= Narrative Report =

TRAINING PROGRAMME ON MICRO HYDRO POWER FOR RURAL DEVELOPMENT




held in cooperation of:
the Government of the Republic of Indonesia
and the Non-Aligned Movement
Centre for South-South Technical Cooperation (NAM CSSTC)

Bali, Indonesia, 19 - 25 April 2016

Narrative Report

Training Programme on Renewable Energy:
Micro Hydro Power for Rural Development

- Bali, Indonesia, 19 – 25 April 2016 -

1. General Situation of the Project

Background

Rural development in developing countries has been given high priority. Programmes to empower rural communities have been in place. Infrastructure such as road, bridge and electricity have been improved to support social and economic activities.

Demand for electricity is substantially increasing in line with the increasing population number, the growing industry and expansion of housing complex. However, people living in some remote areas still do not have access to electricity. Governments' capacity to supply electricity to their people is limited due to budget shortage, insufficient power plant capacity and other factors. One of the solutions to this problem is micro hydro energy that is relatively cheap, sustainable and appropriate for small communities.

Micro hydro is a type of hydroelectric power that typically produces up to 100 kW of electricity using the natural flow of water. These installations can provide power to an isolated home or small community, or are sometimes connected to electric power networks. There are many of these installations around the world, particularly in developing nations as they can provide an economical source of energy without the purchase of fuel.

Micro hydro power is generated through a process that utilizes the natural flow of water. This power is most commonly converted into electricity. With no direct emissions resulting from this conversion process, there are little to no harmful effects on the environment, if planned well, thus supplying power from a renewable source and in a sustainable manner. Micro hydro is considered a "run-off-river" system meaning that water diverted from the stream or river is redirected back into the same watercourse. Adding to the potential economic benefits of micro hydro is efficiency, reliability, and cost effectiveness.

In relation to rural development, the simplicity and low relative cost of micro hydro systems open up new opportunities for some isolated communities in need of electricity. With only a small stream needed, remote areas can access lighting and communications for homes, medical clinics, schools, and other facilities. Micro hydro can even run a certain level of machinery supporting small businesses. The future of micro hydro systems may become more appealing.

The Non-Aligned Movement Centre for South-South Technical Cooperation (NAM CSSTC) in cooperation with the Ministry of Energy and Mineral Resources (MEMR) of Indonesia shared its experience with other developing countries through International Training Programme on Micro Hydro Power for Rural Development.

The participants were requested to present their respective country papers on the first session. The 8 (eight) Training Modules were shared in the Class and Field Sessions, namely: (1) Introduction to Renewable Energy; (2) Basic Knowledge of Micro Hydro Power (MHP); (3) Technical Engineering of MHP; (4) Financial and Economic Aspects of MHP; (5) Sustainability and Environmental Aspects of MHP; (6) Productive Use of Electricity; (7) Community Development; and (8) Case of MHP Plant in Tenganan Village, Karangasem District.

On the concluding session the participants also prepared and presented their Action Plans to be implemented in their respective countries when they are back home.

The series of evaluations were also made by using forms as described in the *Chapter 3, pages 3-16.* Participants were also requested to express their expectations by filling up the Expectation Form before they departed to Bali to be further discussed in the last session before the Closing Ceremony. In conclusion the training programme has achieved its objectives, including the participant's expectations were satisfactorily met.

2. Participants and Beneficiaries

Total participant is 17 persons from 8 developing countries, namely: Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Thailand, and Vietnam. There is 1 person as an observer from the Hydro Empowerment Network intending to knowledge exchange for community hydro in South and Southeast Asia.

The participants are from the government institutions, universities and state enterprises working on energy-related activities. *Details of participants and resource persons are described on pages 19-23 .*

3. Project Achievements

Objectives

(a) The objective of the training programme is to provide participants with basic knowledge of micro hydro power within renewable energy development context and its implementation to support rural development projects which are feasible and affordable.

The training covered the following subjects:

a. Introduction to Renewable Energy;
b. Basic Knowledge of Micro Hydro Power (MHP);
c. Technical Engineering of MHP;
d. Financial and Economic Aspects of MHP;
e. Sustainability and Environmental Aspects of MHP;
f. Productive Use of Electricity;
g. Community Development; and
h. Case of MHP Plant in Tenganan Village, Karangasem District.

(b) the criteria of successful achievement are as follows:

a. participant's expectations were satisfactorily met (98%);
b. training subjects delivered and discussed were relevant and clearly understood;
c. field studies enriched participants with technical aspects of the subjects concerned; and
d. participants could prepare action plans to be implemented post training.

Actual Outputs

The actual outputs are Action Plans prepared by participants on country basis. They also indicated what internal and external assistance to be anticipated. Participant from Thailand requested further assistance from NAM CSSTC to jointly conduct another MHP training in Thailand next year.

Evaluation Results

Following is the resuts of series of evaluations made:

1. Expectations and Evaluation

Before the training session conducted, all participants were requested to express their expectations in written form to be sent before they departed to Bali. Their expectations were compiled by subject of concerns and openly discussed on the last session. They all together checked whether their expectations were met or not. There were also post-class and post-field evaluations by subject. Overall evaluation was also made before the Closing Session.

The results are described as follows:

1. Check Participant's Expectations:

No.	EXPECTATIONS	MET			NOT MET		
		10	8	6	4	2	0

I	**ON THE GENERAL/ KNOWLEDGE RELATED WITH RENEWABLE ENERGY**						
1	Renewable energy is energy generated from natural resources such as sunlight, wind, rain, tides and geothermal heat which are renewable (naturally replenished). Renewable energy technologies range from solar power, wind power, hydroelectricity/micro hydro, biomass and biofuels for transportation. This knowledge is expected to gain from the training program. (Dok Doma, Cambodia)	√					
2	On the general/ knowledge related with renewable energy: Renewable energy (RE) have important role to play in delivering a sustainable in the future. It enhances energy security decreases dependent on imported fuels and contributes to mitigation on the climate change by reducing CO2. However the massive integration of variable Renewable energy such as Hydropower into the national energy mix can become challenge for conventional power system. (San Vibol, Cambodia)	√					
3	Renewable energy is energy generated from natural resources such as sunlight, wind, rain. Renewable energy like solar power, wind power, hydro power, biomass. This knowledge is expected to gain from the training program. (Ven Nat, Cambodia)	√					
4	Knowing about renewable energy, and things that have been donated renewable energy in slowing global warming. (Djemi Matulessy, Indonesia)		√				
5	This training can expand my knowledge of the latest developments in Micro hydro. (Daniel Felle, Indonesia)	√					
6	Through this training I expected to understanding of development and management of renewable energy, included policy and other supporting factor such as funding. (Arman, Indonesia)	√					
7	I would like to acquire the knowledge and capacity building about the micro hydro power for rural development. (Sengvisay Khammanivong, Lao PDR)	√					
8	I would like acquire the knowledge about micro hydro power for rural development. (Bounthavy Vongdala, Lao PDR)	√					
9	We would like to know how other countries implemented their strategies in enhancing the utilization of indigenous Renewable Energy resources to contribute towards national electricity supply security. (Muhammad Rahmat bin Ahmad Tarmizi, Malaysia)		√				
10	I do want to know renewable energy status, not only host country Indonesia but also participant's countries. Moreover, renewable energy policy and experiences from these countries are expected to study. Awareness, energy generation, and cooperation in renewable energy from these countries are expected to share. From this Training, I hope to get some lectures concerned with renewable energy. (Aung Ko Oo, Myanmar)	√					
11	- Design aspect of Hydropower Engineering - International standards and regulations upon energy system control and management	√					

	- Basic aspects on other Renewable Energy sectors such as Solar and Wind Power. (Soe Aung, Myanmar)						
12	I would like to learn the new trends in application or utilization of renewable energy for rural communities either as source of electricity or livelihood. (Caesar Rico S. Acanto, Philippines)		√				
13	In the training program I am expecting that I will gain knowledge on how renewable energy can help to ensure sufficiency, stability, security and accessibility of energy supply. Also, I am expecting that I will learn strategies on how to cultivate strong partnership and collaboration with key partners and stakeholders. (John Paulo C. Sacdalan, Philippines)		√				
14	- How Renewable Energy projects are implemented in other countries. - The most abundant source of Renewable Energy and how to utilize it (Francis Ronald F. De la Pena, Philippines)		√				
15	Contribute the knowledge in design and calculation for hybrid technology. Any alternative energy is various compatible together with others that it is complicated**.** (Nunthanis Wongvatana, Thailand)		√				
16	- Current use of renewable energy in the world. Advantages and difficulties in the development of renewable energy. - Measures to develop renewable energy in developing countries. - The new technologies, equipment, diagrams to exploit renewable energy forms. (Bui The Tai, Vietnam)		√				
17	- Learn the basics of renewable forms of energy; - Current use of renewable energy in the world. Advantages and difficulties in the development of renewable energy. Measures to develop renewable energy in developing countries; - The technology, equipment, diagram exploit renewable energies. (Nguyen Thi Thuy Hang, Vietnam)		√				
II	**ON THE BASIC TECHNICAL ASPECTS OF BUILDING AND DEVELOPING MICRO HYDRO POWER PLANT**						
1	Small hydropower stations are usually run off schemes. The most known example in the developing countries such as Cambodia and Indonesia would probably be a traditional mill. In most countries where water power is used mills have been the first usage. Originally the water wheel drove the millstones directly. Modern micro-hydro power (MHP) plants use Turbines instead of water wheels and mostly power a generator to produce electricity. But in cases where machinery can be used and installed near the turbine direct driven systems have some advantages. Such systems are purely mechanical and therefore extremely robust. How to build this micro hydropower will be the subject to my focus in this training program. (Dok Doma, Cambodia)	√					
2	The method to select the capacity sizing of small hydropower plant. To verify the effectiveness of the proposed method inflow duration curve analysis. (San	√					

	Vibol, Cambodia)						
3	The method to select the capacity sizing of small hydropower plant. To verify the effectiveness of the proposed method inflow duration curve analysis (Ven Nat, Cambodia)	√					
4	The technical aspects of what can be sustained and developed with micro-hydro power plants (Djemi Matulessy, Indonesia)	√					
5	• The importance of equipment for other surveys such as GPS • The need to conduct training on the operation and maintenance to the operator Micro-hydro. (Daniel Felle, Indonesia)	√					
6	Currently, we have assistance programs for communities with micro hydro power management, understanding various aspects in building and development of micro hydro power certainly can support the program running well, including experience from other parties or communities in addressing problem that happens in the management of micro hydro power in Indonesia. (Arman, Indonesia)	√					
7	I would like to acquire about the process technology in fields of micro hydro power as such technology is high quality and friendly with environmental. (Sengvisay Khammanivong, Lao PDR)	√					
8	I would like acquire the process technology in fields of micro hydro power such as technology is high quality and friendly with environmental, we can make micro hydro power is sustainable energy. (Bounthavy Vongdala, Lao PDR)	√					
9	We would like to know about the technology used especially the turbine, the water intake design and also the parameters that need to consider during the pre-feasibility study. (Muhammad Rahmat bin Ahmad Tarmizi, Malaysia)	√					
10	I believe that the Training will share Indonesian's Micro Hydro Power development and experiences. I expect that Micro Hydro Power project feasibility and project development will have to be studied. From site visit, I will have a chance to study Micro Hydro power capacities and technical aspects. (Aung Ko Oo, Myanmar)	√					
11	- Detail design on Micro Hydropower - Developing Fabrication and Manufacturing of Micro Hydropower Equipment with economical advantages - Approaching and solutions on Environmental and Social Impacts related by Hydropower Projects (Soe Aung, Myanmar)	√					
12	I would like to know how to efficiently design and implement a renewable energy system especially micro-hydro so as to reduce cost and increase output. (Caesar Rico S. Acanto, Philippines)		√				
13	In terms of building and developing micro hydro power plant, I am hopeful that the consideration to be prepared and design procedure such us: flow rate measurement, weir, penstock, and selection of turbine and generator will be discussed. (John Paulo C. Sacdalan, Philippines)	√					

14	- Latest technologies used for the assessment of micro-hydro power potential sites - Processes of implementation of a micro-hydro power project from data gathering up to completion of the project including operation and maintenance. - How to deal with the possible challenges that will be encountered during implementation (Francis Ronald F. De la Pena, Philippines)	√					
15	Develop the micro hydropower for low head turbine or no head turbine in order to manage the cost effectiveness. And site selection should be major concept. (Nunthanis Wongvatana, Thailand)	√					
16	- Learn basic knowledge of micro hydro power plants. - The diagrams of exploitation, operation and grid-connected of micro hydro power plants. - Power calculation, manner of construction, installation, investment capital. - Improving the performance of micro hydro power plants. - Advantages and difficulties in the development of micro hydro power. - The solutions for the development of micro hydro power stations in developing countries. (Bui The Tai, Vietnam)	√					
17	- Learn the basics of small hydro power plants; - The schematic exploitation, operation and grid connection of small hydro power plants; - Power calculation, manner of construction, installation works, investment; - Improving the performance of small hydropower plants; - Advantages and difficulties in the development of small hydropower; - The solution for the development of small hydro power stations in developing countries. (Nguyen Thi Thuy Hang, Vietnam)	√					
III	**ON SOCIAL AND ECONOMIC ASPECTS RELATED WITH THE DEVELOPMENT OF MICRO HYDRO POWER PLANT:**						
1	Electricity is one of the key determinants for economic growth of a nation. Although the benefits of rural electrification are immense, more than 40% of the people do not have access to electricity in Cambodia, especially in the rural areas. Micro-hydropower (MHP) scheme is considered the most feasible decentralized renewable energy option for providing reliable and affordable electricity to the remote and isolated areas of Cambodia. This training will get learn more about the impact of a MHP plant on socio-economic conditions in the remote village in the Indonesia. (Dok Doma, Cambodia)	√					
2	MHP scheme is considered the most feasible decentralized renewable energy option for providing reliable and affordable to remote and isolated area in Cambodia. This study assesses the impact of a MHP plant on socio-economic condition in the remote village. (San Vibol, Cambodia)	√					
3	MHP scheme is considered the most feasible decentralized	√					

	renewable energy option for providing reliable and affordable to remote and isolated area in Cambodia. This study assesses the impact of a MHP plant on socio-economic condition in the remote village. (Ven Nat, Cambodia)						
4	what is the role of micro-hydro in addressing the social problems of society and the values and economic income of villagers. (Djemi Matulessy, Indonesia)	√					
5	• What is the role of micro hydro in addressing the social problems of society and the values and economic income of villagers, in addition to lighting? • Papuans have very different cultures between the coast and the mountains where they generally want to see the results of a micro-hydro development immediately (not to be put off) the results of the survey will be are often done two or three years, or not at all. (Daniel Felle, Indonesia)	√					
6	The existence of electrical energy from the micro hydro power can certainly be positive impact for the aspects of the social and economic life of the community, how far of utilization of this energy can be used to improve the welfare of the community and various examples of energy utilization of micro hydro power for the life of community from different areas, both in Indonesia and in many other countries, of course, can be an input to us in developing programs in North Kalimantan. (Arman, Indonesia)	√					
7	For the social aspect is that new technology for micro hydro power plant should be developed by population for prevention environmental pollution. the cost compared with typical energy producing cost applied now, in the present I suggest that we have to find out best economical way. (Sengvisay Khammanivong, Lao PDR)	√					
8	My the social aspects is that new technology for micro hydro power plant should be developed by population for preventing of environmental pollution, the cost compared with typical energy producing cost applied in now, at present I suggest that we have to find out best economical way. (Bounthavy Vongdala, Lao PDR)	√					
9	We would like to know more about : - Planning or set up of operation and maintenance after the installation. - Development of tariff or fee for the community. - How to create the awareness among the community to make sure the power consumption not overload. (Muhammad Rahmat bin Ahmad Tarmizi, Malaysia)	√					
10	Social issues are vital role in considering project feasibility as well as economic development. Mitigation, compensation, resettling and other social aspects in building micro hydro power plant are expected to study and share. Despite micro hydro power plant damages the environment and culture, we can take much advantage from the plant as we all know. So I strongly hope that the Training will share many social and economic experiences in micro hydro power plant construction. (Aung Ko Oo, Myanmar)		√				

11	- Knowledge upon Energy saving Electrical Devices - The ways on reduction of running cost for Rural Electrification - Effect of energy saving measures - Enhancement of energy security by multiple power supply (Soe Aung, Myanmar)		√				
12	The two of the important components in the success of any project is community support and sustainability. I would like to learn best practices in achieving these two components. (Caesar Rico S. Acanto, Philippines)	√					
13	To gain knowledge on financing mechanisms, technical capabilities and management and operation of micro hydro power technology. (John Paulo C. Sacdalan, Philippines)	√					
14	- How to conduct effective IEC/ Social Preparation - How to determine the economic viability of a project (Francis Ronald F. De la Pena, Philippines)	√					
15	The world-wide criteria in quantitative amount of social and economic concept are accept for micro hydropower that they should be apply in the future (Nunthanis Wongvatana, Thailand)	√					
16	- Assessment of impacts of micro hydro power projects to the environment, resident, agriculture, and solutions to reduce the impacts. - Assessment of economic efficiency when building micro hydro power plants. - The programs that support economic development based on the use of electricity. - Training of staff for operation and maintenance of micro hydro power stations.. (Bui The Tai, Vietnam)	√					
17	- Assess the impact of small hydro power projects on the environment, population, agriculture and how to fix; - Assessment of economic efficiency when building small hydro power plants; - The programs that support economic development thanks to the use of electricity; - Training staff knowledgeable staff operating and maintaining small hydro station. (Nguyen Thi Thuy Hang, Vietnam)	√					
IV	**HOW YOU MAY RELATE THE SUBSTANCES (EITHER THEORY OR TECHNICAL ASPECTS) THAT WILL BE DELIVERED IN THE SESSION TO YOUR COUNTRY'S INTEREST**						
1	The interest will be on physical and biological effects on flora and fauna, humans, economic aspects of micro hydropower and investment fund for developing countries to build micro hydropower (Dok Doma, Cambodia)			√			
2	Now I work at Hydro electricity Department and I responsible to monitor micro-hydro scheme. To manage the micro hydro projects successful I should know more either theory or technical aspects in this session and I hope what I learned can apply in my country. (San Vibol & Ven Nat, Cambodia)	√					
3	Need alignment between theory and practice as theory is not always applied to the field conditions, thus need the wisdom of each micro-hydro expert in order to smooth the		√				

	development of micro hydro. (Djemi Matulessy, Indonesia)						
4	In Indonesia in particular in Papua there are a lot of natural resources that have the potential to build Micro-hydro, I hope attention from the central government and local and foreign NGOs which have expertise in development Micro-hydro should be given a chance. (Daniel Felle, Indonesia)		√				
5	Many areas in Indonesia have not been able to get electrical energy and its benefits to their life, including many villages in North Kalimantan. Development of renewable energy, including the micro hydro power, can help the community to get benefit not only the electrical energy use for lighting (or other consumptive use) but also to the development of community-based enterprises. Material either theory or practice techniques, will help us (Indonesia) in the development of micro hydro power now and in the future. (Arman, Indonesia)		√				
6	If I have been training completed I will to get knowledge and I'm going to deliver to my colleagues and I acquire experience from periodic seminar. (Sengvisay Khammanivong, Lao PDR)		√				
7	After this training finished already I will to get new knowledge about micro hydro power. I am going to deliver to my colleagues and I acquired new experience, knowledge from other counties. (Bounthavy Vongdala, Lao PDR)	√					
8	The substances will be presented to the top management of the ministry. If the management decided to pursue on this matter, the paper will be presented to the Planning and Implementation Committee for Electricity Supply and Tariff (JPPPET) chair by the minister. (Muhammad Rahmat bin Ahmad Tarmizi, Malaysia)		√				
9	Our country, Myanmar has many hydro power resources. So, the theories and technical aspects the training will share to us will help Myanmar's micro hydro power project development more than usual . I will report the issues this Training and share to our minister and some discussion will be held in our department through seminars. (Aung Ko Oo, Myanmar)		√				
10	- Detail design on medium scale Hydropower Engineering - Energy policy and management of developing countries - Power market infrastructure development (Soe Aung, Myanmar)		√				
12	Our country is hoping for 100% electrification in all its area. The geographical situation of the Philippines is a big challenge to achieve this dream. I hope that this training would provide insights on how to overcome this challenge. (Caesar Rico S. Acanto, Philippines)	√					
13	The program will address the challenges and gaps for utilizing hydropower in the Philippines particularly in socio-environment concerns, shift in type of development and commercialization of local micro-hydropower technology. (John Paulo C. Sacdalan, Philippines)		√				
14	The provided substances during the course will be one of our basis for future developments of micro-hydro power in	√					

	our country. (Francis Ronald F. De la Pena, Philippines)						
15	If hydro power project is reservoir type, the dam safety will be key plan. (Nunthanis Wongvatana, Thailand)	√					
16	- Currently micro hydro power issues are concerned in Vietnam: - Revaluation of micro hydro power potential in mountainous areas without national power grid. - Diagram selection of exploitation, operation and grid-connected of micro hydro power suitable for the conditions of Vietnam. - Selection of equipment (turbines, generators) with high performance, reasonable price. - Calculation of economic efficiency of micro hydro power projects. - Suggested solutions for the development of micro hydro power plants in Vietnam (Bui The Tai & Nguyen Thi Thuy Hang, Vietnam)		√				
V	**POSSIBLE APPLICATION OF KNOWLEDGE AND EXPERIENCES SHARED IN THE SESSION TO YOUR COUNTRY'S MICRO HYDRO PROGRAMME**						
1	The knowledge gained will be shared with colleagues, engineers, and policy makers in the ministry of rural development in order to bring the knowledge into actions. Case study will be conducted and pilot construction will be taken to address this knowledge (Dok Doma, Cambodia)	√					
2	Up to date in my country have only two micro-hydro power plants and these MHP located in Ratanakiri and Mondulkiri provinces. These two micro-hydro was constructed by JICA, so I hope the application of knowledge and experiences in the session is useful to developing my country. (San Vibol & Ven Nat, Cambodia)	√					
3	- Use of micro hydro is very dependent on initial technical and social community survey results. - It is dominated by the government but knowledge of micro hydro is still very low among government officials. (Djemi Matulessy, Indonesia)	√					
4	• The knowledge I gain from this training will I socialized to my brothers were in the villages, especially micro hydro operator • Wisdom is important in supporting the theory and practice of micro-hydro in line. (Daniel Felle, Indonesia)	√					
5	Practices to build and maintain of micro hydro power installations can be carried out directly by the community and how to develop the utilization of electrical energy from the micro hydro power to appropriate or simple technology that can be used by communities to support their community-based enterprises. (Arman, Indonesia)		√				
6	I propose that possible application of knowledge experience shared in the session shall be in fields of micro hydro power. (Sengvisay Khammanivong, Lao PDR)	√					
7	I suggest that possible application of knowledge from experience shared in the session shall be in fields of micro hydro power. (Bounthavy Vongdala, Lao PDR)		√				
8	Most of the micro hydro system in Malaysia were built by the non-governmental organization (NGO) and universities.	√					

	The ministry might play a role as a focal point to coordinate any collaboration between the NGOs and universities with NAM or any other parties. (Muhammad Rahmat bin Ahmad Tarmizi, Malaysia)						
9	First of all, I have to give some presentations to related people in micro hydro power fields as soon as I arrive in Myanmar back. Then, I will have to report complete documentations related with the Training to our Minister. The knowledge from the Training will be shared to local Trainees because I am a Trainer in micro hydro power technology and application in local area. Finally, I will help private sectors by supporting technical aspects from the Training. (Aung Ko Oo, Myanmar)	√					
10	- The knowledge from this training will be shared to our department - Help to the private sectors by supporting technical of Micro Hydro power (Soe Aung, Myanmar)		√				
11	Since the Affiliated Renewable Centers (AREC's) have already started with the programs on utilization of micro-hydro systems for off-grid installation, it is now time to consider grid integration of this system. If this training can provide knowledge how to achieve this efficiently, it would help. (Caesar Rico S. Acanto, Philippines)		√				
12	- The gain knowledge and experiences will be applied on ways and means on how to involve strategically the stakeholders in the implementation of hydro power projects that will lead to the improved public awareness and acceptance. - This program also offers the latest expertise and technical transfer of hydro power through technical and bilateral cooperation that will help in replication of success micro-hydro project. (John Paulo C. Sacdalan, Philippines)	√					
13	I will relay whatever knowledge I will be gaining from the said training to our division, thus enhancing our capacity to future development/s relative to our "Household Electrification Program". (Francis Ronald F. De la Pena, Philippines)	√					
14	Hydropower construction technique (Nunthanis Wongvatana, Thailand)		√				
15	From the knowledge and experience of this session, I will share and exchange widely with colleagues in the field at the micro hydro programs in Vietnam. (Bui The Tai, Vietnam)						
16	- Selection diagram exploitation, operation of the grid connected small hydro projects in line with the conditions of Vietnam; - Design calculations, a reasonable selection of equipment for small hydro projects; - Given the reviews, the solution minimizes the impact of small hydro power projects on the environment, population and agriculture; - Providing information to structural measures, economic efficiency, the type of turbine equipment of small hydro power plants for investors;	√					

	- Suggested solutions for the development of small hydro power plants in Vietnam. (Nguyen Thi Thuy Hang, Vietnam)						
VI	**OTHER EXPECTATIONS**						
1	The program should have pilot funds to allocate the participants applying the knowledge into action. (Dok Doma, Cambodia)			√			
2	Base as Cambodia Power Development Plant the micro hydro power is the key for rural development and the target is 70% villages have to access to electricity by year 2020 and 60% of household the access to electricity by year 2030. (San Vibol, Cambodia)	√					
3	To enhance the participants skills and capacities needed to achieve improved performance through good management. To provide relevant training and transfer of experience from countries and projects that have been successfully implemented projects. (Ven Nat, Cambodia)	√					
4	- It is recommended that designing a Micro-hydro development based on an initial survey and the implementation of micro hydro development is done by only one person or group. - Development of micro hydro should be done by local people who understand the social / community development needs. (Djemi Matulessy, Indonesia)			√			
5	• It is recommended that designing a Micro-hydro development based on an initial survey and the implementation of micro hydro development is done by only one person or group • Development of micro hydro should be done by local people who understand the social / community development need • Building a should be done not only by science, but using local wisdom. (Daniel Felle, Indonesia)		√				
6	Sharing experience and knowledge and also discuss within participants from different areas, both in Indonesia and in many other countries, as an inputs for community groups assistance programs in order to managing and maintaining micro hydro power, so that the benefits from the presence of the micro hydro power can be perceived by the community in a sustainably. (Arman, Indonesia)	√					
7	For Economic and Financial analysis of each technology. (Sengvisay Khammanivong, Lao PDR)		√				
8	Use for financial and Economic analysis of each technology. (Bounthavy Vongdala, Lao PDR)		√				
9	Energy efficiency improvement at demand–side is a crucial parts of the energy sector development as the demand dictates the energy supply and fuel consumption. Savings on the demand side will reduce the energy loss due to distribution and transmission of power, losses in power generation plants, anad the energy uses associated with extraction anad transportation of fuels. In energy terms, saving one unit of energy in the demand side will save 3-4 units of primary fuels. In addition, investments in energy supply facilities such as power plants and grid can be				√		

	deferred. We would like to propose a workshop on Energy Efficiency because from that we can learn from other economy on how the implement their strategy on Energy Efficiency. (Muhammad Rahmat bin Ahmad Tarmizi, Malaysia)						
10	Frankly, I want to go to famous Bali's beach with the trainers & participants. I want to study culture & arts in Indonesia. I want to keep in touch with NAM CSSTC in future and I also want to be a link to this organization with our department. (Aung Ko Oo, Myanmar)	√					
11	- Management for energy security systems - Management of energy control system achieving economical advantages - Energy technology policy and Human resources management (Soe Aung, Myanmar)		√				
12	I would like to see cooperation and sharing among participants of this training in order to achieve our goal which is to maximize learning and expand our knowledge in micro-hydro system design and implementation. (Caesar Rico S. Acanto, Philippines)	√					
13	I also expect to gain not only friends but also linkages that could help in implementing the micro hydropower technology and in addressing the gaps and challenges in the Philippines. (John Paulo C. Sacdalan, Philippines)	√					
14	- The venue would be suitable for the said training - If possible, hands-on during operation of micro-hydro power plant - The trainers would provide case studies (Francis Ronald F. De la Pena, Philippines)		√				
15	I really want to learn more about the combination of micro hydro power plants with other renewable energy sources as wind, solar, biogas ... to provide electric to remote areas without national electric grid. (Bui The Tai, Vietnam)		√				
16	Technology combines small hydropower plants with other renewable energy sources: wind, solar, biogas ... to provide power to one residential areas without national grid. (Nguyen Thi Thuy Hang, Vietnam)	√					
Total		**62**	**29**	**5**	**1**	**0**	**0**
Percentage		**98%**			**2%**		

Based on the percentage of met expectations (98.00%), we may conclude that the participants are satisfied with the training programmes they participated.

[*As reference, the scoring range is classified as follows: 81-100% met is Satisfied; 51-80% met is Good; 26-50% met is Sufficient; and 0-25% met is Failed*]

2. Summary of Evaluation by Training Subjects:

Participants were requested to fill up the Evaluation by Subject/Field Form right after the related subject/field was finished. The Evaluation by Subject/Field Form is shown on *page 15.* The tabulation result of the filled up questionnaires shows the conclusion as follows:

No	A1	A2	B1	B2	B3	Score	Relevance	Efficiency
1	4.2	4.4	4.3	4.5	4.4	4.4	4.3	4.4
2	4.2	4.3	4.5	4.1	4.3	4.3	4.2	4.3
3	4.5	4.5	4.6	4.8	4.4	4.5	4.5	4.6
4	4.2	4.5	4.4	4.5	4.4	4.4	4.4	4.4
5	4.3	4.2	4.3	4.5	4.5	4.4	4.3	4.4
6	4.5	4.5	4.6	4.6	4.5	4.5	4.5	4.6
7	4.3	4.5	4.5	4.5	4.3	4.4	4.4	4.4
8	4.5	4.4	4.4	4.5	4.5	4.5	4.4	4.5
9	4.5	4.5	4.5	4.7	4.6	4.6	4.5	4.6
	4.4	4.4	4.5	4.5	4.4	4.4	4.4	4.5

1. Budiman Saragih on *Introduction to Renewable Energy*
2. Todo Simarmata on *Basic Knowledge of Micro Hydro Power (MHP)*
3. Samsul Kamal on *Technical Engineering of MHP*
4. Chayun Budiono on *Financia and Econopmic Aspects of MHP*
5. Erick Hutrindo and Sentanu Hindrakusuma on *Sustainability and Environmental Aspects*
6. Erwina Darmajanti on *Productive Use of Electricity*
7. Yuniardi Nugraha on *Community Development*
8. Wayan Dirgayusa on Case of MHP Plant in Tenganan Village
9. Field Study at MHP Plant in Tenganan Village

Block A for Relevance; Block B for Efficiency

The score range is from 1 to 5. [1=strongly disagree; 2=disagree; 3=neutral; 4=agree; 5=strongly agree]. If the average score of all training subjects is closer to 5, it means that the 8 subjects shared in the Class and 1 subject shared in the Field are well understood by the participants and most appropriate for them. Based on the average score described above, the evaluation result is good.

3. Summary of Overall Evaluation:

Participants were requested to fill up the Overall Evaluation Form on the last session. The Overall Evaluation Form is shown on *pages 15-16.* The tabulation results of the filled up questionnaires show the conclusion as follows:

No	A1	A2	B1a	B1b	B2	C1	C2	C3	C4
1	5	5	5	5	5	5	5	5	5
2	5	5	4	4	5	4	4	5	5
3	5	5	5	5	5	5	5	5	5
4	5	5	5	5	5	5	5	4	4
5	5	5	4	5	5	5	5	5	4
6	5	5	5	5	5	5	5	5	5
7	5	5	5	5	5	4	3	4	5
8	5	5	5	5	5	5	4	5	4
9	5	5	5	4	5	5	5	4	5
10	4	4	4	4	5	5	5	5	4
11	4	4	5	5	5	5	5	5	3
12	4	4	4	5	4	5	5	5	4

13	5	5	5	4	4	5	4	5	5
14	4	4	5	4	5	5	5	5	5
15	5	5	5	5	5	5	4	5	4
16	5	5	5	4	5	5	5	5	5
17	4	4	4	4	4	4	4	4	5
Total	80	80	80	78	82	82	78	81	77
Score	4.7	4.7	4.7	4.6	4.8	4.8	4.6	4.8	4.5
	4.71		**4.71**			**4.68**			
					Total Score				42.2
					Final Score				**4.69**

Block A for Relevance; Blok B for Effectiveness; Block C for Efficiency

The score range is from 1 to 5. [1=strongly disagree; 2=disagree; 3=neutral; 4=agree; 5=strongly agree]. If the average score of all training subjects is closer to 5, it means that overall subjects delivered in the Class and Field Sessions are well understood by the participants and most appropriate for them. Based on the average score described above, the overall evaluation result is good. This evaluation also to cross-check the result of evaluation by training subjects. There's consistency between evaluation by subjects and overall performance of the training sessions. All final scores of 4.40 (training by subjects) and 4.69 (overall evaluation) are closer to 5.00 that means they are both closer to good results.

4. Work Activities / Progress

The training programme was conducted through:

Class Session:

The session conducted using adult-learning approach. There is no instruction but knowledge-sharing approach by participatory method is applied.

Field Session:

Field study to the practice of micro hydro power plants is intended to see how micro hydro power plant works to generate electric power and give benefits to local community as the beneficiaries. In the case of MHP Plant in Tenganan Village the beneficiaries are also the owners. They have established an Association of Irrigation (called *Subak*) as the traditional Balinese customary villagers practise their daily management of water intended to irrigate paddy field and as a source of MHP plant. The electricity generated from their MHP plant is used for rice huller operations.

Pesentation of Country Reports:

Participants were requested to prepare and present their Country Reports covering problems and potentials of renewable energy development, especially of micro hydro power. Their knowledge and experiences were shared during the class and field sessions.

Preparation of Action Plan:

At the end of the Class Session, participants were asked to prepare Action Plan to be implemented in their respective countries when they are back home. They also indicated possible future collaboration post training.

Language:

The language used in the Training Programme is English.

5. Problems and Difficulties

Basically problems and difficulties were not significantly found, either during the training preparation and implementation. However there was only one thing that should be carefully managed and anticipated which is related to the nomination and selection processes. As always the nomination comes a bit late, beyond the deadline of submission.

The nomination forms received were not in schedule as expected. Most of the nominees were a bit late in the selection process, although they were still in time to proceed with administrative works. It is fortunate that the participants are from ASEAN countries that are practically easy to manage.

In general, qualification of the participants was met.

6. Recommendations

Following is the conclusion and recommendation for further anticipation:

The overall implementation of the international training programme on micro hydro power for rural development has been well implemented, both substantially and logistically.

However, there are some feedbacks from the participants expressed during the overall evaluation that could be accommodated in future similar training, as follows:

1. Despite the training subjects have been considered appropriate, it could be enriched with supporting references from other countries that have similar cases. Concrete experiences by countries could be used as additional references as well.

There might be either similar or different features in developing micro hydro power plant.

2. Technical exercises at fieldsite should be added using basic instruments which are not complicated.

3. Field facilitator(s) should be prepared to provide participants with more field information to show benefits that really go to the local people.

4. Since the field study is not merely on technical matters, it is suggested to extend more days at feldsite to observe and practise relevant field works related to social, institutional and economic development.

5. A week course is not enough, the duration is minimum effective ten days. Two days should be spent at fieldsite.

There is also strong recommendation to conduct another similar training with considering the feedbacks from participants. In this regard, NAM CSSTC and the Ministry of Energy and Mineral Resources will identify another best practice of community-based microhydro power development that also generates value added to local communty. Potential plants, among others, are located in Lombok, West Nusatenggara. The potential sites in this province should be assessed at field level before they are selected. The coming training should involve the local stakeholders (local government, institution and people) as well.

7. Name and title of person(s) who prepared the report

1. **Achmad Rofi'ie**
   Assistant Director for Programme, NAM CSSTC
   for <u>Narrative Report</u>

2. **Subandiyo**
   Assistant Director for Administration and Finance, NAM CSSTC
   for <u>Financial Report</u>

Other Attachment

List of Participants

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List of Resource Persons

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5	Chayun Budiono	Energy Researcher, "Sepuluh Nopember" Institute of Technology (ITS), Surabaya	ITS Surabaya Jl. Keputih Tegal Timur Blok B-63, Surabaya 60111, Indonesia

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9	Yuniardi Nugraha	PT. ENTEC Indonesia/Small Hydro Power Association/Asosiasi Hidro Bandung (AHB)	Jl. Cisatu I No. 193 Ciumbuleuit, Bandung Indonesia Ph: +62-22-203 2128 Cell.: +62 818 222 734 Fax: +62-22-203 2128 Email: ardi.nugraha@entec.co.id
10	Wayan Dirgayusa	Advisor of Wisnu Foundation	Jl. Pengubengan Kauh 94 Kerobokan-Kuta, Bali, Indonesia Cell:: +62-81220122672 Email : wdirgayusa@gmail.com

Project/Training Programme

Date	Time	Agenda
D-1: Tue, 19 April	08:30 – 09:00	**Opening Ceremony** *Opening Renarks: H.E. Ambassador Esti Andayani* *MC: Annisa Paramita*
	09:00 – 09:15	**Coffee break**
	09:15 – 10:00	- Briefing on the Programme, Logistics and Action Plan *Achmad Rofi'ie*
	10:00 – 12:30	- Presentation of Country Papers *(Facilitated by Faisal Rahadian)*
	12:30 – 14:00	**Lunch break**
	14:00 – 14:30	- Presentation of Country Papers (*continued*) *(Facilitated by Faisal Rahadian)*

Date	Time	Agenda
	14:30 – 15:15	- Introduction to Renewable Energy *Budiman Saragih*
	15:15 – 15:30	**Coffee break**
	15:30 – 16.15	- Introduction to Renewable Energy (*continued*) *Budiman Saragih*
D-2: Wed, 20 April	08:30 – 10:00	- Introduction to Renewable Energy (*continued*) *Budiman Saragih*
	10:00 – 10:15	**Coffee break**
	10:15 – 12:30	- Basic Knowledge of Micro Hydro Power (MHP) *Todo Simarmata*
	12:30 – 14:00	**Lunch break**
	14:00 – 14:30	- Basic Knowledge of MHP (*continued*) *Todo Simarmata*
	14:30 – 15:15	- Technical Engineering of MHP *Samsul Kamal*
	15:15 – 15:30	**Coffee break**
	15:30 – 16:15	- Technical Engineering of MHP (*continued*) *Samsul Kamal*
D-3: Thu, 21 April	08:30 – 10:00	- Technical Engineering of MHP (*continued*) *Samsul Kamal*
	10:00 – 10:15	**Coffee break**
	10:15 – 12:30	- Financial and Economic Aspects of MHP *Chayun Budiono*
	12:30 – 14:00	**Lunch break**
	14:00 – 15:15	- Sustainability Aspect of MHP *Erick Hutrindo*
	15:15 – 15:30	**Coffee break**
	15:30 – 16:15	- Environmental Aspect of MHP *Sentanu Hindrakusuma*
D-4: Fri, 22 April	08:30 – 10:00	- Productive Use of Electricity *Erwina Darmajanti*
	10:00 – 10:15	**Coffee break**
	10:15 – 11:00	- Productive Use of Electricity (*continued*) *Erwina Darmajanti*
	11:00 – 11:45	- Community Development *Yuniardi Nugraha*
	11:45 – 14:00	**(Friday Prayer and) Lunch break**
	14:00 – 15:15	- Community Development (*continued*) *Yuniardi Nugraha*
	15:15 – 15:30	**Coffee break**
	15:30 – 16:15	- Successful Case of MHP Project in Tenganan Village *Wayan Dirgayusa*
D-5: Sat, 23 April	08:30 – 16:15	Field Study at MHP Project in Tenganan Village, Karangasem District, East Bali
D-6: Sun, 24 April	***Whole day***	**Free (Tour and Shopping)**
D-7: Mon, 25 April	08:30 – 10:00	- Preparation of Action Plan by Participants
	10:00 – 10:15	- **Coffee break**

Date	Time	Agenda
	10:15 – 12:30	- Presentation of Action Plan by Participants
	12:30 – 14:00	- **Lunch break**
	14:00 – 15:00	- Check Expectations and Overall Evaluation
	15:00 – 16:00	**Closing Ceremony** *Closing Remarks: H.E. Ambassador Elias Ginting* *MC: Kadek Ayu Nimita Widiyani*

Evaluation Forms

SUBJECT/FIELD EVALUATION

Training Programme on Renewable Energy:
Micro Hydro Power for Rural Development
Bali, 19 - 25 April 2016

Name of Subject/Field :

Name of Trainer/ Resource Person :

Date : **Time :**

Instruction:

Use the following score to indicate the extent to which you agree or disagree with each of the statements below.

Score Code:

Strongly disagree	= 1
Disagree	= 2
Neutral	= 3
Agree	= 4
Strongly agree	= 5

If you have any comment, please write down on the space at the end of each item.

BLOCK A: RELEVANCE

A1. I was able to understand the operating system of Micro Hydro Power. (Level of Understanding)

1	2	3	4	5

Comment:

……

A2. Knowledge/skills gained from this field visit could be applied in my country. (Level of Application)

1	2	3	4	5

Comment:

……

BLOCK B: EFFICIENCY

B1. Documents provided (Training Materials) are appropriate and useful.

1	2	3	4	5

Comment:

……

B2. The Trainer/ The resource person is professional (Method of instruction, Communication skills: clear explanation, clear answers to questions)

1	2	3	4	5

Comment:

……

B3. The time given was appropriate.

1	2	3	4	5

Comment:

.....

……....

.....

OVERALL EVALUATION

Training Programme on Renewable Energy:
Micro Hydro Power for Rural Development
Bali, 19 - 25 April 2016

Instruction:

Use the following score to indicate the extent to which you agree or disagree with each of the statements below.

Score Code:

Strongly disagree	= 1
Disagree	= 2
Neutral	= 3
Agree	= 4
Strongly agree	= 5

If you have any comment, please write down on the space at the end of each item.

BLOCK A: RELEVANCE

A1. The knowledge and practices of Micro Hydro Power for Rural Development scheme seem workable in my country.

1	2	3	4	5

Comment :

.....

.....

A2. The content of the course (how to understand, develop and manage micro hydro power, and its benefit for rural development seem workable in my country.

1	2	3	4	5

Comment:

……..

……..

BLOCK B: EFFECTIVENESS

B1. I was able to achieve the following objectives of this course:

a. Knowledge and practices of Micro Hydro Power.

1	2	3	4	5

Comment:

……

……

b. Explain and analyse Micro Hydro Power Development, its context, actors and venues, its relevance to your host country and the skills it requires.

1	2	3	4	5

Comment:

……

……

B2. The course contents are clearly related to your present or future works.

1	2	3	4	5

Comment:

……

……

BLOCK C: EFFICIENCY

C1. This course has covered the subjects that I expected.

1	2	3	4	5

Comment:

……

……

C2. In general, the study visits arranged were suitable to help me deepen my understanding or further improve my skills on each subject.

1	2	3	4	5

Comment:

……

……

C3. I consider the course is "timely" implemented according to the country's needs in developing micro hydro power (objective of the course).

1	2	3	4	5

Comment:

……

……

C4. One-week course is appropriate.

1	2	3	4	5

Comment:

……...

……...

Documentation

Welcoming Remarks by Trisnaldi,
Head of the Education & Training Centre for Electricity, New Energy,
Renewable & Energy Conservation, Ministry of Energy & Mineral Resources of Indonesia

Officical Opening Remarks by Esti Andayani,
Director of NAM CSSTC

Group photo of participants

Briefing on the Programme, Logistics and Action Plan by Achmad Rofi'ie of NAM CSSTC

Presentation of Country Papers by Participants

Class Session at the Bali Rani Hotel, Bali

Welcoming Dinner

Balinese Dance in the Welcoming Dinner

Class Discussion

Group Discussion

Field Session at MHP Plant in Tenganan Village, Karangasem District

River that is used as source of energy

Walking along the river lane

Discussion at the Power House of MHP Plant in Tenganan Village

Evaluating the MHP Plant of Tenganan Village

Explanation of the MHP Plant of Tenganan by the Village Head

Letter of Appreciation to the Village Head of Tenganan

Visiting a Typical Balinese Temple

Visiting Goa Lawa (Bat Cave) Temple

Visiting Monkey Forest in Ubud

Visiting Tanah Lot

Presentation of Action Plan for Post Training

Participants' representative, Dok Doma (Cambodia), Delivering Vote of Thanks
to the Training Committee on the Closing Session

Sukiman, Head of Cooperation Department,
the Education & Training Centre for Electricity, New Energy,
Renewable & Energy Conservation, Ministry of Energy & Mineral Resources of Indonesia
Delivering Closing Remarks on the Closing Session

Certificate Awarding to the Participant on the Closing Session

Letter of Appreciation Awarding to Faisal Rahadian, the Training Coordinator

H.E. Ambassador Elias Ginting, Ministry of Foreign Affairs of Indonesia
Delivering Closing Remarks on the Closing Session

Group Photo with Certificates

Non-Aligned Movement Centre for South-South Technical Cooperation (NAM CSSTC) was established in 1995 at the 11th Summit of NAM held in Cartagena as one of the vital and effective means for promoting and accelerating development in the developing countries. As a centre for actions and pooling resources as well as a forum for dialogue, its objective is to achieve the development goals of developing countries in attaining sustained people-centred development and to enable developing countries to participate more actively and equally in the process of globalization. The programmes carry direct and long-term benefit to render the economy of developing countries to be more broad-based, efficient and resilient.

Director:
Ambassador Esti Andayani
Assistant Director for Programme:
Achmad Rofi'ie
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Subandiyo

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