members including 8

	Centre (RERC), Hanoi University of Technology	Technology, 01 Dai Co Viet St., Hai Ba Trung Dist., Ha Noi Tel : (84) 04.38692613 - 38692656 - 38691564 Fax : (84) 04.38681185 - 38690018 E-mail : ddthong@hn.vnn.vn	Professors and Doctors. Solar Photovoltaic, Solar thermal laboratory. Research Activities on Solar photovoltaic.
	Solar Laboratory of Institute of Physic (Solarlab), Vietnam Academy of Science and Technology	Address: 01 Mac Dinh Chi St., Q.1 Dist., Ho Chi Minh city Phone: (+84)(8) 3822.2246 Fax: (+84)(8) 3823.4133 Email: hcmip@vast-hcm.ac.vn Website: www.vienvatly-hcm.ac.vn	focusses on solar energy system research, local solar power network, Quick Sun Tester equipment production.
	Institute of Energy under the Ministry of Industry and Trade	Address: 06 Ton That Tung St., Dong Da Dist., Ha Noi Phone: (84.4) 38523730-38529310-35743279 / Fax: (84.4) 3 8529302-38523311 Email: bbt@ievn.com.vn Website: http://www.ievn.com.vn/	established on 1 January 1989 according to the Decision No. 1379 NL/TCCB Dated 05 December 1988 by the Ministry of Energy (now Ministry of Industry and Trade) based on the merger of the Energy and Electrification Institute and Electric Power Research Institute. With more than 20 years of development, Institute of Energy became leading national research institution where the national energy strategies are originated. The Institute carried out research on science and technology issues, development and application of many scientific

			themes, contributing to strong development of Vietnam Energy sector. Nowadays, name of Institute of Energy is widely well known in Vietnam and abroad. Laboratories of Institute of Energy include: Renewable energy laboratory with testing yard for wind, solar energy; experimenting facilities for biogas and residential cooking fuels.

Annex 2. The Evaluation Table of Potential Training Institutions Based On The Capacity Criteria

Training Institutions		Training Program on Solar PV	Curriculum	Trainers	Adminitrative staff	Linkages with other organization	Experiences in PV Training	Class rooms	PV laboratory/ equipment
1	TEDC (Technical Education Development Centre)-Indonesia	v	v	v	v	v	v	v	
2	Center for New and Renewable Energy Research, Institut Teknologi Bandung			v	v			v	
3	Education and Training Center For Electricity, New Energy, Renewable Energy and Energy Conservation,			v			v	v	

	Ministry of Energy and Mineral Resources								
4	Sustainable Energy Development Authority (SEDA) Malaysia	v	v		v	v	v		
5	Universiti Kuala Lumpur - British Malaysia Institute (UniKL BMI), Gombak, Selangor	v			v	v	v	v	
6	Green Energy Research Center, Faculty of Electrical Engineering, Universiti Teknologi MARA (UiTM)	v			v	v	v	v	
7	Selangor Human Resource Development Centre (SHRDC)	v			v	v	v	v	

8	Technical Education and Skill Development Authority (TESDA)	v	v		v		v	v	
10	School of Renewable Energy Technology (SERT), Naresuan University, Phitsanulok			v	v	v	v	v	v
11	Renewable Energy Research Centre (RERC), Hanoi University of Technology			v					v
12	Solar Laboratory of Institute of Physic (Solarlab), Vietnam Academy of Science and Technology			v					v

13	Institute of Energy under the Ministry of Industry and Trade								v

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