

ACTION LEARNING EVENT

UPSCALING MINI-GRIDS FOR LOW-COST & TIMELY ACCESS TO ELECTRICITY SERVICES

The Hilton Hotel | Nay Pyi Taw, Myanmar | February 6-10, 2017



MISSION

The Energy Sector Management Assistance Program (ESMAP) is a global knowledge and technical assistance program administered by the World Bank. It provides analytical and advisory services to low- and middle-income countries to increase their know-how and institutional capacity to achieve environmentally sustainable energy solutions for poverty reduction and economic growth. ESMAP is funded by Australia, Austria, the European Commission, Denmark, Finland, France, Germany, Iceland, Japan, Lithuania, the Netherlands, Norway, Sweden, Switzerland, and the United Kingdom, as well as the World Bank.

WELCOME

It is our great pleasure to announce a learning event that comprises four roundtables, a conference and a field visit on **Upscaling Mini Grids for Low-Cost and Timely Access to Electricity Services**. The event will be held in Naypyidaw, Myanmar, February 6-10, 2017.

The event comes at a time when micro and mini grids provide great promise for electrifying large groups of people who never had access to electricity before. The event will host participants from 52 countries most of whom are managers and decision makers of mini grid programs in Asia and Africa. While mini grids have a long history and were an integral part of the power sector development of many of the current high income countries, they are only now emerging as a scalable option for meeting the energy demand in Sub-Saharan Africa, South and East Asia and Small Island Developing States. In these areas, according to the IEA, mini grids are a low cost and timely option for more than 120,000 villages and towns.

The event is coordinated by Climate Investment Funds (CIF) and the Energy Sector Management Assistance Program (ESMAP)—through Danida and UK DFID-supported Global Mini Grids Facility. The \$8.3 billion CIF provide scaled-up climate financing to 72 countries to pursue low carbon, climate resilient development. ESMAP is a global knowledge and technical assistance program administered by the World Bank. It provides analytical and advisory services to low- and middle-income countries to increase their know-how and institutional capacity to achieve environmentally sustainable energy solutions for poverty reduction and economic growth. ESMAP is a trust funded program.

In addition to a technical conference, this action learning event hosts three round tables targeting specific stakeholder groups to allow operational experts and decision makers to come together to share and discuss solutions to advance the uptake of mini grids in the rural marketplace. Invited participants will have the opportunity to visit two operational mini grid projects in Myanmar that brings together many of the key elements to allow for sustainable upscaling.

The event focusses on “**operationalization**” emphasizing problem solving in a timely fashion with and for the participants, addressing the day-to-day challenges many of you are facing in accelerating the upscaling of many mini grids. It will accommodate specific group discussion around programs and markets, as well as several issue centered discussions led by some of the global experts in the field. These issues range from standardized regulations, access to long term financing, and quality assurance framework to buy-in and ownership of the communities served.

The CIF and ESMAP Organizing Committee is actively engaged with the Government of Myanmar and other partners—particularly GIZ and DFID—in the preparation of the event and it will be a great honor and pleasure to welcome you to our learning event on Upscaling Mini Grids for Low Cost and Timely Access to Electricity Services.



Mafalda Duarte
Program Manager
Climate Investment Funds



Rohit Khanna
Manager
Energy Sector Management Assistance Program



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The Participants' List and available presentations will be posed online after the event has concluded at:
<http://www.esmap.org/node/57666>



MINI GRID CONTEXT IN THE GLOBAL SETTING

Mini grids are expected to play a critical role in meeting the Sustainable Energy for All (SE4All) goal of universal energy access by 2030. According to IEA, an estimated forty percent of the world's poor live in villages which are typically too far from the grid to be feasibly reached via grid extension in the near term. This is particularly true in Sub-Saharan Africa and developing Asia, where a majority of the population is expected to be in rural areas for the foreseeable future. For these load centers, decentralized mini grids are a practical alternative for a variety of technical and financial reasons. Mini grids are one of the main High Impact Opportunities within the SE4All initiative. They are also a priority in most of the SE4All Action Agendas under development in Africa.

In the past, proliferation or acceptance of mini grids as a credible energy access option was constrained by a number of factors: gaps in policies and regulations, a lack of long-term financing, and a lack of capacity or interest among power producers. More recently, technological and institutional innovations, and cost reductions have made mini grids a more attractive option. However, a lack of knowledge and exposure to global best practices continues to create policy and commercial barriers that hold back the expansion of sustainable mini grids. While mini grids have a long history and are widely used in several parts of the world, they are now emerging as a viable option for meeting the energy demand in Sub-Saharan Africa, and South and East Asia.

In response, several initiatives have been launched to address these challenges. In Myanmar, a donor coordination working group on energy access including mini grids has been established. Recently, a draft SWOT analysis and brief was presented as a summary of donor activity surrounding mini grids in Kenya, and outlines the guidance required from the Government to efficiently and effectively realize the potential of mini grids to help Myanmar reach its electrification targets. The updated brief will be available as input for the round table discussion.

The CIF's Clean Technology Fund (CTF) and the Scaling-Up Renewable Energy Program in Low Income Countries (SREP) are supporting the scaled-up demonstration and deployment of renewable energy in middle- and low-income countries. A series of projects supporting clean energy mini grids—based on renewable energy technologies including storage in systems with variable renewables, or RE-diesel hybrid systems—have been approved and are in startup phases, while others are in the pipeline.

ESMAP at the World Bank—leveraging the core funding from DFID—has initiated a Global Facility for Mini Grids to accelerate the pace of electrification to large groups of people. The facility will mainstream least cost mini grids into World Bank Group operations as well as develop the policy- and business-relevant knowledge and data needed to accelerate mini grid deployment. For more information see Annex A.

The objective of this event is to bring these initiatives/programs and related stakeholders together to discuss and isolate two or three issues for each of the stakeholder groups and seek solutions/action plans for these to accelerate the uptake of the mini grid sector for low cost and timely access to electricity services in the different countries. A facilitator ensures that a process of action learning is established and/or continued based on/in follow up to last year's event in Kenya. Beyond the group specific outcomes, it is envisioned that the overall lessons generated through the event will inform future efforts in the global mini grid sector on how to effectively scale up.

MINI GRID CONTEXT IN MYANMAR

In Myanmar, mini-grids using locally engineered technology have played a key role in the provision of electricity for thousands of villages that are outside of the country's limited national grid distribution network. These mini-grids largely emerged due to the drive from the local private sector and community organizations and with little or no public sector support, and reflect the resolve and ingenuity of many local communities in finding alternatives to candles and kerosene. At the same time, with limited access to the engineering expertise and/or constrained by limited budgets, most Myanmar mini-grids have significant issues with quality and reliability.

The Myanmar Department of Rural Development (DRD) under the Ministry of Agriculture, Livestock and Irrigation (MOALI) is the leading government agency in implementing the off-grid component of the National Electrification Plan (NEP), including mini-grid development in support of national electrification. The NEP provides technical assistance, capacity building and investment support for mini-grids. To date, over US\$600 million has been approved or committed by the government, World Bank and other development partners, as well as the private sector to support NEP implementation. Significant opportunities exist to both upgrade existing mini-grids and to develop new sites. Currently the NEP provides support for part of project capital cost, funding a portion of feasibility studies as well as capacity building.

According to the 2014 Myanmar Population and Housing Census, the national grid provides electricity to about 33% of Myanmar's 11 million households. In rural areas national grid coverage is much lower at only 15% of households. The same census estimates that about 1,013,000 households (9%) received electricity from private diesel generators. Solar home systems are in use in 11% of households, and batteries charged in local towns add another 21%. Failing these options, households use kerosene or candles.

Business models for mini-grids vary. In some cases, mini-grid projects are operated by a group of farmers selected by a village's Village Electrification Committee (VEC) with collection of monthly tariff payment performed by the leader of each 10-household block within the village. In other cases, the mini-grid is owned and operated by a private entrepreneur.

Diesel mini-grids encountered in villages are often powered by Chinese-made agricultural diesel motors powering inexpensive synchronous generators with power output typically 20kVA or lower. Tariffs for diesel mini-grids vary considerably, and are often charged per light or appliance. For example, in 2015 the Asian Development Bank found 2000 kyat/month (US\$ 1.82/month)¹ typical for a single 20W CFL lightbulb, and 5000 kyat/month (US\$ 4.55/month) for two lights and a TV.² Slightly lower tariffs were found in a 2016 study of 10 diesel mini-grids by the micro-credit NGO PACT, which found tariffs of 1000 to 1500 kyat/month for a single light bulb and 2500 to 4000 kyat/month (US\$ 1.83 to 2.92) for lighting and TV.³ Equivalent per kWh tariffs vary from US\$ 0.37 to over US\$ 1.

Hydropower mini-grids are mostly in hilly communities especially in Shan, Mandalay, and Sagaing states.⁴ The 2014 census reported approximately 178,000 households received electricity from "private waterwheels" – a category that includes both hydro-powered mini-grids as well as household-scale hydropower. FY 2015/16 data from the DRD estimates over 1,200 villages have electrified at least 70% of their households with micro-hydropower. Tariffs are typically lower than those charged by diesel-powered mini-grids at 200 to 860 kyat/kWh (US\$ 0.18 to 0.78/kWh).⁵

¹ This paper uses an exchange rate of 1100 kyat per US\$, consistent with rates mid-year 2015. Source: [http://www.xe.com/currencycharts/?from=US\\$&to=MMK&view=1Y](http://www.xe.com/currencycharts/?from=US$&to=MMK&view=1Y).

² Pradeep Tharakan. "Off-Grid Renewable Energy Program in Myanmar," accessed November 8, 2015, https://energypedia.info/images/b/bf/WB_NEP_seminar_ADB_presentation_Tharakan.pdf.

³ PACT. "Enabling Electricity Access in Myanmar: Assessing Diesel Mini Grids" (Yangon, Myanmar, October 2016).

⁴ Personal communication, U Aung Myint, October 2015.

⁵ Ajith Kumara. "Off-Grid Hydropower Status of Myanmar" (The NEP Workshop on Off-Grid Electrification in Myanmar, Naypyitaw, Myanmar, January 28, 2015), https://energypedia.info/wiki/File:1-4_Myanmar_offgrid_2015-01_Ajith_Kumara_Hydropower_Status.pptx. Slide 30.

Biomass gasifiers are common in the delta region, powering mini-grids as well as rice mills, irrigation pumps, saw mills, oil pressing, and ice making.⁶ The DRD records 472 villages provide power to at least 70% of village households by biomass/biogas. A reference tariff for biomass gasification mini-grids is 400 kyat/kWh (US\$ 0.36/kWh).⁷

Much less common at this point are solar mini-grids, either stand-alone or hybrid PV/diesel. DRD estimates that 150 villages are powered by solar mini-grids, but more are in the pipeline.⁸ Most solar mini-grids have been heavily subsidized as pilot projects commissioned by NGOs or the DRD. Myin Chi Naing (see field trip planned Wednesday 8 February) charges 1500 kyat for up to 100 watt-hours per day.

Key Issues

Considering that the vast majority of Myanmar's mini-grids were built from scratch with no government support under conditions of acute materials shortages, Myanmar's mini-grids have played an impressive role in helping achieving rural electrification. Never the less, four key issues constrain scale-up of mini-grid deployment:

Technical Quality | Some mini-grid distribution systems in Myanmar are built with high quality concrete poles and wires built to national grid standards. However, many are informal networks of wires strung on untreated wooden or bamboo poles or trees. Thin wires, inappropriate conductor metal (e.g., galvanized steel) and poor splices have considerable line loss. They can also be dangerous and failure prone: poles rot and fall over, thin wires break easily, and poor splices corrode and fail. The generators (diesel, micro-hydro, biomass) that energize Myanmar mini-grids are often inefficient, failure-prone, and unsafe.

Lack of Regulatory Framework | A regulatory framework that addresses mini-grids is necessary to provide developers and investors the certainty that they need to build these projects, and to provide assurances to the public that mini-grids will provide reliable power at affordable prices. Components of the needed regulatory framework include safety, quality of service, tariff regulation, and provision for what happens to the mini-grid when the main grid arrives. Eventually mini-grids will benefit from the creation of an independent regulatory authority, but until that happens basic functions such as registration of mini grid project sites to avoid competition for same load centers can be accomplished through local DRD offices.

Uncertainty Concerning Grid Expansion | Under the NEP, the national grid is expanding quickly in some areas, but others will not receive grid electricity for 15 years, if ever. Mini-grid developers hesitate to invest if they suspect the national grid is arriving soon. To ensure that investment in mini-grids is made in the right places and not made in the wrong places, NEP maps must be updated to reflect the best, most recent estimates. These maps should be made available to stakeholders including mini-grid developers and village decision-makers. As discussed above, regulations need to be put in place that provide opportunities for integration with the grid when it arrives for example through transfer of assets- or co-existence agreements.

Financing is not Available or with Very Unattractive Terms | Many mini-grid developers find it very difficult to get loans. Where they can get loans, they have short tenors (e.g., 1 year) and very high interest rates (40% or higher). With these terms it is nearly impossible to finance mini-grids that charge affordable tariffs. A consequence of high cost financing is that the private sector has built less robust and less reliable mini-grids that may have lower upfront costs, but cost more in the long run because of inefficiencies and frequent breakdowns.

More generally, the financial sector in Myanmar is under-developed and local capital markets which provide securitized long-term capital for infrastructure is non-existent.

⁶⁶ One company alone, "Royal Htoo Linn Manufacturing Co., Ltd." installed over 733 units as of August 2015. Of these, 358 were used to power rice mills and 145 for village electrification.

⁷ Royal Htoo Linn Manufacturing Co., Ltd. "Biomass Gasification as Renewable Energy" (Yangon, Myanmar, August 4, 2015).

⁸ Sunlabob. "Sunlabob Renewable Energy Secures Myanmar Contract for 11 Solar Grids," Eco-Business, October 9, 2015, <http://www.eco-business.com/press-releases/sunlabob-renewable-energy-secures-myanmar-contract-for-11-solar-grids/>; ADB, "MYA: OFF-GRID RENEWABLE ENERGY DEMONSTRATION PROJECT Technical Assistance Concept Paper," November 2013, <http://www.adb.org/sites/default/files/project-document/79567/47128-001-cp.pdf>.

AGENDA

Day 1. Monday, February 6 | SREP Country Round Table

TIME	SESSION	SPEAKERS
8:30	Registration	
9:00	Welcome and Introductions	Mr. Zhihong Zhang , SREP Program Coordinator, Climate Investment Funds Mr. Gevorg Sargsyan , Global Lead for Clean Energy, World Bank
	Overview: SREP Support to Mini Grids Overview: Outcomes from the Nairobi Conference Introduction of SREP Countries	Mr. Zhihong Zhang , SREP Program Coordinator Mr. Rafael Ben , Energy Specialist, Climate Investment Funds
9:45	Overview: Status Update on Projects Development, Including Implementation Issues	Insights from 8-10 countries
10:30	COFFEE BREAK	
10:45	Discussion: How to Address Implementation Issues—The Role of Innovation in Financing and Contractual Structures	Eng. John F. Kitonga , Energy Engineer, Ministry of Energy and Minerals, Tanzania (TBC) Mr. Nicolas Allien , Senior Energy Specialist, Cellule Energie, Ministère des Travaux Publics Transport et Communication, Haiti (TBC)
12:30	LUNCH	
1:45	Risks in Mini-Grid Development, including Social and Capacity Development Risks Group Discussion	Mr. Antony Garae , Director, Department of Energy, Vanuatu (TBC) Mr. Toch Sovanna , Director of New and Renewable Energy, Ministry of Mines and Energy, Cambodia (TBC)
2:30	Business Models: Transit from Subsidy Based Mechanism Business-as-Usual Model to a Market Driven Business Model Group Discussion	Mr. Morris Kayitare , Director of Primary Energy and Social Energies, Energy Development Corporation Ltd (EDCL), Rwanda (TBC) Mr. Mungai Kihara , Engineer, Ministry of Energy and Petroleum, Kenya (TBC)
3:30	Discussion on Solutions: What Can SREP, MDBs, and This Group Do to Tackle These Issues?	Facilitator
4:15	Summary and Closing	Mr. Zhihong Zhang & Mr. Rafael Ben
4:30	Q&A with SREP Government Officials – Open to the Public	

HOMER[®] Training Sessions

Introduction	Mon. & Fri. 9:00 – 12:00 pm
Advanced	Mon. & Fri. 1:30 – 4:30 pm

Day 2. Tuesday, February 7 | Mini-Grid Learning Event Technical Conference

TIME	SESSION	SPEAKERS
7.30	Registration	
08.00	Welcome	<p>H.E. Dr. Tun Naing, Deputy Minister, Ministry of Electricity and Energy (MOEE)</p> <p>U Khant Zaw, Director General, Department of Rural Development, MOALI</p> <p>Mr. Abdoulaye Seck, World Bank Country Manager for Myanmar</p>
	The Potential for Mini Grids in Providing Electricity Access	Mr. Manoj Sinha , CEO, Husk Power
8:40	Video Screening: <i>Access to Power Vital for Ending Poverty in Myanmar</i> (World Bank)	
8:45	Press and Photos	
9.00	Overview of the Day Introduction of Breakout Sessions #1	
	1 The Five Key Policy and Regulatory Decisions	Dr. Bernard Tenenbaum , Energy and Regulatory Consultant
	2 Subsidy Delivery & Tariffs	Mr. Subodh Mathur , Economist
	3 Three Standardized Solar Hybrid Mini Grid Packages	Mr. Peter Lilienthal , CEO, HOMER
	4 Standardized Process for Productive Uses & Gender Integration	<p>Ms. Svati Bhogle, TIDE, member of Energia</p> <p>Mr. Sebastian Rodriguez, Infrastructure for Sustainable Development</p>
	5 Digital Platforms for Community Engagement	Mr. Avinash Kumar , Quicksand
	Q&A	
10.00	COFFEE BREAK & Move to Breakout Sessions #1	
10:30	Breakout Sessions #1	Breakout Session Leaders
11:30	Return to Ballroom	
11.45	Report Out on Breakout Sessions #1 (5 mins. each)	
12.15	LUNCH	
1.30	Introduction to Breakout Sessions #2	
	6 Arrival of the Main Grid: Three Asian Case Studies	Dr. Chris Greacen , Regulatory Specialist (with Dipti Vaghela, Bernard Tenenbaum)
	7 Interconnection & Technical Specifications	Mr. Payomsarit Sripattananon , Thailand Provincial Electricity Authority (VSPP)
	8 Geospatial Planning	Dr. Claudio Vergara , MIT Energy Initiative
	9 Facilitation for New & Established Mini-Grid Companies	Mr. Pariphan Uawithya , Rockefeller Foundation
	10 Guarantees and Financial Products	Mr. Kapila Subasinghe , Development Finance Corporation of Ceylon (DFCC Bank)
	Q&A	
2.30	COFFEE BREAK & Move to Breakout Sessions #2	
3:00	Breakout Sessions #2	Breakout Session Leaders
4.00	Return to Ballroom	
4.15	Report Out on Breakout Sessions #2 (5 mins. each)	
4:45	Summary and Wrap Up	Mr. Rohit Khanna , ESMAP Practice Manager Myanmar official (TBC)
5:30	RECEPTION	

Day 3. Wednesday, February 8 | Field Trip (Registration Closed)

TIME	SESSION
05:00	Depart from Hilton Hotel, Naypyitaw
05:30	Bus ride #1 to Myin Chi Naing (21.519436 N, 96.098465 E)
08:00	BREAKFAST / Rest Stop
10:30	Field Visit: Myin Chi Naing (2.5 hours) Visit: solar array, distribution network, pre-pay purchase kiosk, and one or more customers; meet operator
1:00	Bus ride #2 to Ton Lon (21.56344032 N, 96.12715912 E) LUNCH (en-route)
1:30	Field Visit: Ton Lon (1.5 hours) Visit: generator, distribution network, and one or more customers; meet operator
3:30	Bus ride to Hilton Hotel
8:30	Arrive hotel

Note: To minimize crowding, the group may be split into parallel visits.

Day 4. Thursday, February 9 | Myanmar Mini-Grids Roundtable

TIME	SESSION	SPEAKERS
7.30	REGISTRATION	
08:00	Welcome and Myanmar Overview	U Khant Zaw , Director General, Department of Rural Development, MOALI U Tin Maung Oo , Managing Director, Electricity Supply Enterprise
8.30	Expert Overview: The Status, Opportunities, and Challenges Facing Mini Grid Expansion in Myanmar	Dr. Chris Greacen , Mini-Grid Specialist
8.50	Panel Discussion: What Role Can/Do Development Partners Play?	Moderator: Xiaoping Wang , World Bank Ms. Regine Dietz , GIZ Mr. Pariphan Uawithya , Rockefeller Foundation Mr. Yoshifumi Tokushige , JICA Mr. Richard Harrison , Pact Ms. Christa Avery , Infra Capital Myanmar (DFID)
	Q&A (15 minutes)	
10.00	Introduction of Breakout Sessions #1	
10.30	COFFEE BREAK & Move to Breakout Sessions	
10.45	Breakout Sessions #1	
	1 Interconnection to the Grid	U Tint Myint , Suntac Technologies Mr. Tony Kalupahana , Myanmar Department of Rural Development consultant
	2 Business Models to Support Community Ownership & Private Sector Developers	U Zaw Min , Win-Thet-Di Hydro Power Mr. Matthew Tiedemann , Pact Myanmar
	3 Reducing Capital Expenditures for Mini Grid Systems	Mr. Pol Arranz-Piera , Trama TecnoAmbiental
	4 Access to Financing	Mr. Subodh Mathur , Economist
	5 Two-tier Tariff Structure	Mr. Peter Lilienthal , HOMER
11.45	Return to Ballroom	
12.00	Report Out on Breakout Sessions #1 (5 mins. each)	
12.30	LUNCH	

TIME	SESSION	SPEAKERS
1.30	Mini Grid Developers Panel: What Challenges do Myanmar's Developers Face in Mini Grid Expansion? (In Ballroom)	U Sai Htun Hla , Sai Htun Hla Brothers U Soe Tint Aung , Royal Htoo Linn Mr. Andrew Schroeter , Sunlabob U Aung Myint , REAM
	Q & A	
2.15	Introduction of Breakout Sessions #2	Breakout Session Leaders
2.45	COFFEE BREAK & Move to Breakout Sessions	
3.00	Breakout Sessions #2	
	6 Regulation Without a Regulator	Dr. Bernard Tenenbaum , Regulatory expert Dr. Soe Soe Ohn , Myanmar Department of Rural Development
	7 Improvements in Safety and Service Delivery	U Khun Aung Myo , Small Hydro Association of Myanmar Mr. Patrick Pawletko , GIZ
	8 Rebranding Mini Grids as a Sustainable Solution for Myanmar	Ms. Adriana Karpinska , Pact Myanmar Mr. Ashish Dhankhar , Mandalay Yoma
	9 Experiences of Mini grid Operators in Myanmar	Mr. Matthew Tiedemann , Pact Myanmar DMG Operators
	10 Training Centers and Capacity Building	Mr. Vishwa Amatya , Practical Action
4.00	Return to Ballroom	
4.15	Report Out on Breakout Sessions #2 (5 mins. each)	
4.45	Reflections and Closing	U Khant Zaw , Director General, Department of Rural Development, MOALI

Day 5. Friday, February 10 (AM) | Private Sector Roundtable

TIME	SESSION	SPEAKERS
7.30	REGISTRATION	
8.00	Welcome and Introductions	Mr. Malcolm Cosgrove-Davies , Global Lead on Energy Access, World Bank Group
8.15	Opportunities for the Private Sector in Asia	Mr. Ricky Buch , GE Power
8.30	Respondents: Lessons from the Field	U Soe Tint Aung , Royal Htoo Lin U Zaw Min , SHPAM Mr. Kyaw Min Tun , SolarRiseSys
	<ul style="list-style-type: none"> What does it take to move from a few projects to many? Q & A	
	Respondents: Lessons from the Field	Mr. Enamul Karim Pavel , IDCOL Mr. Andrew Schroeter , Sunlabob Mr. Anjal Niraula , Gham Power
	<ul style="list-style-type: none"> What do you need to bring private sector development to scale in your target country? Q & A	
10.00	COFFEE BREAK	
10.15	Respondents: Lessons from the Field	Mr. Ricky Buch , GE Power Ms. Csilla Kohalmi-Monfils , Executive VP, Business Development, ENGIE Mr. Zaw Zaw Aung , Director, Business Development, Schneider Electric Mr. Alakesh Chetia , Micropower International
	<ul style="list-style-type: none"> What is your global corporate strategy for roll-out of mini grids to 1,000 load centers? Q & A	

TIME	SESSION	SPEAKERS
11.00	Building a Mini Grid Industry Association: Experience from Africa	Mr. Manoj Sinha , CEO, Husk Power
	Panel Discussion: How to Advance the Role of the Private Sector in Respective Countries and the Role of Associations <ul style="list-style-type: none"> • What roles should an association play? • How can an association foster relationships with government? • How do competitors work together to advance the industry? • As membership grows and diversifies, how does the role of the association change? 	U Aung Myint , Renewable Energy Association of Myanmar Ms. Katarina Hasbani , Alliance for Rural Electrification Ms. Dipti Vaghela , Hydro Power Network
	Q & A Summary and Closing	Mr. Malcolm Cosgrove-Davies , Global Lead on Energy Access, World Bank Group

12.00 LUNCH

Day 5. Friday, Feb 10 (PM) | Mini-Grid Innovations & Solutions from Around the Globe

TIME	SESSION	SPEAKERS
1.00	REGISTRATION	
1.30	Welcome and Introductions	Mr. Jon Exel , Team lead, Global Facility on Mini Grid, ESMAP
1.45	Ignite Session #1	
	Incentivizing Private Investment for Upgraded Energy Services	Mr. Kamalesh Doshi , Simplify Energy Solutions
	Lessons Learned from PV Hybrid Microgrid System in Chaungtha, Ayeyarwady Region, Myanmar	Prof. Dr. Aung Ze Ya , West Yangon Technological University
	Electro-Water Bottle: A Tool for Community Education on Off-grid Electricity Systems	Mr. Eric Youngren , Capillary Systems
	Research and Data Needed to Support Mini Grids	Ms. Adriana Karpinska and Mr. Matthew Tiedemann , Pact Myanmar
	Myanmar Leapfrog to Mini Grid Solutions	Mr. Dieter Billen , Principal, Roland Berger, Myanmar
3.00	COFFEE BREAK	
3.15*	Ignite Session #2	
	Mini Grid Survey of Nepal, Cambodia and Myanmar	Mr. Byran Bonsuk Koo , World Bank
	Enabling Villages to Harness Community Power	Mr. Staffan Qvist , MPower Initiative, Myanmar (TBC)
	Lessons from Renewable Energy Development from Nigeria and Bangladesh	Dr. Mostaq Ammed , Green Housing and Energy
4.45	Closing and Week Wrap-Up	U Khant Zaw , Director General, Department of Rural Development, MOALI Mr. Jon Exel , Team Lead, Global Facility on Mini Grids, ESMAP Ms. Xiaoping Wang , Energy Specialist, ESMAP

* If you are interested in making a 5-minute presentation during this session, please contact the program organizers: Catherine Morris or Marjorie Araya.

BIOS | SPEAKERS & MODERATORS

ADRIANA KARPINSKA | PACT MYANMAR



After living off the grid in New Zealand, **Adriana** studied a multidisciplinary MSc programme *Renewable Energy & Environmental Modelling* in Scotland, with a focus on commercial, policy, and technology aspects of renewable energy grid integration in the UK's energy market. During a placement at the Sino-Danish Renewable Energy Centre in Beijing, she assessed the technical and political challenges of integrating off-shore wind energy resource into China's energy mix. She later interned with GIZ at a multi-donor energy programme European Energy Initiative – Partnership Dialogue Facility and later continued to work as a consultant on EU-Africa policy dialogue issues in Belgium. She settled down in Myanmar in mid-2016 after 2 months of exploring off-grid energy solutions in Indonesia and joining the Global Himalayan Expedition to electrify a remote monastery in Northern India. She has supported GIZ Myanmar in initial phases of its off-grid electrification programme and recently joined Pact Myanmar, where she focuses on community-driven decentralized energy solutions and rural entrepreneurship in Myanmar.

ANJAL NIRLA | GHAM POWER



Anjal is an off-grid solar expert leading a team of 30 highly talented individuals in developing and deploying solar PV based projects in rural areas of Nepal. The focus is on developing micro-grid along with productive end use loads to ensure that the micro-grid are self-sustainable at the least, but with the aim of achieving decent return for a private investor over 10 years.

Anjal was a Chevening scholar at University of Edinburgh where he read Energy Systems, and has an electrical and computer engineering degree from Jacobs University, Germany. He also volunteers for Engineers without Borders.

ASHISH DHANKHAR | TECHNICAL DIRECTOR | MANDALAY YOMA



Ashish is Technical Director of Mandalay Yoma dedicated to the development of community scale renewable energy projects in rural and isolated locations of Myanmar. Most projects are located in central Myanmar and use solar PV technology with a capacity between 100 -200 kW. He previously held the position of Sub-Division Officer at the Power Department in Government of India, focusing on rural electrification through grid extension and renewables. There he worked on the design and implementation of a "RGGVY" scheme with the Ministry of Energy for village electrification and providing electricity to all. He also consulted Windiva Hybrid Energy Pvt Ltd in various solar, wind, and hybrid projects as independent advisor. Ashish is an Electrical Engineer with experience in sustainability, renewable energy, and grid extension planning.

AUNG MYINT | GENERAL SECRETARY, RENEWABLE ENERGY ASSOCIATION MYANMAR



In 1995, **U Aung Myint** 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). Previously, he was a teaching staff and research scholar/leader at Departments of Botany, Marine Biology and Marine Science at Mawlamyine University between 1972 and 1989.

BERNARD TENENBAUM | INDEPENDENT CONSULTANT



Bernard is an independent energy and regulatory consultant. He has served as a lead advisor to The World Bank on power sector reform and regulation projects in Brazil, China, India, Mozambique, Tanzania, and Nigeria. He is a co-author (with Chris Greacen, Tilak Siyambalipitya, and James Knuckles) of *From The Bottom Up: Using Small Power Producers to Promote Electrification and Renewable Energy in Africa* (World Bank), which 13,000 downloads since its publication in February 2014.

Before joining The World Bank in 2000, he served as the Associate Director of the Office of Economic Policy at the U.S. Federal Energy Regulatory Commission; authored/co-authored *Regulation by Contract: A New Way to Privatize Electricity Distribution?*; *Governance and Regulation of Power Pools and System Operators: An*

*International Comparison; Electrification and Regulation: Principles and a Model Law; and A Handbook for Evaluating Infrastructure Regulatory Systems; and is a member of the editorial board of the *International Journal of Regulation and Governance*.*

He is a Phi Beta Kappa graduate of Colgate University and received his Ph. D. in Economics from the University of California, Berkeley.



BRYAN BONSUK KOO | CONSULTANT | THE WORLD BANK

Bryan is currently working on Multi-tier energy access Tracking Framework global survey for household as well as mini-grid operators at the World Bank, specifically he has experiences in designing sampling strategies and survey instruments for energy projects. Particularly, he is responsible for mini-grid operator survey in Myanmar, Cambodia, and Nepal.



CATHERINE MORRIS | SR. MEDIATOR, CONSENSUS BUILDING INSTITUTE

Catherine has designed, convened, and facilitated stakeholder forums and negotiations on a broad range of environmental and energy topics both in the U.S. and internationally. Catherine helps stakeholders across diverse organizations and sectors to develop and implement more effective agreements by relying on credible experts and analysis to support their joint learning and negotiations. Catherine facilitated the joint World Bank-Climate Investment Fund Mini Grid Learning Event in Nairobi in May 2016. Following the event, she has been working with a number of mini-grid private sector developers in East Africa, exploring the creation of an industry association. In the U.S.



CHRIS GREACEN | INDEPENDENT CONSULTANT | RENEWABLE ENERGY AND RURAL ELECTRIFICATION

Chris 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 policies and conduct studies in support of the country's feed-in tariff program. As a consultant to The World Bank, GIZ, and ADB, he is helping develop and implement 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 to develop the regulatory framework for Tanzania's Small Power Producer program. He has worked on renewable energy mini-grid projects in Thailand, Cambodia, Laos, Vanuatu, Micronesia, India, US Native American reservations, 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.



CHRISTA AVERY | COMPANY DIRECTOR | REEX CAPITAL ASIA & PROJECT DIRECTOR INFRA CAPITAL MYANMAR

Christa is a Company Director (GAICD) and senior executive with over 20 years' experience in Asia Pacific regional markets and over 8 years of on-the-ground operational roles in Myanmar since the 1990's. Largely assisting companies with market entry strategy, project development, and finance, Christa has been involved in a range of sectors, including oil and gas, manufacturing, and agriculture. Previously, Christa served as the Chief Operations Officer of the KT Group of Companies in Myanmar and helped structure joint venture agreements and joint operations agreements between international and local partners. Having obtained a Master Degree in Environmental Management in 2010, Christa welcomed the opportunity to be part of the *Infra Capital Myanmar* team committed to developing and financing renewable energy solutions as part of their mandate to originate, develop, and finance infrastructure projects in Myanmar.



CSILLA KOHALMI-MONFILS | EVP STRATEGY AND NEW BUSINESS | ENGIE ASIA-PACIFIC, THAILAND

Csilla is the Head of Strategy and New Business at ENGIE Asia-Pacific. Before joining ENGIE in 2011 as Strategic Projects Director, Csilla held senior functions at various energy companies in Hungary, including MOL Group. Csilla started her career with Unilever where she headed up business development projects in Europe and Latin America. Later, at the Boston Consulting Group, she developed new business opportunities and managed change projects for corporate clients across the world.

Csilla holds a BSc in Chemical Engineering and an MSc in Bioengineering from the Technical University of Budapest (Master thesis in Molecular Biology at CNRS—Institut Jacques Monod in Paris). She also holds an MBA from INSEAD, Fontainebleau.

DIETER BILLEN | PRINCIPAL & HEAD | ROLAND BERGER, MYANMAR



Dieter has worked in several countries across Southeast Asia, and originally started at the firm's Brussels office in Belgium. With 10 years of experience, he consults on public sector development, economic development, regulations and strategic infrastructure development, including setting up public-private partnerships. His infrastructure experience covers areas such as energy and utilities, transport and telecom. Dieter has advised on the Dawei Special Economic Zone in Myanmar, one of the largest industrial and infrastructure developments in Asia, and on liberalizing Myanmar's telecom industry.

Dieter holds a Master's degree in International Economics and Business from the University of Leuven in Belgium. He is also a graduate in International Economic Policy at the Kiel Institute for the World Economy in Germany and attended the Executive Program in Infrastructure and Public-Private Partnerships at Harvard University.

ENAMUL KARIM PAVEL | HEAD OF RENEWABLE ENERGY | INFRASTRUCTURE DEVELOPMENT COMPANY LIMITED



Md. Enamul Karim Pavel joined IDCOL in 2004 and played a key role in development and implementation of renewable energy programs/projects of IDCOL. He is leading IDCOL's renewable energy team to promote renewable energy technologies in Bangladesh. Enamul is an expert in financing modeling and developed several financial models for implementation of various infrastructure and renewable energy projects financed by IDCOL. He is also a faculty in financing modeling course regularly offered by IDCOL and so far trained more than 500 bankers, government officials, project developers and project sponsors. As an expert in renewable energy financing he trained officials from various African and Asian countries.

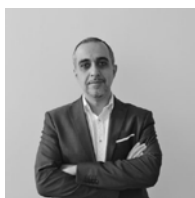
Before joining IDCOL, he served in various administrative positions in the Government of Bangladesh.

ERIC YOUNGREN | CAPILLARY SYSTEMS



Eric worked on his first solar PV system in 1993 and has been designing and installing off-grid and grid-tied solar PV and hybrid power systems professionally since 2001. Eric is currently the solar PV specialist technical consultant to the Asian Development Bank's Off-Grid Renewable Energy Demonstration Program mini-grid project in central Myanmar and the Inspection and Verification Agent team for the World Bank-supported off-grid solar PV elements of the Myanmar National Electrification Project. Eric is Founder and CEO of Capillary Systems, a start-up company based in Washington (state), USA, developing hardware and software technology for electric power management and distribution in battery based solar PV and hybrid mini-grids.

GEVORG SARGSYAN | GLOBAL LEAD – CLEAN ENERGY | THE WORLD BANK



Gevorg is currently the Global Lead for Clean Energy at the World Bank. He is responsible for renewable energy, energy efficiency and carbon capture and storage business lines. Mr. Sargsyan is also overseeing clean energy investments financed by various climate funds. During his 15 years of experience at the World Bank, he has led energy and infrastructure programs in India, Russia, Sri Lanka, Maldives, Armenia and Georgia, and worked in a number of other countries in Europe, Asia and Africa.

Prior to joining the Bank, he worked as a manager in various private and public sector organizations. He is the author and co-author of a number of publications and papers in the area of clean energy and infrastructure finance. He has an M.S. in applied math, and a Ph.D. (ABD) in economics.

JON EXEL | LEAD - GLOBAL FACILITY ON MINI-GRIDS | ENERGY SECTOR MANAGEMENT ASSISTANCE PROGRAM, THE WORLD BANK



Jon leads ESMAP's Global Facility on Mini Grids. The facility's objective is to mainstream low-cost mini-grids into operations, as well as develop the knowledge to achieve this. Jon also manages ESMAP's Energy Access for the Urban Poor initiative. Jon has over two decades of experience in energy access and alternative energy sector. He previously worked with The World Bank (1998-2004) on renewable energy operations in Asia and Africa, private investors, national governments, and NGOs; and started the first registered mini-hydro development company under the new energy policy and regulations in Croatia. He has worked with diesel, solar, hydro, wind, and biomass based energy systems, focusing on the delivery of energy services to large groups of end users, business delivery models, business plans, (pre)investment plans, market intelligence, and how institutions and businesses deliver these services.

Jon has lived and worked in Liberia, Indonesia, Bosnia and Herzegovina, East Jerusalem, and Cambodia. Jon is a Dutch national and holds Master's in Energy Engineering and Business Administration.

KAPILA SUBASINGHE | VICE PRESIDENT OF SPECIALIZED PROJECT LENDING/HEAD OF CONSULTING | DEVELOPMENT FINANCE CORPORATION OF CEYLON (DFCC BANK)



Kapila is Vice President of Specialized Project Lending/Head of Consulting at DFCC Bank and a former Project Director of the Sri Lankan Renewable Energy for Rural Economic Development Project, funded by The World Bank and Global Environment Facility. Kapila has 23 years of experience at DFCC Bank in project management, renewable energy, and project finance; extensively involved in financing investments related to off-grid and grid-connected renewable energy; and served as head of the Project Management Department for 3 years, managing credit lines offered to the Government of Sri Lanka by The World Bank, Asian Development Bank, European Investment Bank, and KfW. Currently, his responsibilities include: driving the project lending function; overseeing the evaluation and implementation of large scale, specialized projects; and managing DFCC Consulting (Pvt) Ltd.

He is a resource to renewable energy forums and delegations studying the Sri Lankan renewable energy model. Last year, he led a team in developing an Adoptable Solar Loan Product for Participating Financial Institutions in Uganda. Kapila holds a Civil Engineering degree from University of Moratuwa, Sri Lanka, and is a Fellow Member of the Chartered Institute of Management Accountants, UK.

KATARINA UHEROVA HASBANI | ALLIANCE FOR RURAL ELECTRIFICATION



Katarina is a Board Member of the Alliance for Rural Electrification. Katarina manages business development for Revelle Group with focus on Asia and sustainable energy. Katarina is a public policy professional with more than 15 years of experience from South-East Asia, Middle East, and Europe. She moved to Singapore from Dubai, where she was directing Government's efforts to reduce energy consumption by 30% by 2030. In the European Commission, she worked on energy diversification efforts in its East and South Neighborhood along with policy work on renewables, energy efficiency, and electricity and gas market liberalization. She worked on projects with REN21, UNECE, and IRENA. She holds Insead Global Executive MBA and a MA from the Paris Institute of Political Sciences.

KHUN AUNG MYO | MANAGING DIRECTOR, KHUN FHARA BWAR CONSTRUCTION COMPANY AND WIN-THET-DI HYDRO POWER



U Khun Aung Myo is a Civil Engineer, having graduated from the Yangon Institute of Technology in 1996. He served as a Building Engineer in the Department of City Development, Yangon Division from 1996 to 1998. In 2000, he started a private construction company and, from 2003 to 2004, he managed joint private businesses related to hydropower electrification. He is currently the Managing Director of the Khun Fhara Bwar Construction Company and the Win-Thet-Di Hydro Power Production Company. His Aung Thet Di Company now provides hydroelectricity services, including site survey and feasibility studies, and produces various types of micro hydropower turbines.

KYAW MIN TUN | MANAGING DIRECTOR, SOLARISESYS



U Kyaw Min Tun has extensive management experience in U.S. Corporate world and local Myanmar Industries. As a Founder and Managing Director, Kyaw Min Tun is responsible for the company's entire operations, including near- and long-term strategies, within a focus on expanding the company's customers and services based on creating new revenue growth in both government and commercial sectors.

He holds a BA in Economics from the University of Virginia, U.S.

MALCOLM (MAC) COSGROVE-DAVIES | GLOBAL LEAD FOR ENERGY ACCESS, WORLD BANK



Mac is a U.S. National who started with the World Bank in 1992 as a contract employee for the Asia Alternative Energy Unit (ASTAE), focusing on rural and renewable energy in South and East Asia. He formally joined the Bank in 1999 as a Sr. Energy Specialist. Mac has worked in the Africa region for nearly 10 years, and returned to South Asia for about 3 years before serving as Energy Practice Manager in LAC for 3 years. He is currently the World Bank's Global Lead for Energy Access.

Mac's career includes deep experience across the energy sector, including team leadership and supporting roles covering grid and off-grid energy access, small and large renewable energy, energy sector reform/restructuring, emergency power, hydropower, thermal power and transmission. His passion for the energy access agenda has been nurtured throughout his career, including highlights such as the Sri Lanka Energy Services Delivery Project, Lao Rural Electrification Project, and Uganda Energy for Rural Transformation Program. In his current role, he seeks to lead the World Bank's Energy Practice in expanding and further leveraging its energy access work, including building effective and impactful links within and outside the institution.

MANOJ SINHA | CO-FOUNDER AND CEO, HUSK POWER SYSTEMS



Manoj is the co-founder and CEO of Husk Power Systems—a pioneering rural utility that provides decentralized renewable energy to off-grid and underserved communities. He co-founded Husk Power Systems in 2008, which designs, installs, and operates 25 to 250kW mini-power plants that convert agricultural waste and solar energy into affordable electricity for people in rural India and East Africa. Currently, they are providing energy to 500 Indian villages, which serves over 250,000 people. By 2021, Manoj aims to provide affordable, renewable and reliable power to over one million people in rural areas.

Previously, Manoj worked as a Senior Director of the Innovation Lab at McGraw-Hill Financial in New York, where he led a team of financial analysts to develop and launch risk management analytics for financial institution professionals. Prior to this, he worked as a Senior Design Engineer at Intel Corp in Austin, Texas, where he designed next generation microprocessors for mobile devices. He holds 7 U.S. patents in the semiconductor industry for circuit design.

Manoj completed his MBA from Darden GSB at University of Virginia, MS in Electrical and Computer Engineering from University of Massachusetts Amherst, and B.Tech from IIT Varanasi.

MATTHEW TIEDEMANN | CHIEF OF PARTY | PACT MYANMAR



At PACT Myanmar, **Matthew** manages the US Agency for International Development's flagship development award in Myanmar, *Shae Thot (The Way Forward)*, a US\$70 million program that has improved services in more than 2,800 rural villages. *Shae Thot* builds capacities of communities to identify and manage their development priorities, enhance their livelihoods through access to finance and improved agricultural practices, address maternal and child health needs, and increase access to safe water. PACT Myanmar's *Ahlin Yaung (Light)* access to renewable energy program overlaps with *Shae Thot* project communities. Matthew developed a strategic paper to include renewable energy programming into PACT's global portfolio, and he is a key member of the PACT country office renewable energy incubation team. Before coming to Myanmar, he led country offices and large development projects in Vietnam, Malawi, and Tanzania.

PARIPHAN UAWITHYA | ASSOCIATE DIRECTOR, THE ROCKEFELLER FOUNDATION



Since joining The Rockefeller Foundation in 2012, **Pariphan** is part of The Rockefeller Foundation's Smart Power for Rural Development initiative, a \$75 million program aimed at scaling decentralized renewable energy mini-grids to serve off-grid and underserved communities in rural India. Most recently, he has been scoping renewable energy mini-grid market in Southeast Asia, particularly Myanmar. He is also responsible for building strategic partnerships with donors and investors seeking to invest in mini-grid and rural development. Pariphan manages Monitoring and Evaluation partners who monitor the impact and outcomes of the Smart Power initiative. In 2014, Pariphan oversaw the implementation of an accelerated decentralized renewable mini-grid effort that established 26 solar power plants and mini-grids in India and led the development of Smart Power Implementation Monitoring System (SIMS), a near real-time portal that is being used to track operation data of power plants. He coordinated the design of Smart Power India (SPI), an entity uniquely created to provide support services to energy service companies. He is a member of Bellagio Review Committee assessing and reviewing applicants to the Bellagio Practitioner Residency program, and manages other innovative projects aimed at addressing development challenges in the region.

Before joining the Foundation, Pariphan worked with Save the Children Sweden. He coordinated regional child rights governance programs and led the design and implementation of its regional advocacy and communications strategy. Prior to joining Save the Children, Pariphan worked at Oxfam as the Regional Communications Officer.

He holds a Master's degree from Ball State University, Indiana, and a Bachelor's degree from University of Melbourne.

PATRICK PAWLETKO | GIZ



Patrick is a mini-grids advisor for the GIZ Myanmar project, *Promotion of Rural Electrification*, where he works to facilitate private sector, governmental, and community capacity building activities. Prior to joining GIZ, Patrick served as an in-house mini-grids expert at the Renewable Energy Association Myanmar (REAM) from 2015-2016. Patrick worked for four years as a micro-hydropower designer in Cameroon and, since 2010, he has supported community- and private-sector driven mini-grid campaigns in Borneo, Indonesia, Myanmar, and in the South Pacific.

Patrick holds a degree in Civil Engineering from Purdue University.

POL ARRANZ-PIERA | PROJECT DIRECTOR | TRAMA TECNOAMBIENTAL



Pol has worked for Trama TecnoAmbiental (a private Spanish firm) since 2002, where he currently serves as Projects Director, dealing with projects in the field of rural electrification based on renewable energy, sustainable energy service schemes, stand-alone PV systems, mini-grids, public lighting applications, grid-connected systems, business models, social integration, communication and dissemination.

Since 2010, he has collaborated as an Associate Researcher in Sustainable Energy within the Research Group on Engineering sciences and Global development and the Institute for Sustainability at the Technical University of Catalonia, focusing on the development of distributed energy generation planning methodologies, supply chains, and small scale bioenergy and solar systems. He has been actively involved in the promotion of sustainable energy infrastructure and service schemes (covering basic community and productive uses of energy) for rural and isolated areas, including technical and financial design, implementation, monitoring and evaluation, by commissioning of private and public clients, NGOs, and multilateral agencies like The World Bank, the European Commission, and UN agencies, among others. Pol has over 16 years' experience in renewable energy engineering and consultancy projects and has worked in off-grid mini-grids since 2004 in Perú, Ecuador, Nicaragua, Ivory Coast, Costa Rica, Paraguay, Morocco, Guinea Bissau, Burkina Faso, Sierra Leone, Kenya, and is currently supervising the GEDAP pilot mini-grid project in Ghana.

RAFAEL BEN | ENERGY SPECIALIST | CLIMATE INVESTMENT FUNDS



Rafael (Rafa) is an Energy Specialist for the Scaling-Up of Renewable Energy Program (SREP), coming from The World Bank Energy and Extractives Global Practice where he worked as a consultant on renewable energy projects (mostly CSP and geothermal), in Africa, Middle East & North Africa, and Latin America & Caribbean regions. He was also part of the IFC Advisory Services Clean Energy team, analyzing the portfolio of renewable captive power projects. Prior to joining The World Bank, Rafa held different positions in the public and private sectors, among them, bioethanol project manager at Acciona, renewable energy engineer at the Spanish Institute for Aerospace Technology (focused on hydrogen and fuel cells), and business development manager for the European market at Sinovel (a Chinese manufacturer).

Rafa is a Spanish national and holds a Chemical Engineering degree and a Master's in Renewable Energy and Energy Markets.

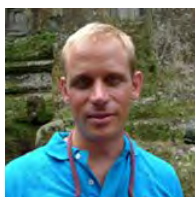
REGINE DIETZ | GESELLSCHAFT FÜR INTERNATIONALE ZUSAMMENARBEIT (GIZ) GMBH



Regine is heading the rural electrification project in Myanmar implemented by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. Before she was a team leader in the energy department of GIZ, coordinating different international cooperation programmes on behalf of the German Federal Ministry for Economic Affairs and Energy that are fostering business partnerships and the political environment in the renewable energy sector in Sub-Saharan Africa and South-East Asia. She has more than 10 years of experience in the field of renewable energy/ rural electrification policy consulting with a focus on emerging and developing countries.

She has studied at Freie Universität Berlin, Ludwig-Maximilians-Universität, München, and the University of Westminster, London, and holds a degree in political science.

RICHARD HARRISON | COUNTRY DIRECTOR | PACT MYANMAR



Richard provides overall leadership and management across Pact Myanmar's 26 offices, which serve the development needs of more than 13,000 villages nationwide. He has expanded the country office portfolio to include access to renewable energy via Pact Myanmar's *Ahlin Yaung (Light)* program, and leads a team incubating access to energy innovations in Myanmar. Previous to Pact, Richard directed PSI in Botswana and Zambia after an earlier stint in Myanmar as Deputy Director of PSI from 2002 to 2004. Richard's 19 years of professional experience include work in journalism, investment banking, and international health and development in multiple countries, particularly in Europe, South and South East Asia, and Africa. His most recent expertise is in general management, strategic planning, social marketing, and the development of scaled integrated development programs in Myanmar.

RICKY BUCH | SENIOR STRATEGIC MARKETING LEADER | GE POWER



Ricky is a Senior Strategic Marketing Leader for GE Power. In his role, Ricky is responsible for identifying and validating new business opportunities for GE Power that will position the company for future growth. One of his prior initiatives led to the launch of GE Current, an entirely new business for GE. Currently, he is focused on developing new renewable hybrid technologies that can be used to provide low-cost and sustainable power for emerging market off-grid electrification, among other applications. Ricky began his career with GE in 2011 as part of the Experienced Commercial Leadership Program.

Ricky has a B.S. in Electrical Engineering and Computer Science from UCLA, and an MBA and graduate certificate in public policy from the University of Michigan. Ricky lives just outside New York City, NY.

ROHIT KHANNA | PROGRAM MANAGER | ENERGY SECTOR MANAGEMENT ASSISTANCE PROGRAM (ESMAP), THE WORLD BANK



Rohit oversees a portfolio of analytical and advisory activities to inform the energy sector policy dialogue. Under his direction, ESMAP has grown exponentially to support over 250 activities in more than 130 countries; influence World Bank, IDA, and IBRD financing; and leverage billions from global partners to support the growth of and strengthen the design and implementation of investment projects in the sector. Rohit joined The World Bank in 2000, and prior to assuming his current position at ESMAP, he worked on the Global Environment Facility (GEF) and Clean Technology Fund (CTF) at the World Bank. Before joining the World Bank, he was a Program Officer in the UN Environment Program, and worked for Save the Children Fund in its Bhutan Field Office.

SAI HTUN HLA | OWNER, SAI HTUN HLA & BROTHERS COMPANY; FOUNDER, HYDRO POWER COOPERATIVE LIMITED



U Sai Htun Hla is currently the owner of a micro hydropower turbine production and installation workshop in Lashio, Northern Shan State, Myanmar. He has been producing water turbines since 1982 and, in 2003, he fabricated and installed a 50kW micro-hydropower turbine at his own workshop. To date, his workshop has fabricated and installed over 150 turbines in various regions and states, ranging from 5 to 300 kW. His group provides hydropower development and installation support through planning, design, feasibility study, turbine fabrication, installation, power grid, transformer production, and power distribution to rural areas.

He obtained his A.G.T.I. in Mechanical Power from the Mandalay Government Technical Institute, Mawlamyine, in 1986.

SOE SOE OHN | DIRECTOR | DEPARTMENT OF RURAL DEVELOPMENT



Dr. Soe Soe Ohn has been working as a Director in Department of Rural Development of Ministry of Agriculture, Livestock and Irrigation. She got the Ph.D in Chemical Engineering from Yangon Technological University. She worked as a researcher in renewable energy department of Ministry of Science and Technology. She has 10 years of experience in bio-gas project in Rural Electrification. In the bio-gas project, she researched and applied community and family scale bio-gas plant for more than 150 remote villages in the country. Currently she has been working as a project manager in National Electrification Project.

SVATI BHOGLE | TIDE, MEMBER OF ENERGIA



Svati is associated with several clean energy organizations in India, working largely in design and dissemination of fuel efficient cookstoves; technical training and incubation of energy linked livelihoods for rural women from TIDE's Women's Technology Park; and implementation of small hydro projects for remote village electrification. Her institutional affiliations include TIDE, a non-profit organization that she co-founded, Sustaintech (a pvt. ltd. company for improved cookstoves dissemination as Founder and Managing Director) and is Chairperson of Clean Energy Access Network—a network of practitioners in decentralized renewable energy. She also supports ENERGIA as a technical advisor on grass root level gender and energy projects Besides, she also conducts training programmes in biomass conservation, gender & sustainable energy and in planning / monitoring of energy access projects. She has studied Chemical Engineering and is an alumnus of Indian Institute of Technology Bombay. She has played a crucial role in shaping the space around sustainable technology innovation and dissemination, grassroots entrepreneurship models and associated policy initiatives through TIDE and Sustaintech. Awards & recognitions include: the Ashden Award for Sustainable Energy (2008), National Award for Women's Development (through Science and Technology), Government of India (2011) and the Parisara Prashasthi Award for Environment of the Government of Karnataka (2013).

VISHWA AMATYA | PRACTICAL ACTION



Vishwa has substantial experiences in issues related to micro hydro, since 1992 when he installed 3 cascading plants of each 50 kW at an altitude of 4,000 m above mean sea level to power various activities related to a mining operation in Himalayas. Since then, he has contributed to the micro-hydro sector in terms of policy, planning, and institutionalisation of renewable sectors in Nepal. He is currently heading the energy programme in Practical Action South Asia Regional Office and is active in project development and advocacy activities in the field of Access to Energy in Nepal and South Asia Region. His other interests include: energy economics and planning, large hydropower development, renewable energy, climate change and adaptation issues and project/program planning, organization development, and management. He has served for 30 years in the Government of Nepal, nongovernmental organizations, donor agencies, and private sector.

XIAOPING WANG | SENIOR ENERGY SPECIALIST | ENERGY SECTOR MANAGEMENT ASSISTANCE PROGRAM, THE WORLD BANK



Xiaoping is a senior energy specialist at the Energy Sector Management Assistance Program (ESMAP) of the World Bank. She is leading the initiative on helping the Myanmar Government develop and implement the National Electrification Plan toward universal electricity access by 2030. Over the last four years, she has helped establish a multiple-stakeholder platform to align resources and support under the common goals of NEP and mobilize more than US\$600 million from the public and private sector for grid extension, mini-grid, and off-grid solutions. Her areas of expertise include urban and rural energy access, renewable energy, and energy sector resilience. She has worked in the energy sector for the Chinese government, UNDP, and, in Latin American, Eastern European, and Asian countries with the World Bank for the last 13 years.

ZAW MIN | OWNER AND DIRECTOR, ZAW SOE WIN HYDROPOWER COMPANY



In 1999, **U Zaw Min** started as a micro hydropower practitioner in his father's enterprise and he has 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, 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 solutions, including system planning, design, feasibility study, turbine fabrication, and installation to off grid areas. U Zaw Min coordinates Renewable Energy Association of Myanmar's Small Hydropower Association of Myanmar, an association of micro, mini, and small hydro practitioners formed to advance the sector within the NEP. U Zaw Min's family has been in the micro and mini hydro sector for over 20 years in Shan State.

He obtained his B.Sc. in Physics from Distance Education of Mandalay University in 2002.

ZHIHONG ZHANG | SENIOR PROGRAM COORDINATOR | CLIMATE INVESTMENT FUNDS



Currently, **Zhihong** oversees the Clean Technology Fund and the Program for Scaling up Renewable Energy in Low Income Countries with a combined portfolio of over US\$6 billion. From 2004-2011, he was a Senior Climate Change Specialist and Coordinator for Climate Change Mitigation at the Global Environment Facility (GEF). In this capacity, he led the development and implementation of the GEF climate change focal area strategy, managed the climate change portfolio, and was extensively involved in the UN climate change negotiations on mitigation, finance, and technology transfer. Zhihong worked in the energy sector at The World Bank in the early 1990s and later served as the Chief Technical Advisor at the UN Industrial Development Organization to manage energy efficiency projects in China.

Zhihong holds a Ph.D. in Energy Management and Policy from the University of Pennsylvania.

ANNEX A | PROGRAM DESCRIPTIONS

Clean Energy Mini Grids, SREP

Both of the major energy sector Climate Investment Funds (CIFs)—the Clean Technology Fund and the Scaling-Up Renewable Energy in Low Income Countries (SREP) Program—are supporting the scaled-up demonstration and deployment of renewable energy in middle- and low-income countries. Clean energy mini grids (CEMGs)—based on renewable energy technologies (including storage in systems with variable renewables) or renewable energy-diesel hybrid systems—are one potentially promising option for delivering reliable energy in a sustainable manner.

While some initiatives are also ongoing within Clean Technology Fund, mini grids are of particular interest to SREP countries. The SREP has allocated more than \$140 million to mini grid projects identified through country investment plans in 13 countries (out of 27 SREP countries), representing a relevant and strategic part of the SREP portfolio, with strong ownership from countries. An additional \$55 million has been allocated to mini grid projects through the Clean Technology Fund Dedicated Private Sector Program on Renewable Energy Mini Grids and Distributed Power Generation.

Global Facility on Mini Grids, ESMAP

ESMAP at the World Bank—with core funding from DFID and committed funds from Danida—initiated a Global Facility for Mini Grids to accelerate the pace of electrification to large groups of people by mainstreaming least cost mini grids into World Bank Group operations as well as develop the global and local knowledge associated to achieve this. While mini grids have a long history and are widely used around the world, they are now emerging as a viable option for meeting the energy demand in Sub-Saharan Africa, South and East Asia, and Small Island Developing States. Mini grids are the expected least-cost option for more than 120,000 villages and towns in these regions.

The Global Facility for Mini Grids is part of the joint effort of ESMAP and the SE4All High Impact Opportunity on Mini Grids. The Global Facility for Mini Grids, focusing on:

- Pillar 1: Accelerating the pace of electrification for large groups of people by working together with operational task teams and clients to mainstream least cost mini grids into World Bank Group operations and national electrification programs. Where possible, these mini grids will be powered by renewable energy.
- Pillar 2: Developing the required knowledge to assist in achieving the first objective and contribute to the frontiers of global knowledge development and learning. This development will look at the experience of mini grid projects worldwide.

ANNEX B | FIELD VISIT: MYIN CHI NAING



One of three identical 3.6 kW solar powered mini-grids that power Myin Chi Naing village. Photo by Eric Youngen

Myin Chi Naing: Solar Mini-Grid

The lights went on in Myin Chi Naing village, Kyaukse Township, Mandalay District in October 2016 with the commissioning of three identical 3.6 kW solar mini-grids. The mini-grids were built by the Yangon-based SolaRiseSys Co., Ltd., as part of an Asian Development Bank (ADB) mini-grids pilot program that installed solar PV based mini-grids at 12 villages in the Mandalay, Magway and Saiging regions.

Collectively the three systems in Myin Chi Naing village provide electricity to 200 households, a monastery, and a library.

Households purchase electricity using a pre-pay metering system that uses

magnetic cards. At this point all customers are signed up for the basic package which provides up to 100 watt-hours per day and a maximum of 50 watts at any time. Tariffs are 1500 kyat per month. As demand increases, SolarRiseSys may increase capacity and provide additional tariff levels. In each household the system powers two five-watt LED lights, a USB charging port, and a 230 volt electrical outlet. The project is owned and operated by the local Village Electrification Committee (VEC) with technical support from SolaRiseSys.

The system was built “grid ready” in two ways. First, electricity is distributed on grid-ready concrete poles. Second, the inverter has the ability to synchronize with the grid, allowing bi-directional power flows when the main grid arrives.

Execution Agency: Department of Rural Development (DRD) under the Ministry of Agriculture, Livestock and Irrigation (MALI)

Development Partner: Asian Development Bank (ADB) with funding from the Japan Fund for Poverty Reduction (JFPR)

Technical Consultant: Nexant Asia

Myi Chi Nai Village Mini-Grid Project Cost: \$98,580, of which 20% was paid for by the village.

Location: 21.519436 N, 96.098465 E

FIELD VISIT: TON LON

Ton Lon: Diesel Mini-Grid

The diesel mini-grid in Ton Lon village was not built as part of any government program and provides an example of typical village-operated mini-grids found in much of rural Myanmar.

Ton Lon village has 97 households, of which about 30 are served by a diesel generator-powered mini-grid. Households that pay 2,500 kyat a month (US\$1.84) can turn on a single 26 watt CFL. For 4,000 kyat per month (\$2.94), a household can power a CFL and a television. Payment of the monthly fee also entitles the household to use of pumped well water available from a water tank immediately adjacent to the generator.



Diesel generator at Ton Lon village. Photo by Chris Greacen

The remaining 60+ households are not served by the mini-grid as they cannot afford the monthly fee. Local leaders are interested in finding a way to bring electricity to these poorer households.

While the village is near the existing grid (within 3 miles), the village is poor and cannot afford the 10% upfront connection fee, even though the main grid electricity is expected to be installed this year.

Ton Lon's genset is a 24 horsepower, 1-cylinder diesel agricultural engine manufactured by Changzhou machinery coupled by a universal joint made of strips of an old tire to a 10 kW single-phase alternator (Chinese-made, brand unknown). The generator was provided to the village in FY 2015-6 by the DRD to power a submersible pump (also provided by DRD) that draws water from a 200-foot well. The installation was one of many similar installations by the DRD in the area. The installation company won a regional tender for installation of these combination diesel generators + well pumps. The village later added a distribution system comprising a mixture of interior-grade romex-type wire and galvanized steel baling wire either wrapped on tree branches or on crude wooden poles. Voltage losses are assumed to be huge, especially in rainy weather (wet trees conduct electricity to ground). In building the distribution system, the village did not seek technical help, but rather built it themselves.

The generator is owned and managed by the Village Electricity Committee (VEC) comprised of 14 individuals. The VEC is split into seven groups of two and each duo is scheduled one day a week to start and stop the generator. The generator is run 6pm to 9pm nightly, at the same time that water is pumped.

Diesel cost is currently 3,400 kyat/gallon and the generator burns about 1 gallon during the 3 hours it is operated at night.

The occasional breakdown of the generator results in no service for 3 to 4 days until a repairman can be sent to the village.

Location: 21.56344032 N, 96.12715912 E

ANNEX C | HOMER© PRO TRAINING

Dr. Peter Lilienthal, the CEO of HOMER Energy and the original developer of NREL's HOMER software, will conduct an in-person training workshop in the HOMER Pro software. The workshop will consist of two half-day sessions and be offered twice during the week of February 6-10, 2017.

The first half-day session will be an introduction to HOMER covering the fundamental concepts of the HOMER software. Participants will leave with an understanding of the interface and modular design. They will also work simple modeling projects from beginning to end and interpret the results. Participants will learn how HOMER calculates the technical feasibility, economic value, and other metrics of different designs through its powerful sensitivity analyses and its ability to simulate and optimize thousands of system designs in minutes.

The second half-day session will cover advanced topics in wind, solar, large systems with multiple generators, small 100% renewable systems, and water pumping applications. This will include modeling multiple solar arrays, using the maximum power point tracker and dedicated inverter, understanding wind data and turbine models, and understanding HOMER's approach to operating reserves. The introductory workshop is a prerequisite for this advanced workshop.

SCHEDULE AT-A-GLANCE

Day 1 Mon 6 Feb	9.00	SREP COUNTRY ROUNDTABLE Welcome & Introductions
	10.45	Discussion: How to Address Implementation Issues—The Role of Innovation in Financing and Contractual Structures
	1.45	Discussion: Risks in Mini-Grid Development, Including Social And Capacity Development Risks
	2.30	Discussion on Business Models: Transit from Subsidy Based Mechanism Business as Usual Model to a Market Driven Business Model
	3.30	Discussion on Solutions: What Can SREP, MDBs and This Group Do to Tackle These Issues?
	4.30	Q&A with SREP Government Officials – Open to the Public
Day 2 Tues 7 Feb	8.00	MINI-GRIDS LEARNING EVENT TECHNICAL CONFERENCE Welcome, Video Screening, Press & Photos
	9.00	Overview of Breakout Sessions #1
	10.30	Breakout Sessions #1
	1.30	Overview of Breakout Sessions #2
	3.00	Breakout Sessions #2
	4.45	Wrap-Up
	5.30	Reception
Day 3 Wed 8 Feb	5.00	FIELD TRIP Myin Chi Naing (departing Hilton Hotel) – <i>Registration Closed</i>
	1.00	FIELD TRIP Ton Lon (departing Myin Chin Naing) – <i>Registration Closed</i>
	8.30	Return to Hilton Hotel
Day 4 Thurs 9 Feb	8.00	MYANMAR MINI-GRIDS ROUNDTABLE Welcome & Overview
	10.00	Overview of Breakout Sessions #1
	10.45	Breakout Sessions #1
	2.15	Overview of Breakout Sessions #2
	3.00	Breakout Sessions #2
	4.45	Wrap-Up
Day 5 Fri 10 Feb	8.00	PRIVATE SECTOR ROUNDTABLE Welcome
	8.15	Opportunities for the Private Sector in Asia Lessons from the Field <ul style="list-style-type: none"> • What does it take to move from a few project to many? • What do you need to bring private sector development to scale in your target country?
	10.15	<ul style="list-style-type: none"> • What is your global corporate strategy for roll-out of mini grids to 1000 load centers?
	11.00	Building a Mini Grid Industry Association Experience from Africa Panel Discussion: How to advance the role of the private sector in respective countries and the role of associations
	1.30	MINI-GRID INNOVATIONS & SOLUTIONS FROM AROUND THE GLOBE Welcome
	1.45	Ignite Session #1
	3.15	Ignite Session #2
	4.45	Closing

HOMER® Training Sessions

- Introduction Mon. & Fri. 9:00 – 12:00 pm
- Advanced Mon. & Fri. 1:30 – 4:30 pm