

# Advancing Mini-Hydropower in Myanmar Towards SE4ALL

## Opportunities, Challenges and Next Steps

30 July 2015  
Naypyidaw, Myanmar



Supported by the Bureau of Energy Resources at the United States Department of State  
Hosted by the Renewable Energy Association of Myanmar  
In collaboration with the World Bank and the Hydro Empowerment Network



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Renewable Energy Association Myanmar



HYDRO EMPOWERMENT NETWORK  
Knowledge Exchange for Community Micro Hydro in South and Southeast Asia

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## Welcome

On behalf of the United States Department of State, we welcome you to this event in support of Myanmar's National Electrification Plan and the United Nation's Sustainable Energy for All (SE4ALL) initiative. As the government and international development partners focus on increasing the current electrification rate from 30% to 100% by 2030 under SE4ALL, we are pleased that experts and policymakers seek to build upon the efforts of local practitioners.

We would like to acknowledge our local and international partners who helped us conceptualize and organize this event, including the World Bank. In particular, we would like to thank the Renewable Energy Association of Myanmar (REAM). This event benefited greatly from REAM's input and network of community-based practitioners.

Small hydropower producers have been operating in Myanmar for decades and seek supportive policies and techniques for improved output, reduced maintenance and operation costs, and greater private sector participation. For nearly three decades, rural communities in Myanmar have been practicing self-electrification by building and installing their own distributed or decentralized renewable energy systems, mostly micro/mini-hydropower and bio gasification plants.

With 70% of Myanmar's population living in rural and remote areas, decentralized power production can be a cost-effective and sustainable solution for rural electrification. Utilizing public-private partnerships designed to address the electricity needs of remote communities, existing efforts can be transformed into reliable and scalable mini-grids that serve well-beyond the pre-electrification phase of the national electrification roadmap.

Given these objectives, this workshop focuses on widely acknowledged topics for advancing mini-hydropower as an integrated solution towards achieving rural electrification. These topics have been identified by stakeholders, including community-based decision makers, who attended micro and mini-hydropower strategy events held during the last year.

The speakers and moderators invited for this event represent diverse and highly-experienced regional and local expertise, with practical insights and tools to benefit the mini-hydropower sector. We hope that you find useful perspectives in today's presentations and discussions, which will provide forward momentum for your own contributions to the rural electrification sector in Myanmar.

Bureau of Energy Resources,  
U.S. Department of State  
July 2015

## Workshop Background

Myanmar faces a multitude of development challenges in the energy sector, including the need to develop regulatory and institutional frameworks to support the growth of modern power infrastructure. At only 100 kWh per year, Myanmar's per capita electricity consumption is among the lowest in Asia. The rural electrification rate is less than 30%, with vast regions of the country beyond the reach of the national grid. Myanmar's many waterways (rivers, creeks, tributaries, etc.) and mountainous terrain create abundant opportunities for using small-scale hydropower to support rural electrification efforts.

### Why Mini-Hydropower?

While addressing Myanmar's domestic power sector challenges, under the National Electrification Plan (NEP), will require a variety of measures, mini-hydropower (100 - 1000kW) holds promise as an equitable, economical and sustainable solution that can be more rapidly deployed in some areas than conventional grid extension. When properly executed, mini-hydropower is a cost-effective renewable energy resource that builds upon local entrepreneur capacities and leverages the participation of local communities to sustainably address their own energy needs. Mini-hydropower projects can involve efforts to protect and in many cases enhance the ecological integrity of local watersheds that help regulate flow regimes and provide a stable supply of water, which in turn power productive uses that accelerate socio-economic growth and development. These community-level and small-medium enterprises (SME) productive activities powered by mini-hydropower promote economic development without negatively impacting the environment or land rights.

### Status of Small-Scale Hydropower in Myanmar

Over the last few decades, despite limited technology access and financing, local practitioners and government agencies have built, commissioned, and sustained hundreds of pico, micro, and mini-<sup>1</sup> hydropower projects. In the pico and micro hydropower scale, local practitioners have self-financed community-owned projects, allowing communities to repay the capital costs within ~5 years of commissioning from tariff collection. Because the projects have been commissioned on low budgets-- affordable by rural communities -- reliance on low quality hardware and no load controllers have led to frequent technical issues. In the mini-hydropower scale, the government has established 30+ power stations, some using imported technology, which also have reliability issues to due to lack of maintenance and flow control mechanisms.

### Opportunities for Mini-Hydropower in Myanmar

While Myanmar's small-scale hydropower scenario needs much strengthening, the opportunities for advancing mini-hydropower are promising in lieu of the following factors.

- *Regional hindsight.* Because inclusive electrification programs involving small-scale hydropower have already been established in south and southeast Asia, hindsight lessons

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<sup>1</sup> In this context, *pico* refers to <5kW, *micro* refers to <100kW, and *mini* refers to 100 - 1000 kW.

and evolved innovation can readily be leveraged for the Myanmar context, including best-practices for watershed strengthening, grid-interconnectivity and productive use of systems.

- *Localized core competencies.* While projects are currently not optimally operational in Myanmar, unlike other scenarios in the region Myanmar has existing human resources with appropriate core competencies (e.g. experienced civil engineers) that can help to advance the sector. Much of these core skills are rooted in the local private sector, which regional hindsight has shown to be a requirement for a professional, local hydropower industry.
- *Multitude of international support.* The UN's SE4ALL initiative in Myanmar is led by the World Bank's IDA, in cooperation with the ADB, UNESCAP, UNDP, JICA, and KfW -- all of which aim to support financing and capacity building for advancing mini-hydropower in Myanmar. The ASEAN-RESP, led by GIZ, seeks to promote technology transfer and institutional frameworks that strengthen local practitioners and government agencies.

## Challenges and Next Steps

Mini-hydropower energy solutions have only reached a fraction of their potential positive impacts on increasing access to electricity in rural Myanmar. While NEP partners have prioritized the sector in recent events, in order for the government and local practitioners to advance the sector with available international resources, an integrated approach to developing the sector is now required.

- *Reliable and centralized data for planning.* Coordination among multiple sources of international support targeted at government-led outputs, closely involving the local private sector, is severely stalled by the absence of a centrally-accessible, geo-spatial database that houses reliable information on hydrological resources, potential sites, and project details.
- *Financing, standards and regulatory frameworks.* There is a dire need for appropriate rules and regulations that incentivize, facilitate and formalize the deployment of reliable mini-hydropower systems and their integration with country-wide rural electrification efforts, including grid-interconnectivity and commercialization via the local private sector.
- *Institutional structures for high-quality implementation.* In recent months progress has been made to identify key actors and components of a scaled mini-hydropower program. The next step is to establish institutional structures that encourage and support the participation of local communities and project developers; and to establish mechanisms for government agencies to monitor and assure high-quality implementation, operation and maintenance.
- *Vehicles for capacity development and knowledge management.* Once the above components are in place, capacity building for transfer of technology and technical processes are immediately required to ensure reliable feasibility studies, civil engineering, electro-mechanical design, electronic load controllers, and socio-technical interfaces.

## Workshop Goals

Building upon recent events, the goal of this workshop is to facilitate a strategy-building dialogue among core actors for mini-hydro development in Myanmar, towards identified and immediate priorities for advancing the sector within the NEP and SE4ALL framework:

- Developing a reliable, centralized, and accessible database for efficiently planning project pipelines and designing robust projects.
- Identifying next steps for appropriate financing and regulatory frameworks that strengthen off-grid projects and initiate grid-interconnected projects.
- Designing institutional structures and processes that ensure high-quality demonstration projects to pilot multi-actor governance of an integrated program.
- Establishing effective vehicles for capacity development and knowledge management.

## Agenda - July 30

<i>Activity</i>	<i>Key Persons<sup>2</sup></i>
8 to 8.30A: Registration at workshop venue, Thingaha Hotel	
8.30 to 9A: Session 1 - Introduction	
Welcome and Objectives	Reggie Singh, Bureau of Energy Resources (ENR), Department of State, United States
Opening Remarks	Dr. Robert F. Ichord, Jr., Bureau of Energy (ENR) Resources, Department of State, United States
Scope of Mini-Hydro in the National Electrification Plan	U Khant Zaw, Director General, Dept. of Rural Development
9 to 10.30A: Session 2 - Overview of Existing Mini-Hydropower Projects: Status, Progress and Requirements	Moderator: U Aung Myint, Renewable Energy Association of Myanmar (REAM)
Government Efforts	Dr. Soe Soe Ohn, NEP PMO, Dept. of Rural Development (DRD) Dr. Hla Myo Aung, Dept. of Research and Innovation (DRI)
Entrepreneur Projects	U Zaw Min, Small Hydropower Association of Myanmar (SHPAM)
Local Community	U Sen Leik, Kone Nam village, Kakku community hydro project, Shan State
10.30 to 10.45A: Tea Break	

<sup>2</sup> Please see Page 8 for speakers' bios.

<p>10.45 to 12.15P: Session 3 - International / SE4ALL Efforts for Mini-Hydropower: Objectives, Partners, Resources, and Timelines</p>	<p>Moderator: Oliver Haas, INTEGRATION</p> <p>Dr. Xiaoping Wang, World Bank Kohji Iwakami, United Nations ESCAP Dr. Hanna Yolanda, ASEAN-RESP Divyam Nagpal, IRENA (video presentation)</p>
<p>12.15 to 1.15P: Session 4A - Reliable, Centralized, and Accessible Database for Coordinated Planning</p>	<p>Moderator: Dipti Vaghela, Hydro Empowerment Network</p> <p>U Tin Myint, Suntac Technologies, Myanmar Ippei Kitahara, Asia AIR Survey, Japan Dr. Marc Muller, University of California, Berkeley (video presentation)</p>
<p>1.15 - 2.15P: Lunch Break</p>	
<p>2.15 to 3.15P: Session 4B - Financing, Standards, and Regulatory Frameworks for Scalability</p>	<p>Moderator: Oliver Haas, INTEGRATION</p> <p>Dr. Chris Greacen, Independent Policy Consultant (video presentation) Bhatiya Rantunga, KMRI Lanka Ltd. (cancelled) U Ye Naing, Independent Engineering Consultant</p>
<p>3.15 to 4.15P: Session 4C - Institutional Structures and Processes for High-Quality, Scaled Implementation</p>	<p>Moderator: Kohji Iwakami, UN ESCAP</p> <p>Oliver Haas, INTEGRATION, Germany Nawa Raj Dhakal, Alternative Energy Promotion Centre, Nepal (cancelled)</p>
<p>4.15 to 4.30P: Tea Break</p>	
<p>4.30 to 5.30P: Session 4D - Vehicles for Capacity Development and Knowledge Management</p>	<p>Moderator: Dr. Yolanda Hanna, ASEAN-RESP</p> <p>Keith Rabin, KWR International Dr. Thi Thi Soe, Department of Research and Innovation (DRI) Patrick Pawletko, Green Empowerment</p>
<p>5.30 to 6P: Closing - Ways Forward and Closing</p>	<p>Moderator: Reggie Singh, ENR</p> <p>U Khant Zaw, Director General, Dept. of Rural Development Dr. Robert F. Ichord, Jr., Bureau of Energy (ENR) Resources, Department of State, United States U Aung Myint, Renewable Energy Association of Myanmar (REAM)</p>

## Speakers and Resources

*Listed alphabetically by first name.*



### **AUNG MYINT**

*General Secretary, Renewable Energy Association Myanmar (REAM)*

**The Renewable Energy Association of Myanmar** is an NGO based in Yangon focused on technology, policy, and capacity building dissemination and strategy for decentralized renewable energy knowledge in Myanmar. REAM is a member of the National Energy Management Committee and Energy Development Committee.

U Aung Myint was a teaching staff and research scholar/leader at Departments of Botany, Marine Biology and Marine Science at Mawlamyine University between 1972 and 1989. In 1995, he founded the Renewable Energy Association of Myanmar (REAM), a local environmental NGO which works to educate the public and increase awareness of environmental and renewable energy resources. REAM implements grassroots projects to fulfill basic community energy needs by networking with international, government, and local organizations for the development of Myanmar villages, while advocating for conservation and management of the surrounding natural resources. U Aung Myint is a member of Myanmar's National Energy Management Committee, Renewable Energy Working Group, and Village Electrification and Water Supply Committee. He also serves on the Ph.D. Supervision Board of the Marine Science Department of Mawlamyine University, the Central Committee of the Forest Resource Environment Development Association, and he is a lifetime member of the International Society of Mangrove Ecosystems (ISME).



### **BHATIYA RANATUNGA**

*Chief Executive Officer, KMRI Lanka Limited*

Eng. Bhatiya Ranatunga has been involved in designing, building and operation and maintenance of Small Hydro Power Projects in Sri Lanka and in East Africa over the past 20 years. He started his small hydro power career as the Team Leader of the hydro power programme of ITDG which is a UK based NGO in Sri Lanka which was involved in developing over 20 micro and pico hydro power off grid village level projects. Eng. Ranatunga then joined Eco Power Group of Companies from its inception in 1996 which is still the private sector largest small hydro power developer in Sri Lanka and he was the Chief Executive Officer of the company from 2011 to end 2014. Eco Power Group developed 13 Small Hydro Power projects ranging from 0.5MW to 10MW totaling up to 40MW in capacity in Sri Lanka and in East Africa. The group was one of the first private sector organisations in Sri Lanka to develop SHP projects in Sri Lanka and receive financing through World Bank's Energy Services Delivery Programme in Sri Lanka. Eco Power Group also developed two SHP projects in East Africa, 9.2MW project in Rwanda and 6.5MW project in Uganda. All these projects were designed built and operated by Eco Power Group except for the project in Rwanda which was an EPC contract. Mr. Ranatunga now heads KMRI Lanka Limited, a company set up in Sri Lanka and in Uganda which is currently in the process of developing two 5MW SHP projects in Uganda and a 4MW Dendro Power project in Sri Lanka. Eng. Ranatunga has over the years contributed to many International workshops, seminars and conferences on Renewable Energy Development organised by the World Bank, IFC and other International agencies.



### **CHRIS GREACEN**

*Independent Consultant, Small Power Producer Regulations*

Dr. Greacen works on policy and hands-on implementation of renewable energy from village to government levels. As co-director of the non-profit organization Palang Thai he helped draft Thailand's Very Small Power Producer (VSPP) policies and conduct studies in support of the country's feed-in tariff program. As a World Bank consultant he helped develop the off-grid component of Myanmar's National Electrification Program. From

2008 to 2014 he worked as a World Bank consultant assisting the Tanzanian Energy Water Utilities Regulatory Authority (EWURA) developing the regulatory framework for Tanzania's Small Power Producer (SPP) program. He has worked on renewable energy mini-grid projects in Thailand, Vanuatu, Micronesia, India, and North Korea. He has a Ph.D. in Energy and Resources from the University of California at Berkeley, where his doctoral dissertation focused on community-scale micro-hydropower projects in Thailand.



**DIPTI VAGHELA**

*Rural Energy Consultant and Coordinator, Hydro Empowerment Network*

Since 2006, Ms. Vaghela's roles as a energy policy researcher and field practitioner in *adivasi*/India have facilitated rural communities, local entrepreneurs, field-based NGOs, policy makers, donors, and government actors towards integrated approaches to community hydro initiatives. In 2012, she helped to establish the Hydro Empowerment Network for South and Southeast Asia (HPNET), a knowledge exchange platform to advance micro/mini hydro in the region. In 2013, supported by the Switzer Foundation Environmental Leadership Grant, she served as the Energy Solutions Coordinator for International Rivers to promote policy solutions and regional networks that support locally-driven energy development. Ms. Vaghela's focus is to create effective synergy among diverse and pertinent actors of micro/mini-hydropower development. She holds a BS in Mechanical Engineering from the University of California, Berkeley and an MS in Environmental Studies from San Jose State University.



**DIVYAM NAGPAL**

*Associate, Knowledge, Policy and Finance Centre, International Renewable Energy Association (IRENA)*

Within the Policy Unit, Mr. Nagpal works specifically on off-grid renewable energy applications for energy access and the water, energy and food nexus. He has been actively involved in the organisation of the biennial IRENA International Off-grid Renewable Energy Conference and Exhibition (IOREC) as well as in associated follow-up activities. He has co-authored several publications, including *Accelerating Off-grid renewable energy: Key Findings from IOREC 2014* and *Renewable energy in the water, energy and food nexus*. He is currently working towards analysing the role of policies in stimulating private sector development in the mini-grid sector. Prior to joining IRENA, he worked in the United Kingdom and India focusing on techno-economic and financial assessments of large-scale and off-grid renewable energy projects, as well as on sector-level energy efficiency benchmarking. He is a mechanical engineer by training and has an MSc in Sustainable Energy Futures from Imperial College London.



**HANNA YOLANDA**

*Senior Advisor, ASEAN Renewable Energy Support Programme (RESP)*

Ms. Yolanda got her Bachelor of Engineering from University of Indonesia in 1990. After gaining four years of working experience in a professional association and two UNDP/ UN Habitat Projects, she was granted a British Chevening scholarship for a Master's degree on Development Study at University College London in 1994-1995. Afterwards, she joined a state-owned bank in Indonesia and contributed to several divisions, namely risk management, SMEs, Institutional Funding, and Corporate Social Responsibility. Her roles were an advisor for sustainability practices and climate change issues for the Board of Directors, as well as a liaison from the bank to the UNEP Finance Initiatives, and other multilateral and bilateral development banks and CSOs. After thirteen years in the banking sector, she was granted an Australian Leadership Award for pursuing a PhD study on Sustainable Development in University New South Wales, Sydney Australia in 2010-2014. After completed her PhD dissertation on "Corporate Sustainability and Responsibility of Banks in the Transition to a Low Carbon Economy: Cases in Australia and Indonesia", she joined the GIZ (German state-owned enterprise for international development cooperation) as a Senior

Advisor for the ASEAN Renewable Energy Support Programme (RESP) and based in the ASEAN Center for Energy, Jakarta Indonesia from January 2015 until now.



**HLA MYO AUNG**

*Deputy Director and the Head of Renewable Energy Research Department, Department of Research and Innovation, Ministry of Science and Technology*

Dr. Hla Myo Aung received his Ph.D. degree from Mandalay Technological University, Mandalay in 2008. He has experience in the Renewable Energy Sector, especially in the field of wind and solar energy for over 10 years. He received the Master Trainer certificate on “Support project to improve maintenance skills for Photovoltaic and other Renewable Energy Power Generation Systems” conducted by NEDO, Japan. He also attended the other Renewable Energy and Energy Efficiency training courses in India, Singapore, Thailand and Japan. His research interests include all aspects of Renewable Energy, Energy Efficiency and Energy Conservation, Energy Policy and Hybrid Power Generating System for rural electrification.



**IPPEI KITAHARA**

*Senior General Manager, Business Administration Headquarters, Asia Air Survey Co., Ltd.*

Asia Air Survey Co., Ltd. (AAS) is one of the biggest Japanese consultant companies specializing in aerial surveying. AAS has a 60 years history and provides solutions based on spatial information technologies. AAS has developed overseas projects worldwide. In October 2013 AAS Myanmar was established as part of AAS group with the main objective to carry out geospatial projects in Myanmar. Mr. Kitahara is a construction consultant engineer and obtained several Japanese professional engineering qualifications such as erosion control, construction environment, etc, as well as the Japanese surveyor license. Initially, he worked as river and erosion control expert in multiple public projects in Japan. In 2013, he became the person in charge for renewable energy at AAS and promoted several projects such as small hydroelectric generation, wood biomass generation, wind farms, hot springs generation, etc. In 2014, he was involved for one year in a JICA project for the investigation of the potential of small hydroelectric generation in Myanmar farm villages.



**KEITH RABIN**

*President, KWR International, Inc. and KWR International (Asia) Pte Ltd.*

Mr. Keith Rabin possesses over thirty years of public-private sector experience as a manager and consultant with substantial expertise directing energy, renewable energy and rural electrification as well as business, investment, economic, trade and project development, research and public relations/affairs initiatives. Mr. Rabin has several decades of Asia- and Myanmar-focused experience and recently directed a multi-year Myanmar Integrated Energy Development initiative for the University of Tokyo and Economic Research Institute for ASEAN and East Asia (ERIA), emphasizing grid extension, cross-border integration and rural/off-grid development. Mr. Rabin also directed preparation of Energy/Electrification section of Myanmar Comprehensive Development Vision, a multi-sector review for Myanmar’s Ministry of National Planning and Economic Planning. Mr. Rabin has also helped to design, implement and support many other energy, infrastructure, economic development, financial transactions, and policy related initiatives for public-private sector clients in Myanmar, Japan, Korea, Indonesia, Thailand, India, Malaysia, Bangladesh, Palau, Singapore, Philippines, China, Hong Kong, Vietnam, Kazakhstan, Turkey, Afghanistan and the United States. He has additional experience in Central and Eastern Europe, Latin America and the Caribbean. Mr. Rabin holds a Master’s degree from Columbia University School of International Affairs with a focus on International Business and Finance and a Bachelor’s Degree, Anthropology from the State University of New York/Albany.

**KHANT ZAW**

*Director General, Department of Rural Development, Ministry of Livestock Fisheries and Rural Development, Myanmar.*

With a background in engineering, U Khant Zaw progressively leads the Department of Rural Development (DRD), including leading the off-grid implementation of the National Electrification Plan.

**KOHI IWAKAMI**

*Economics Affairs Officer, United Nations, ESCAP*

Mr. Iwakami joined the United Nations' Economic and Social Commission for Asia and the Pacific (ESCAP), based in Bangkok in 1990. Since then, he has been working on different issues in the energy sector from electricity data collection from the member States, institutional arrangements in promoting energy efficiency, strategic planning and management of the energy sector, and now on the promotion of pro-poor public-private partnership in promoting widening access to energy services.

**MARC MULLER**

*Post-Doctoral Researcher, University of California, Berkeley and Stanford University*

Dr. Muller is interested in the potential to use satellite and GIS information to quantify hydrologic variability in ungauged basins. His current research focuses on Nepal, where this variability determines the feasibility of integrating micro-hydropower systems into rural water and power infrastructure into rural communities, and the Middle East, where predicting this variability is of strategic value to allocate transboundary water resources. Dr.

Muller's long term interests lie in valuing hydrological information (particularly derived from remote sensing platforms) and integrating this information into decision-making to support the development and improvement of water infrastructure. Marc has a PhD from the University of California at Berkeley and a licensed civil engineer (ETH) in his natal Switzerland.

**NAWA RAJ DHAKAL**

*Assistant Director, Alternative Energy Promotion Centre (AEPC), Nepal*

Mr. Dhakal serves as the Head of Planning at AEPC and the Manager for Institutional Development Sub-Component and Monitoring & Quality Assurance Unit of National Rural and Renewable Energy Programme (NRREP) executed by AEPC and supported by multiple external development partners. He has over 12 years of experience in implementation of renewable energy programmes/projects in Nepal. He started his career with AEPC in 2003 as Training Officer responsible for planning and implementation of various capacity building activities and worked in that position for more than four and a half year. Then he got promoted in the position of Senior Officer where he worked for another four and a half year coordinating capacity building activities and serving as the AEPC Counterpart for Biomass Energy Component of Energy Sector Assistance Programme as well as the Focal Person for Rural Energy Development Programme. He also worked as the Manager of Biomass Energy Sub-Component of NRREP, Focal Person for energy efficiency, Coordinator for the Biofuel Programme, and Focal Person for Biogas Support Programme of AEPC at various times. Mr. Dhakal holds Master of Science in Renewable Energy degree from Naresuan University, Thailand, and Master of Science in Microbiology degree with specialization in Environmental Microbiology from

**OLIVER J. HAAS**

*Energy Consultant and Project Manager, INTEGRATION, Germany*

Mr. Haas' areas of expertise include rural electrification in developing countries. His fields of interest are the conjunction of sectoral and spatial development in energy systems as well as the harmonization between global and local energy governance with respect to climate

friendly economic development and private sector participation. Mr. Haas acted as a team leader for INTEGRATION environment & energy on behalf of the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) in Northeast Afghanistan. The project supported rural electrification by decentralized mini-hydropower schemes and received the Ashden Award for Sustainable Energy in 2012 for innovative and successful approaches to rural electrification. Beside this, Mr. Haas has worked in Nepal, Pakistan, Nigeria, Kenya and Ghana on different assignments on decentralized rural electrification and productive use of energy.



**PATRICK PAWLETKO**

*Projects Officer, Green Empowerment, Myanmar*

Since 2011, Mr. Pawletko has worked in the micro-hydropower sectors of Central Africa and Southeast Asia as a turbine designer, a civil works consultant, and a local fabrication advocate. He learned the nuances of appropriate and local engineering design during his undergraduate studies, while working on a 40kW micro-hydropower scheme in the remote Cameroonian highlands. Mr. Pawletko recently transitioned to Southeast Asia, at first assisting HPNET and the REAM with a practice-to-policy workshop held in November 2014. He completed a six-month internship at the Center for Renewable Energy and Appropriate Technology (CREATE) in North Borneo earlier this year, in which he trained local, indigenous fabricators on the design of appropriate turbine technology. He is now serving as Projects Officer in Myanmar for the US-based non-profit Green Empowerment. Mr. Pawletko holds a Bachelor's Degree in Civil Engineering from Purdue University."

**REGGIE SINGH**

Reggie Singh has been an Energy Officer in the State Department's Bureau of Energy Resources, Office of Electricity and Energy Efficiency, since February 2014. His previous foreign assignments were Sydney, New Delhi, and Mexico City. He recently served on detail at the Office of the U.S. Trade Representative, where he focused on the Trans-Pacific Partnership trade negotiations. Additional assignments were in the Bureau of Economic and Business Affairs and the State Department's long term economic training course. He has a BA from the University of Maryland and a JD from Georgetown.



**ROBERT F. ICHORD, JR.**

*Deputy Assistant Secretary, Bureau of Energy Resources, Department of State, USA*

Dr. Ichord has a long history of U.S. Government service in the energy field, having worked for the Energy Research and Development Agency, the US Department of Energy, and USAID in Asia, the Near East and North Africa, and Eastern Europe and Eurasia. He initiated the first US energy assistance programs in Eastern Europe in 1990-92 and the New Independent states in early 1992. He pioneered the Utility and Regulatory Partnership programs with the US Energy association and the US National Association of Regulatory Utility Commissioners. From 1978-89, he guided efforts to expand rural electrification systems in Asia and introduce energy efficiency, renewable energy, and private power generation technologies and approaches. Dr. Ichord holds a Masters degree in Law and Diplomacy from the Fletcher School of Law and Diplomacy at Tufts University. He was awarded a Ph.D. in Political Science from the University of Hawaii.



**SOE SOE OHN**

*Director, National Electrification Plan, Project Management Office, Department of Rural Development, Ministry of Livestock Fisheries and Rural Development, Myanmar*

Dr. Soe Soe Ohn received a PhD. in Chemical Engineering from Yangon Technological University, Myanmar. She worked in the Renewable Energy Department, in the Ministry of Science and Technology as a chief of the bio-gas project for rural electrification from 2003 to 2013. In the bio-gas project, she researched and applied in more than 150 villages for electrification using community and family scale bio-gas plants. She now works as a project manager in NEP

project (off-grid electrification) to access the electricity by 2030 in Myanmar.



**THI THI SOE**

*Deputy Director, Renewable Energy Research Department, Department of Research and Innovation, Ministry of Science and Technology, Myanmar*

Dr. Thi Thi Soe obtained a PhD in Electrical Power Engineering from Mandalay Technological University, Myanmar. She has five years of experience in small-scaled wind turbine research specializing in the design and construction of radial and axial type wind turbine, as well as wind resource assessment. She has international papers published in IET, WASET, ICSE, ASEAN Engineering Journal and IJRR. She got Diploma of Wind Power Development and Use 2012b by Life Academy, sponsored by Sweden International Development Agency (SIDA) in 2013. She attended “11th International Training Programme on Wind Turbine Technology and Application” conducted by Centre for Wind Energy and Technology (CWET), India in 2013. She has successfully completed “The Talented Young Science Program (TYSP)” at Northwest University with the project title of “Optimum Model Plan of Wind Energy Application for Rural Electrification in Myanmar” from March 1, 2014 to March 1, 2015” certified by Ministry of Science and Technology, P.R.China. Her designation is Deputy Director of Renewable Energy Research Department, Department of Research and Innovation (DRI), Ministry of Science and Technology, where she serves not only as a researcher of the Wind Energy Section, but also as one of the trainers for the Short Term Course on Renewable Energy Training at the Renewable Energy Research Department, DRI.



**TIN MYINT**

*Director, Suntac Technologies, Myanmar*

U Tin Myint is a Director of Suntac Technologies, a leading engineering services company in Myanmar. He is responsible for business development, human resources development and training. Currently, U Tin Myint is focusing on the development of renewable energy businesses in Myanmar. U Tin Myint also consults to private and government clients in power generation (renewable and non-renewable), as well as engineering education. Currently he is with the international consultant team for “Off-grid Renewable Energy Demonstration Projects in Myanmar” of the ADB. He earned his Master of Engineering Science degree at the Development Technologies unit of the University of Melbourne in 1990. Previously U Tin Myint worked as a lecturer in Yangon Technological University and Defense Services Technology Academy, Myanmar Maritime University.



**XIAOPING WANG**

*Senior Energy Specialist, Energy Sector Management Assistance Program (ESMAP), The World Bank*

Dr. Wang is a senior energy specialist at the Energy Sector Management Assistance Program (ESMAP) of the World Bank. She led the initiative to develop Myanmar’s National Electrification Plan towards Universal Electricity Access by 2030 and is now preparing a \$400 million investment operation to support the implementation of the Plan. Her areas of expertise include renewable energy, urban and rural energy access, efficient supply and use of energy, and energy sector policies. She has worked in the energy sector for the Chinese government, UNDP and, in the last eleven years, for the World Bank in Latin American and Eastern European countries.



**YE NAING**

*Consultant, Kyaing Tone Power Company, Kyi Thein & Family Company, and Aye Thar Electrical Factory*

U Ye Naing served on the Government Electricity Supply Board from 1962 to 1992, as well as on various engineering officer posts across Myanmar. In 1992, he started his private work of constructing and consulting in establishing privately-owned small scale hydro

power plants. His experiences include constructing power line and power relay stations, including many mini grid lines established for remote villages. He became a member of the Renewable Energy Association of Myanmar (REAM) in 2005. As a consulting engineer for Kyaing Tone energy Company, he oversees the constructing and operating of village electrification and local township independent power producer projects across Myanmar.



**ZAW MIN**

*Coordinator, Small Hydropower Association of Myanmar, and Assistant Director, Kyaw Soe Win Micro Hydropower Enterprise, Shan State*

In 1999, U Zaw Min started as a micro hydropower practitioner in his father's enterprise. He obtained his B.Sc. in Physics from Distance Education of Mandalay University in 2002. And he designed various types of turbines including Pelton (single- and multi-jet), Francis (spiral case and open-flume type), propeller, and crossflow. He also serves as the Managing

Director of the Mega Myanmar Energy Company, which was founded in 2014 and has since signed two MOU contracts with the State Government for small hydropower projects to electrify off-grid areas in Eastern Shan State near Mong Ping. Currently, he provides small hydropower solution including system planning, design, feasibility study, turbine fabrication, and installation to off grid areas. U Zaw Min coordinates REAM's Small Hydropower Association of Myanmar, an association of micro, mini, and small hydro practitioners formed to advance the sector within the NEP.