APEC Workshop on Microgrids for a Just Energy Transition

APEC Energy Working Group
December 2023
APEC Workshop on Microgrids for a Just Energy Transition

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I. BACKGROUND

Across the APEC region, economies are experiencing growing demand for electricity coupled with the need to build more sustainable, resilient, and low-carbon energy infrastructures.\(^1\) However, there are significant challenges associated with simultaneously mobilizing investment in those infrastructures while ensuring those investments are safe, secure, just, and inclusive. This is especially true for emerging energy systems, like microgrids.

Particularly for rural areas of developing APEC economies, prior APEC projects (e.g., EWG 15 2011A, EWG 06 2013A) have explored the benefits of leveraging DC power systems and microgrids towards the achievement of climate and energy objectives. DC power systems and microgrids can deliver sustainable, low-carbon energy services to isolated areas with greater reliability and at lower costs than traditional systems.

The use of DC power and microgrids in APEC economies is inhibited by the global non-alignment of regulatory and conformity assessment approaches. In accordance with World Trade Organization (WTO) principles, the harmonization of policy approaches for those systems can help eliminate trade barriers, facilitate investment, and promote the use of high-quality, safe electrification technologies.\(^2\)

In June 2023, the United States submitted a proposal for an APEC project titled “Driving Trade & Investment for DC Power Systems and Microgrid Frameworks Through Public Policy Alignment” to address the dynamics outlined above. At the time of this report’s writing (October 2023), the project has been approved in principle. The workshop covered in this report was organized by Pacific Northwest National Laboratory, USA, and UL Solutions to inform the execution of that future (likely 2024 and/or 2025) project and strengthen its potential impact.

A global leader in applied safety science, UL Solutions transforms safety, security, and sustainability challenges into opportunities for customers in more than 100 economies. UL Solutions delivers testing, inspection, and certification services, together with software products and advisory offerings, that support its customers’ product innovation and business growth.

\(^1\) According to the APEC Energy Demand and Supply Outlook (7th Edition), produced by the Asia Pacific Energy Research Centre, the final energy demand of APEC economies by 2050 will increase by 21 percent above 2016 levels.

\(^2\) According to the WTO | World Trade Report 2022 Climate change and international trade, while tariffs on environmental goods are on average lower compared to tariffs for other goods, environmental goods are particularly affected by non-tariff measures (NTMs). Technical barriers to trade (TBT) are especially important to environmental goods – like solar panels and wind turbines – as they are often subject to technical regulations and conformity assessment procedures. Between 2005 and 2020, TBT-related specific trade concerns (STCs) in the WTO TBT Committee covered an annual average of USD42 billion in imports of environmental goods.
II. OBJECTIVES

The workshop’s primary objective was to build capacity in APEC economies on how to deploy microgrid technologies to promote a sustainable and just energy transition. The second goal of the project was to inform future related projects. With a focus on microgrids, the project’s capacity building aimed to support the Putrajaya Vision 2040 and the Aotearoa Plan of Action by driving sustainable, inclusive growth and long-term energy and economic resiliency. By supporting sustainable and inclusive clean energy transitions, it also aimed to advance the U.S. 2023 host year priorities of “Interconnected. Innovative. Inclusive.”

III. WORKSHOP PARTICIPANTS

The workshop’s expert speakers included representatives from a global solar technology company, a non-profit organization working to expand energy access in Southeast Asia, a leading Philippines energy utility, the Philippines Department of Energy, the Industrial Technology Research Institute (ITRI) in Chinese Taipei, the U.S. Department of Energy, the U.S. Agency for International Development (USAID) Energy Secure Philippines Activity, and UL Solutions.

Overall, the workshop convened 43 participants. A breakdown of those participants is below:

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total participants</td>
<td>43</td>
</tr>
<tr>
<td>Male/Female</td>
<td>36 male, seven female</td>
</tr>
<tr>
<td>Public/Private</td>
<td>International organizations: two</td>
</tr>
<tr>
<td></td>
<td>• ASEAN Center of Energy</td>
</tr>
<tr>
<td></td>
<td>• Asia Pacific Energy Research Centre (APERC)</td>
</tr>
<tr>
<td></td>
<td>Private Sector: 27</td>
</tr>
<tr>
<td></td>
<td>Public Sector: 14</td>
</tr>
<tr>
<td>Economies:</td>
<td>Six economies:</td>
</tr>
<tr>
<td></td>
<td>• Hong Kong, China</td>
</tr>
<tr>
<td></td>
<td>• Japan</td>
</tr>
<tr>
<td></td>
<td>• Malaysia</td>
</tr>
<tr>
<td></td>
<td>• The Republic of the Philippines</td>
</tr>
<tr>
<td></td>
<td>• Chinese Taipei</td>
</tr>
<tr>
<td></td>
<td>• United States</td>
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</tbody>
</table>
IV. WORKSHOP SUMMARY

The half-day workshop took place on 16 October, 2023, in Manila, The Philippines, in conjunction with the Joint Meeting of APEC 61st Expert Group on Energy Efficiency and Conservation (EGEEC61) and 29th Expert Group on New and Renewable Energy Technologies (EGNRET59). The workshop convened experts primarily from the region to build capacity in APEC economies to leverage microgrids and related technologies toward a just energy transition. The full agenda may be found in Appendix I. All presentation materials can be found in Appendix IV.

The Project Overseer, Dr. Cary N. Bloyd (USA), opened the workshop and introduced the first panel session on Microgrid Innovation. This session covered cutting-edge technologies, approaches, and challenges to deployment. The first panelist, Marc Louie L. Olap, (Chief Science Research Specialist, Rural Electrification and Management Division, Electric Power Industry Management Bureau, The Philippines Department of Energy), delivered a presentation on the Philippines Department of Energy’s ongoing efforts to leverage microgrids in the economy, as well as recent regulatory changes. The second panelist, Dr. Bloyd, overviewed the conclusions of a recent APEC project titled “Lessons learned on resiliency and uptake of variable energy resources from islanded grids that support APEC clean energy goals.” The third panelist, Dr. Chi-Wen Liao (Deputy Division Director, Low-Carbon Energy & Energy Storage Technology Division, GEL, Industrial Technology Research Institute) presented on recent developments in microgrids and case studies in their deployment.

In the following discussion, the panelists addressed roadblocks and challenges to operating both larger and remote microgrids. Those included issues of human training/capacity associated with microgrid maintenance (particularly in remote settings), fluctuations in energy prices, and inconsistent public policy environments. The panelists then spoke about their experiences fostering consumer and broader stakeholder engagement in microgrid investments. In some cases, panelists found their ability to generate stakeholder buy-in was improved when microgrids increased the hours of service to consumers, though strategies varied with the remoteness of a microgrid. When discussing public policy approaches to promoting the use of microgrids, the panelists noted that emerging technologies required greater cooperation on standards development.

The workshop’s second session was titled “Microgrid Sustainability, Safety, & Science.” This session addressed the need to ensure microgrids verifiably meet their objectives, are secure, adhere to safety standards, avoid stranded asset investment scenarios, and promote an inclusive energy transition. The first panelist, Jason Hopkins (Principal Engineer, Energy & Industrial Automation, UL Solutions), delivered a presentation on best practices related to promoting microgrid safety, security, and sustainability. The second panelist, Matthew Kasdin (Director, Senior Counsel, Maxeon Solar Technologies), spoke to Maxeon’s case studies deploying environmental sustainability projects in APEC economies and circular economy practices across its solar supply chain. The third panelist, Jose S. Reyes, Jr. (Vice President and Head, Network Technology & Asset Management, Meralco), spoke to Meralco’s microgrid projects in the Philippines and their work to extend energy access to remote households.

In the question-and-answer portion, the panelists spoke about the differences between large, small, rural, and urban microgrids from the safety science and financing perspectives. The panelists asserted that while smaller residential grids can sometimes be less expensive, they
have different safety considerations than larger ones. For example, small microgrid energy storage systems are often positioned directly adjacent to, or within, residential buildings – posing significant safety challenges. Especially as microgrid projects scale up, panelists noted that policymakers must address the increasing costs and complexity of projects while preserving their safety and financial viability. For some developing economies, one panelist emphasized that short time horizons for investments were a significant challenge to incentivizing long-term financing. With the heightened availability of affordable renewable energy, panelists noted the importance of government policies in enabling those investments.

The third session was titled “Compatible Regulatory Frameworks for Microgrids” and focused on the critical role of regulatory frameworks in promoting access to microgrid technology. The first panelist, Christian Roatta (Senior Trade and Multilateral Affairs Specialist, UL Solutions), delivered a presentation on best practices for conformity assessment regulatory frameworks in the microgrids context, including how public policy can foster/hinder sustainable access to energy. The second panelist, Claire Marie Yvonne Lee (Senior Policy and Finance Advisor, USAID Energy Secure Philippines Activity), overviewed current efforts by the Energy Secure Philippines Activity to expand energy access in the Philippines. The third panelist, Ayu Abdullah (Executive Director, Energy Action Partners), provided the perspective of a non-profit leading in community engagement to bring microgrids to underserved populations.

The panelists then discussed some regulatory and market challenges to investments in microgrids. Those challenges included:

- High levels of regulatory complexity, especially for small microgrid systems, that often involve extensive and burdensome permitting requirements
- Varied local regulatory requirements
- Frequent changes in regulatory agency leadership, which result in inconsistent policy
- High barriers to market entry and exit
- Slow demand-side growth due to unclear, volatile, and/or high connection fees

The panelists recommended the following actions to address those challenges:

- Streamlining regulations and permitting approval processes
- Periodically reviewing technical regulations and conformity assessment procedures with the aim to increasingly align them with international obligations and risk-based approaches
- Using international standards, where applicable, for microgrid technologies
- Strengthening public-private partnerships to stabilize financial investments in microgrids
- Exploring community-owned forms of microgrid asset management
- Leveraging additional opportunities for multilateral cooperation
V. KEY RECOMMENDATIONS

In the final session of the workshop, all panelists were invited to highlight key outcomes and recommendations from the workshop for future work, summarized as follows:

1. Microgrids provide opportunities to increase the reliability and resiliency of energy access in both urban and remote settings, especially for underserved communities.
2. Whether or not an energy system is part of a large grid or microgrid, all persons deserve the same level of safety and security. This is especially true for underserved communities. Microgrid technologies and deployed systems are not sustainable assets if they are not safe and secure.
3. When considering how to invest in microgrids, economies should consider how to incorporate circular economy-related principles into their policies.
4. Regulatory framework alignment and compatibility are critical to enabling access to microgrid technologies through streamlined, high-standard processes.
5. Investment in further research and innovation is essential to expanding energy access. This includes research in business frameworks and models, effective public policy, peer-to-peer technologies, and more.

VI. CONCLUSION

The workshop was conducted to build capacity in APEC economies on how to deploy microgrid technologies to promote sustainable and just energy transition. In the workshop’s evaluation survey, participants indicated a general increase in their knowledge and skills in the workshop’s topics, demonstrating that the project made important progress towards that objective. The survey respondents also reported an increase in their understanding of:

- Applications of microgrids in the APEC region
- The value of microgrids for remote communities, including the community-level developments and challenges related to microgrid advancement
- The importance of standards to innovation and interoperability of these technologies
- Ongoing relevant APEC projects
- Insights related to the digitalization of energy

Respondents indicated these learnings will be utilized to develop new policy initiatives, projects, and trainings, and inform future energy-related initiatives. One respondent noted the “need to support this initiative to improve energy access with emphasis on affordability of energy to off-grid access.” To improve this project, respondents noted a desire to cover more case studies over more time to facilitate deeper in-person discussions. When asked what needs to be done next by APEC, respondents desired more dialogues with a wider array of APEC stakeholders, including with those responsible for standards and conformance. They also desired additional discussions on implementing microgrids laws/policies with local governments, knowledge-sharing on microgrids, and scaling up the digitalization of power systems.

The second goal of the project was to inform future related projects. The results of this workshop will be used to inform the proposed APEC project titled “Driving Trade & Investment for DC Power Systems and Microgrid Frameworks Through Public Policy Alignment” in 2024, if approved.
VII. APPENDIX 1: WORKSHOP AGENDA

Microgrids for a Just Energy Transition
16 October, 1:00pm to 5:00pm
Manila, The Republic of the Philippines
(EWG 04 2023S)

This half-day workshop will convene experts from the public and private sectors to build capacity in APEC economies to leverage microgrids and related technologies towards a just energy transition. The workshop will begin with a scene-setting discussion among leaders in government, private sector, and academia on key developments in microgrid innovation, including an overview of the results from a recent APEC Energy Working Group Project on islanded grids. Then, panelists will discuss issues related to the effective long-term deployment of microgrids, including ensuring their sustainability, security, and safety. After, the workshop will host a panel and discussion on issues related to regulatory frameworks for microgrid technologies, including how they can foster/hinder sustainable access to energy. The workshop will conclude with an open discussion to identify key outcomes and recommendations, geared toward informing subsequent working group discussions later in the week (17-19 October), and development of APEC projects and documentation of key findings.

<table>
<thead>
<tr>
<th>Time</th>
<th>Session 1 – Microgrid Innovation</th>
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<tbody>
<tr>
<td>13:00 – 13:05</td>
<td><strong>Opening remarks</strong></td>
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<tr>
<td></td>
<td>- The U.S. Department of Energy – <strong>Dr. Cary N. Bloyd, Ph.D.</strong>, Senior Advisor, Electricity Infrastructure &amp; Buildings Division, Pacific Northwest National Laboratory</td>
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<tr>
<td>13:05 – 14:00</td>
<td><strong>Session 1 – Microgrid Innovation</strong></td>
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<tr>
<td>(55 minutes)</td>
<td>Combination of cross-sectoral panelist presentations (5 minutes each) and facilitated Q&amp;A, discussion and brainstorming, focused on cutting edge microgrid technologies and approaches.</td>
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<td><strong>Proposed panelists:</strong></td>
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<td></td>
<td>- <strong>Marc Louie L. Olap</strong>, Chief Science Research Specialist, Rural Electrification and Management Division, Electric Power Industry Management Bureau, Philippines Department of Energy</td>
</tr>
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<td></td>
<td>- <strong>Dr. Cary N. Bloyd, Ph.D.</strong>, Senior Advisor, Electricity Infrastructure &amp; Buildings Division, Pacific Northwest National Laboratory – <em>Project Overseer for APEC/EWG 04 2021A: Lessons learned on resiliency and uptake of variable energy resources from islanded grids that support APEC clean energy goals</em></td>
</tr>
<tr>
<td></td>
<td>- <strong>Dr. Chi-Wen Liao</strong>, Deputy Division Director, Low-Carbon Energy &amp; Energy Storage Technology Division, GEL, Industrial Technology Research Institute (ITRI)</td>
</tr>
<tr>
<td>Time</td>
<td>Session Description</td>
</tr>
<tr>
<td>---------</td>
<td>--------------------------------------------</td>
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</tbody>
</table>
| 14:00 – 15:00 | Session 2 – Microgrid Sustainability, Safety, & Science | Moderator: Christian Roatta, Senior Trade & Multilateral Affairs Specialist, UL Solutions  
Combination of cross-sectoral panelist presentations (5 minutes each) and facilitated Q&A, discussion and brainstorming, focused on the critical need to ensure that microgrids verifiably and reliably meet their objectives, are secure, avoid stranded asset investment scenarios, adhere to safety standards, and are positioned as a part of a just energy transition.  
**Proposed panelists:**  
- Jason Hopkins, Principal Engineer, Energy & Industrial Automation, UL Solutions  
- Matthew Kasdin, Director, Senior Counsel, Maxeon Solar Technologies  
- Engr. Jose S. Reyes, Jr., Vice President and Head, Network Technology & Asset Management, Meralco |  
Moderator: Christian Roatta, Senior Trade & Multilateral Affairs Specialist, UL Solutions |
| 15:00 – 15:30 | Coffee and networking break |  |
| 15:30 – 16:30 | Session 3 – Compatible Regulatory Frameworks for Microgrids | Moderator: Christian Roatta, Senior Trade & Multilateral Affairs Specialist, UL Solutions  
Combination of cross-sectoral panelist presentations (5 to 8 minutes each) and facilitated Q&A, discussion, and brainstorming, focused on understanding the critical role of regulatory frameworks as applicable to microgrid technology, including topics of conformity assessment (testing, inspection, certification, etc.) and key differences in regulatory frameworks among economies.  
**Proposed panelists:**  
- Christian Roatta, Senior Trade & Multilateral Affairs Specialist, UL Solutions  
- Claire Marie Yvonne Lee, Senior Policy and Finance Advisor, U.S. Agency for International Development, Energy Secure Philippines Activity  
- Ayu Abdullah, Executive Director, Energy Action Partners |  
Moderator: Dr. Cary N. Bloyd, Ph.D., Senior Advisor, Electricity Infrastructure & Buildings Division, Pacific Northwest National Laboratory |
<p>| 16:30 – 17:00 | Session 4 – Next Steps and Potential Projects | Facilitated plenary discussion to document major findings, identification of project ideas, and conclusions. |</p>
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<tbody>
<tr>
<td></td>
<td><strong>Moderator:</strong> Dr. Cary N. Bloyd, Ph.D., Senior Advisor, Electricity Infrastructure &amp; Buildings Division, Pacific Northwest National Laboratory</td>
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<tr>
<td></td>
<td>All speakers invited to provide brief thoughts and takeaways, followed by general Q&amp;A</td>
</tr>
</tbody>
</table>
VIII. APPENDIX II: EVALUATION SURVEY RESPONSES

An APEC project evaluation survey was sent to all participants shortly after the conclusion of the workshop. The respondents indicated an increase in their knowledge and skills in the covered topics resulting from the workshop. Four respondents indicated a one-point increase in their level of knowledge, while three respondents indicated it remained the same.

The full outcomes of the survey are presented below.

The objectives of the training were clearly defined. (Provide any comments in "other.")

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 (85.7%)</td>
<td>1 (14.3%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

The project achieved its intended objectives. (Provide any comments in "other.")

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 (85.7%)</td>
<td>1 (14.3%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

The agenda items and topics covered were relevant. (Provide any comments in "other.")

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 (100%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>
The content was well organized and easy to follow. (Provide any comments in "other.")
7 responses
- Strongly Agree: 7 (100%)
- Agree: 0 (0%)
- Disagree: 0 (0%)

Gender issues were sufficiently addressed during implementation. (Provide any comments in "other.")
7 responses
- Strongly Agree: 5 (71.4%)
- Agree: 2 (28.6%)
- Disagree: 0 (0%)

The trainers/experts or facilitators were well prepared and knowledgeable about the topic. (Provide any comments in "other.")
7 responses
- Strongly Agree: 8 (85.7%)
- Agree: 1 (14.3%)
- Disagree: 0 (0%)

The materials distributed were useful. (Provide any comments in "other.")
7 responses
- Strongly Agree: 4 (57.1%)
- Agree: 1 (14.3%)
- Disagree: 0 (0%)
- Not sure if I received any material, except for the agenda": 1 (14.3%)
In your view what were the project's results/achievements? (Seven responses)

1. sharing current and valuable information on microgrids
2. The forum provided a venue to talk about microgrids which as of the moment, is not the government's priority but is significant for the development of offgrid areas in the Philippines.
3. Future directions on long-term deployment of microgrids
4. Identification of challenges, benefits, and recommendations for sustainably deploying microgrids; sharing of policy-related best practices for positioning microgrids as part of a just energy transition.
5. Information sharing
6. Topics and presentations covered thoroughly issues related to IT-based energy innovations.
7. It serves as an "eye opener" on challenges that need to be overcome.

What new skills and knowledge did you gain from this event? (Seven responses)

1. A better understanding of the value of microgrids for remote communities
2. Learned about colleagues' current projects
3. Microgrid applications in the APEC regions
4. I learned more about some of the community-level developments and challenges related to microgrid advancement.
5. Information
6. I earned extensive and deep insights that will be brought forth by digitalization of energy.
7. Importance and innovation and interoperability based on standards.
How will you apply the project’s content and knowledge gained at your workplace? Please provide examples (e.g., develop new policy initiatives, organize trainings, develop work plans/strategies, draft regulations, develop new procedures/tools etc.). (Seven responses)

1. Information will be utilized in the related APEC funded microgrid workshop
2. Develop new projects and trainings.
3. Develop work plans/strategies
4. The information I learned from this workshop will help inform our future energy-related initiatives, including the organization of additional workshops and policy workstreams.
5. Organize training
6. Develop new policy initiatives
7. Need to support this initiative to improve energy access with emphasis on affordability of energy to off-grid access
What needs to be done next by APEC? Are there plans to link the project’s outcomes to subsequent collective actions by fora or individual actions by economies? (Seven responses)

1. Utilize information from this workshop for the APEC funded microgrid workshop that was discussed.
2. More dialogues on how to implement the laws on microgrid and invite the local government units (LGU)
3. Continue to promote the knowledge sharing of microgrid development
4. I would love to see further discussions on how to better leverage microgrid technologies with a wider array of economy stakeholders from other APEC fora. This includes with those responsible for standards and conformance.
5. Currently no.
6. Scaling up digitalization of power system
7. Yes, this is very important to be discussed in subsequent dec meetings

How could this project have been improved? Please provide comments on how to improve the project, if relevant. (Seven responses)

1. The project was well planned.
2. Invite the LGUs
3. More in-person workshops and discussions
4. Rather than a half day, a full day would have provided more room for open discussions between panelists and audience members.
5. No more, I can think of now.
6. It was good enough.
7. More case studies

Organization/Economy (identifying information is optional): (Five responses)

1. Pacific Northwest National Laboratory (PNNL)
2. United States
3. Japan
4. Korea University
5. National Grid Corporation of the Philippines (NGCP)
### IX. APPENDIX III: WORKSHOP PARTICIPANTS

<table>
<thead>
<tr>
<th>Gender</th>
<th>Last Name</th>
<th>First Name</th>
<th>Economy</th>
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<td>Male</td>
<td>LUI</td>
<td>Marco</td>
<td>Hong Kong, China</td>
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<tr>
<td>Male</td>
<td>IKEDA</td>
<td>Takao</td>
<td>Japan</td>
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<td>SWEETNAM</td>
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<tr>
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<td>Abdullah</td>
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<td>Yiyuan William</td>
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<tr>
<td>Female</td>
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<td>Louisa</td>
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</tbody>
</table>
X. APPENDIX IV: PRESENTATION MATERIALS

The presentation materials are included in the order they were presented as per the agenda (See Appendix 1).
Adoption of Microgrid System for Total Electrification

Session 1: Microgrid Innovation

Engr. Marc Louie L. Olap
Chief Science Research Specialist
Rural Electrification Administration and Management Division

MICROGRID SYSTEM INNOVATION

PRESENTATION OUTLINE

- TOTAL ELECTRIFICATION DIRECTIVES
- MICROGRID SYSTEMS IN THE PHILIPPINES
- MICROGRID SYSTEMS ACT - IMPLEMENTATION
- DIRECTION OF MICROGRID SYSTEMS
Administration’s Commitment to Achieve 100% household electrification by 2028

“Alongside power generation, we are also as relentless in pursuing total electrification. Since my assumption into office, almost half a million homes have been given access to electricity. We will spare no effort to achieve full household-electrification by the end of my term. 100% is within our reach.”

-PBBM

<table>
<thead>
<tr>
<th>Household Electrification</th>
<th>Stand-Alone Home Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribution Line Extension</td>
<td>Microgrid System</td>
</tr>
</tbody>
</table>

**NATIONAL TOTAL ELECTRIFICATION FRAMEWORK**

1. DU Internally Generated Funds / Private Sector Initiative / Foreign Assisted Projects
2. ER 1-94 – Electrification Funds
3. DOE Locally Funded Project / NEA Subsidy
4. NPC Missionary Electrification Plan Funds

**Funding Sources**

- Project Implementors

**Distribution Utilities (DUs)**
- ECs
- PIOUs
- LGUOUs

**State Universities and Colleges (SUCs)**

**Non-Government Organizations (NGOs)**

**Microgrid Systems Service Providers (MGSPs)**

**NPC-Small Power Utility Group (NPC-SPUG)**
WHAT IS A MICROGRID SYSTEM?
It refers to a group of interconnected loads and a generation facility or Distributed Power Generation with clear defined electrical boundaries that acts as an integrated power generation and distribution system, whether or not connected to a distribution or transmission system (RA 11646, Section 4 (p), Definition of Terms)

WHAT IS A MICROGRID SYSTEM PROVIDER (MGSP)?
It refers to a natural or juridical person whose business includes the installation, operation, and maintenance of microgrid systems in unserved or underserved areas nationwide. (RA 11646, Section 4 (p), Definition of Terms)

Existing Microgrid Systems Provider (MGSP)

National Power Corporation - Purely Served Areas
Diesel Mini-grid Facilities

Calayan
Antique
Zamboanga Del Sur
Antique
Samar
Guimaras
## Existing Microgrid Systems Provider (MGSP)

<table>
<thead>
<tr>
<th>Project Location</th>
<th>Proponent</th>
<th>Technology</th>
<th>Approved Tariff</th>
<th>Served Customers</th>
<th>Average Demand Load (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malapascua, Daan-Bantayan, Cebu</td>
<td>PSPI</td>
<td>Diesel 1.455 MW</td>
<td>&lt;=40kWh = PhP12/kWh; &gt;40kWh = PhP 15/kWh</td>
<td>1,163</td>
<td>9,733.46 (Daily)</td>
</tr>
<tr>
<td>Linlingangong, Taytay, Palawan</td>
<td>PSPI</td>
<td>Diesel .805 MW</td>
<td>PhP 9.12/kWh</td>
<td>1,020</td>
<td>3,682.50 (Daily)</td>
</tr>
<tr>
<td>Candawaga &amp; Culesian, Rizal, Palawan</td>
<td>PSPI</td>
<td>Diesel .43 MW</td>
<td>PhP 9.9082/kWh</td>
<td>1,062</td>
<td>2,934.52 (Daily)</td>
</tr>
<tr>
<td>Silo Sabang, Puerto Princesa City, Palawan</td>
<td>SREC</td>
<td><strong>Diesel 1.2 MW + Solar - 1.452 MWP, Battery Storage - 2.44 MWh</strong></td>
<td>PhP12/kWh for Residential &amp; Public Bldgs; PhP15/kWh for Commercial Bldg</td>
<td>588</td>
<td>2,589.65 (Daily)</td>
</tr>
<tr>
<td>Lahuy Island, Caramoan, Camarines Sur</td>
<td>FPIEC</td>
<td>250 kWp Solar + 468 kW Diesel + 232 kWh Battery</td>
<td></td>
<td>940</td>
<td></td>
</tr>
<tr>
<td>Haponan Island, Caramoan, Camarines Sur</td>
<td>FPIEC</td>
<td>107 kWp Solar + 104 kW Diesel + 232 kWh Battery</td>
<td>N/A</td>
<td>133</td>
<td>93,003.75 (Monthly)</td>
</tr>
<tr>
<td>Quinalasag Island Gachitorena, Camarines Sur</td>
<td>FPIEC</td>
<td>404 kWp Solar + 585 kW Diesel + 232kWh Battery</td>
<td></td>
<td>1,376</td>
<td></td>
</tr>
<tr>
<td>Brgy. Manamoc, Cuyo, Palawan</td>
<td>PSPI</td>
<td>0.216 MW Diesel</td>
<td></td>
<td>659</td>
<td>28,125 (Daily)</td>
</tr>
<tr>
<td>Brgy. Port Barton, San Vicente Palawan</td>
<td>PSPI</td>
<td>0.61 MW Diesel</td>
<td></td>
<td>610</td>
<td>3,138.71 (Daily)</td>
</tr>
<tr>
<td>Balut Island, Sarangani, Davao Occidental</td>
<td>PSPI</td>
<td>0.71 MW Diesel</td>
<td>9.553/kwh</td>
<td>3570</td>
<td>6000 kW (Daily)</td>
</tr>
</tbody>
</table>
Policy Direction on Microgrid System

- Pursue sustainable rural development and poverty reduction towards nation building through energy access.
- Accelerate total electrification and ensure the provision of quality, reliable, secure and affordable supply of electric power in unserved and underserved areas (UUAs)
- Promote private sector participation in the electrification of UUAs
- Provide a competitive environment and level playing field for different kinds of energy sources with a preference for low-cost, indigenous, renewable, and environment-friendly sources of energy; and
- Ensure the adoption of a dynamic regulatory environment that allows end-users to benefit from technologies and innovations in the electric power industry.
"DOE to be the primary entity to conduct the Competitive Selection Process (CSP) for Microgrid System Provider (MGSP) in DOE-declared unserved and underserved areas;"
Conclusion

- The Microgrid System is poised to play a pivotal role in advancing the Philippines towards achieving 100% electrification, especially in areas where conventional line extensions are impractical.

- While the primary purpose of the Microgrid System, as outlined in the Microgrid System Act, is currently focused on expanding electricity access, its potential utility extends far beyond that. We are not confined solely to electrification but can also harness its capabilities across diverse sectors like agriculture, healthcare facilities, and transportation.

- The Department of Energy (DOE) is committed to exploring these additional applications and will soon release comprehensive policy guidelines for the implementation of grid-tied microgrid systems and their various uses.
Outline

• Functions of Microgrid
• Deployment in Chinese Taipei
• Supporting Technologies and Measures
Functions of Microgrid

- Provide (limited) energy to users at a blackout
- Optimize the users’ energy use
- Support the overall system operation with optimization of resources

Microgrid for Emergency Response

- A microgrid at the Elementary School WuLai in Taipei was built by Taipower and the township office. It is able to accommodate local residents at emergency such as strong rainstorm.
  - It includes a solar PV system of 29kWp, a diesel power generator of 60kW, and an Lithium energy storage system of 60kWh.
- 7 microgrids of similar scale were also built in Ping-Tung, a mountainous area with inconvenient transportation.
Microgrid for R&D

ITRI Southern campus
- 430kW Solar PV
- 500kW/1MWh ESS
- 5kW Biomass generation
- 200kW Backup gen.
- Load 150~700kW

Features
- Solar PV Control
  - Smoothing of output
  - Fixed-power output
- Power flow control at interconnection point
- Peak reduction of load
- Autonomous control of ESS

Microgrid for feeder-level stand-alone operation

- TaiPower initiated a pilot in 2023. The system is under development.

- In normal operation, the ESS (energy storage system) facilitate the power flow control of the feeder line to improve flexibility.
- In stand-alone operation, the ESS becomes a voltage source, and support the black start. Proper control of the switchgears and the diesel generator will recover the power for the first step. The solar PV systems on the feeder line will gradually join the operation, and expand the power recovery scope.

Source: TaiPower Company
Supporting Technologies and Measures

• Development of software and hardware for the microgrid operation, such as
  ▪ Grid-forming inverter for ESS and solar power
  ▪ Forecasting and scheduling for system control
  ▪ Information and communication architecture involving the ESS, backup power generator, solar PV, user load, and switchgears on feeder line

• Subsidy for new resources and pilots

• Uniform Standards for interoperability


16 - 19 October 2023
Makati City, Metro Manila, Philippines

Workshop on
Microgrids for a Just Energy Transition

16 October 2023
Makati City, Metro Manila, Philippines
Matt Kasdin  
Director, Senior Counsel, Maxeon Solar Technologies  
maxeon  

Previous Experience:  
- United Nations Global Compact  
- LATHAM & WATKINS LLP  
- Fulbright  

Selected Publications:  
- Corruption as a Pan-Cultural Phenomenon: An Empirical Study in Countries at Opposite Ends of the Former Soviet Empire  
- More Cops, More Guns, More Military Presence: Is this the Solution?

A Leading Provider of Premium Solar Technology

Ongoing innovation has led to seven generations of ever-improving IBC solar technology

Maxeon IBC Platform

>30 years of Solar Leadership

First >20% Efficient Solar Cell

First 400W Residential Panel

<table>
<thead>
<tr>
<th>GEN 1</th>
<th>GEN 2</th>
<th>GEN 3</th>
<th>GEN 5 &amp; 6</th>
<th>GEN 7</th>
<th>NEXT GENERATION</th>
</tr>
</thead>
</table>
# Maxeon Sustainability Framework

## Purpose & Value:
Maxeon's purpose and company values are at the heart of everything we do. Maxeon values drive decisions we make every day.

**Our Values:**
- **We Push the Boundaries**
- **We Hold Ourselves to a Higher Standard**
- **We Thrive Together**

## Key Pillars:

### Environmental
Creating positive environmental impact to sustain our natural world by investing in technologies to combat climate change.

### Social
Creating positive value in society and communities by leading, partnering and supporting initiatives to enhance people's lives.

### Governance
Creating positive economic value and maintaining ethics and integrity through responsible and transparent business practices.

## Material Topics:
- **Energy and Emissions**
- **Water Management**
- **Circular Economy**

## UN SDG Goals:
- **Occupational Health and Safety**
- **Fair Labour and Human Rights**
- **Employee Engagement**
- **Learning and Development**
- **Diversity and Inclusion**
- **Community Investment**
- **Business Integrity and Ethics**
- **Product Quality, Reliability and Safety**
- **Sustainable Innovation**
- **Customer Engagement and Satisfaction**

---

## Circular Economy Practices

- **How they apply to a solar supply chain**

### Materials Sourcing
- Screen suppliers for carbon footprint and other environmental metrics
- Public disclosure of all panel materials (i.e. Declare label)
- Meet strictest standards set for harmful chemicals (such as lead-free)

### Production
- Use products manufactured in facilities that demonstrate they use the best practices (LEED is one such body)
- Demonstrate high standards in material health, water stewardship and social fairness (Cradle to Cradle)

### Product
- Use highest efficiency product – this will maximize the electricity you produce in the lowest amount of space which is limited with a rooftop
- Install products correctly (maximize sun – flat commercial rooftops are perfect)
- RoHS certified for our products

### Product Re-Use
- Use longest lasting product
- Use a product designed for upcycling, recycling when only necessary
- Have a robust process for screening recycling partners
Examples of Environmental Sustainability Initiatives in the Philippines

Project: Solar Water Pump
Details: Solar Water Pump is used for Watering Plants and Landscaping. Water used came from cooling water blowdown. While the cart including the solar panel, battery are composed of recycled construction and electrical supplies.

Installation of Solar Panels Across Our Manufacturing Site

Waste Recycling Programs in the Philippines

- **Project:** Waste recycling program in the Philippines
  **Details:** 254 tons of solid wastes recycled/diverted from landfill yearly

- Metal Wastes for Smelting
- Foams for Pillows and Pellets for Reuse
- Wood Wastes turned to Wood Furnitures
- Cartons to Paper Pulp Manufacturing
Examples of Environmental Sustainability Initiatives in Mexico

Installation of Solar Panels Across Our Manufacturing Site

Installation of Solar Panels Across Our Manufacturing Site and Composting Garden

Composting Garden at Mexico Manufacturing Site Powered by Solar Panels

MAXEON GIVES
Powering Positive Change™ for Good

Installation of 21 pcs. 310W solar panels at Lemery Pilot Elementary School under Sinag Schools Program, powering up the school building

Photo courtesy of SM Foundation
An archipelago of 7,641 islands, the Philippines is challenged in expanding electricity access to all households in the entire nation

- Interconnection of islands is relatively costly and difficult which makes total electrification inherently challenging. Only about 2,000 are inhabited and ~4,000 are yet to be named.

- As of December 2020, 5.51% or more than 1.27 million households still have no access to electricity

- In addition, 258 of the 281 (or 91.82%) remote islands or far-flung areas currently served by the NPC-SPUG have limited supply of power, i.e., less than 24 hours of electric service per day

- Meralco is one with the Philippine Government in bringing access to electricity to all Filipinos

---

MERALCO launched its own campaign to accelerate the expansion of energy access to all households across its entire franchise.

**“PROJECT ZERO UNSERVED”**

- Philippine Government’s drive to achieve 100% household electrification
  - 100 percent electrification of targeted and identified households accessible to the grid is target to be attained by 2022
  - 100 percent electrification of household in off-grid areas are expected in the long-term period (2023-2040)
- Fulfills MERALCO’s social obligation to provide universal service within its franchise area in a manner that shall sustain the economic viability of the utility
- Utilizes several electrification methods with preference towards emerging and sustainable technologies such as Solar Home Systems (SHS) and Microgrids using renewables and energy storage

Traditionally, diesel generators are used to power communities in extremely remote areas, where distribution line extension is unviable.

**Energy Regulations No. 1-94 or ER 1-94 Electrification Fund**

- **Deployment of Small-Scale Diesel Generators**
  - Low-voltage distribution and initial fuel supply

**Availability**

- **6pm – 10pm**
  - Daily operation

**Power Quality**

- **Low quality of power** due to:
  - High voltage drops
  - Overloaded generators
  (evident on the flickering of the lights)

**Operational Sustainability and Impact to Environment**

- **Defective usually after 2-3 years**
- Emissions significant amount of CO₂

Sizes range from 5 – 30 KVA
MERALCO explored a more sustainable, reliable, technological, and cost-effective solution to electrify remote and unviable areas

A microgrid is a localized energy grid aimed to achieve specific grid objectives, with the capability to disconnect from the traditional grid and operate autonomously.

With Microgrids, MERALCO can maximize RE sources like solar in combination with battery storage and an intelligent control system.

With Microgrids, MERALCO can maximize RE sources like solar in combination with battery storage and an intelligent control system.

✔ Cheaper true cost of power compared to 100% diesel generators
✔ Displaces significant amount of fuel
✔ Environment-friendly: massive reduction in carbon emissions
MERALCO started to deploy Microgrids with its implementation of Cagbalete Island Microgrid Pilot Project

DESCRIPTION
A pilot project on Microgrids for the electrification of households located in remote islands and far-flung areas.

PROJECT SITE
Cagbalete Island is a booming tourist attraction because of its beautiful white sand shore and pristine beach
- 1,795 hectares total land area
- 13 resorts and 800 households
- Approximately 12 km from Mauban port (1-hour boat ride)

OBJECTIVES
- Evaluate the feasibility and sustainability of using Microgrids for island electrification in providing reliable, affordable, sustainable, and clean 24/7 electric service
- Gain actual learning experience from planning to operations and maintenance of Microgrids
- Prepare Meralco for future Microgrid installations

HOMER Energy Simulation Software was used to determine the optimal sizes of the energy resources in the Microgrid

KEY SPECIFICATIONS
- Solar PV and BESS are AC-coupled for ease of scalability
- 2 units of diesel generators were installed for cycled operation and additional redundancy
- PV inverters, BESS PCS, and diesel generator controllers are under coordinated control of the Microgrid controller through a local IP network
- Served ~150 households
The Cagbalete Microgrid Pilot facility was energized last May 2019 and has supplied more than 300 MWh to the community since then.
Cagbalete Microgrid Phase 2 is about 25 times larger than the size of the pilot and can fulfill the power requirements of the entire island.

**KEY SPECIFICATIONS**

- 1.4 MWp solar PV, 1 MW/2.3 MWh BESS, and total of 1 MW diesel generator
- Solar PV and BESS are AC-coupled for ease of scalability
- 1 MW diesel generator requirement was split into 4 units for cycled operation, easier hauling, and additional redundancy
- PV inverters, BESS PCS, and diesel generator controllers are under coordinated control of the Microgrid controller through a local IP network

The solution's economic viability is one of the primary criteria in determining the preferred electrification method for a specific area. In delivering reliable, affordable, and sustainable electric service to communities in off-grid areas, MERALCO studied three (3) technically feasible alternatives and compared their economic viability through LCOE:\(^1\):

<table>
<thead>
<tr>
<th>ALTERNATIVES</th>
<th>Estimated Levelized Cost of Electricity (LCOE)(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development of a Microgrid with Hybrid System</td>
<td>PhP 15.96 / kWh ((~ $ 0.32 / kWh))</td>
</tr>
<tr>
<td>Development of a Microgrid with Diesel Generators</td>
<td>PhP 30.70 / kWh ((~ $ 0.61 / kWh))</td>
</tr>
<tr>
<td>Extension of Distribution Lines through Submarine Cables</td>
<td>PhP 34.23 / kWh ((~ $ 0.68 / kWh))</td>
</tr>
</tbody>
</table>

\(^1\) LCOE calculations made for Cagbalete Microgrid Phase 2 project

\(^2\) includes replacement costs, fuel, annual operation and maintenance costs
With a more cost-effective solution, MERALCO helps accelerate community development and bring positive impact to the residents

**IMPACT TO THE COMMUNITY**

- Improved way of life with access to reliable, affordable, and sustainable 24/7 electric service
- Gained peso savings from the reduced electricity rates (~65 to 80% reduction)
- Enhanced safety and security especially during the night
- Boosted economic activities in the island and provided additional livelihood to most of the residents

---

Key challenges in developing Microgrids in the Philippines

<table>
<thead>
<tr>
<th>Regulatory Policies &amp; Permitting</th>
<th>Logistics</th>
<th>Choice of Technology &amp; System Optimization</th>
<th>Scalability</th>
<th>Sustainability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affordability</td>
<td>Logistics</td>
<td>Choice of Technology &amp; System Optimization</td>
<td>Scalability</td>
<td>Sustainability</td>
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<td>🛠️</td>
<td>🔄️</td>
</tr>
</tbody>
</table>

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KEY CHALLENGES: Affordability

Rates imposed in Cagbalete Island

<table>
<thead>
<tr>
<th>FLAT RATE PER APPLIANCE (Peso/day)</th>
<th>METERED RATE (Peso/kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 1 light bulb – Php 10</td>
<td>Php 31 – Php 36 per kWh</td>
</tr>
<tr>
<td>• 1 radio – Php 10</td>
<td></td>
</tr>
<tr>
<td>• 1 TV – Php 15</td>
<td></td>
</tr>
<tr>
<td>• 1 ref – Php 20</td>
<td></td>
</tr>
</tbody>
</table>

- Very high electricity price is currently imposed in the island, up to 4 times more than in the mainland
- If rates are subsidized, effectively bringing down electricity price close to mainland rates, customers in the mainland will be burdened
- Microgrid developers for rural electrification must be prudent and exert considerable effort in minimizing the amount of subsidies yet providing the same quality of service to island customers

Comparison of Electricity Prices PER KWH

*latest 3-month average of a residential customer consuming 0 - 50 kWh; includes cross-subsidies

KEY CHALLENGES: Regulatory Policies and Permitting

- Full implementation of the microgrid law to enable the full electrification of the Cagbalete island
  - Phase 1 – 60kW
  - Phase 2 – 1MW
- Challenges in land conversion and permitting and ROW
KEY CHALLENGES: Logistics

- Hauling and logistics are critical in the development due to the need for sea transport and lack of public infrastructure such as public roads and seaports
- Most works are done manually without the aid of heavy equipment/vehicle
- Hauling costs add not only on construction cost but also on O&M costs
- MERALCO estimates a 6.18 to 18.33 difficulty factor* for the construction of the island microgrid

*based on a time-and-motion study conducted on similar installations

KEY CHALLENGES: Choice of Technology & System Optimization

- Slowly gaining expertise in running initial simulations to determine optimal system size and architecture (lowest LCOE & NPV)
- Capacity building in conducting detailed engineering design to ensure stable Microgrid operation with high RE penetration
  - Frequency control
  - Right sizing of BESS energy capacity and power rating (power to energy ratio) and appropriate technology (li-ion vs. redox flow vs. lead-acid)
  - Optimal diesel operation considering efficiency, reliability, and asset life

<table>
<thead>
<tr>
<th>Optimization Software</th>
<th>GENERATION SCHEME</th>
<th>SOLAR PV</th>
<th>BATTERY STORAGE</th>
<th>DIESEL GEN-SET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar + Battery + Diesel Generator</td>
<td>57 kWp</td>
<td>143 kWh</td>
<td>22 kWh</td>
<td></td>
</tr>
<tr>
<td>Solar + Battery</td>
<td>199 kWp</td>
<td>286 kWh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diesel Generator</td>
<td>30 kW</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*based on a time-and-motion study conducted on similar installations
**KEY CHALLENGES: Scalability**

- Initial electrification initiatives usually do not achieve 100% electricity access.
- However, most of the systems are not scalable and normally implemented through various independent grids.
  - Initial system voltage is 230V single-phase.
  - Only tree branches or bamboo stems are used for holding the lines.
  - If poles are installed, they are usually not sized to support primary line devices such as distribution transformers, insulators, and alley arms. Poles and other facilities should be storm resilient.
- Interoperability of systems (protocols, BMS).
- Proper master planning (ultimate scheme) must be established.
- Forecasting methods specifically for island microgrids must be established. Demand increases significantly shortly after system commissioning.
  - Projected to breach the 1MW capacity (phase 2) by 2027.

**KEY CHALLENGES: Sustainability**

- In the Philippines, most of the existing off-grid electrification which are not under SPUG and QTP schemes, are not sustainable.
- Generation systems, such as diesel generators or small solar home systems, usually fail after a few years of operation due to poor product quality or lack of maintenance.
- Hence, after an area has been electrified, the same effort is needed to re-electrify them again due to rapid deterioration of facilities.
- “Hybridized” microgrids (solar PV + BESS + diesel gensets) can be a better solution.
KEY LESSONS LEARNED

- Microgrids may be the sole or main energy supply in an off-grid area; hence, the system should be **highly scalable to support the long-term growing demand in the area**.

- Proper master planning must be established together with the LGU, local community, and other key stakeholders considering several factors including socio-economic parameters, customer consumption behaviors, future development plans, among others.

- Microgrids shall be able to integrate with various DERs using varying brands of controllers and inverters. The **use of open protocols such as Modbus and DNP 3.0 helps ease the integration**.

- Capacity building for **use of simulation software, microgrid design and equipment specification** is very important.

- **Equipment and facilities** should be of **high quality, resilient and adaptable** to the island environment. **Qualified service providers** who will perform O&M activities should be engaged.

CONCLUSION

Microgrids powered by RE sources like solar and wind and coupled with energy storage through an intelligent controller can provide **reliable, sustainable, and cost-effective electricity access to underserved and unserved communities in off-grid areas** while addressing the need to reduce carbon footprint.

Aligned with its sustainability agenda, MERALCO has taken broader steps in **developing a more sustainable energy future for Filipinos**.
DOE Workshop on Microgrids in Energy Transition

Jose S. Reyes, Jr., PEE, MSEE
Vice President & Head
Network Technology & Asset Management
Manila Electric Company
October 16, 2023
Conformity Assessment and Compatible Regulatory Frameworks for Microgrids

Workshop: Microgrids for a Just Energy Transition

Christian Roatta, Senior Trade & Multilateral Affairs Specialist, UL Solutions
October 16, 2023


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Agenda

1. Introduction
2. Regulatory frameworks and conformity assessment
3. Roles of government and the private sector
4. Regulatory compatibility and microgrids
Key takeaways

1. Within regulatory frameworks, the relationship between governments and private sector varies across economies. That doesn't mean those frameworks are incompatible with one another or international trade obligations.

2. There is value in public-private partnerships towards delivering on regulatory objectives/mandates. Overview of some examples of mature models.

3. It is important to help ensure that regulatory frameworks align with international trade obligations and tenets.

4. Regulatory compatibility is extremely important to enabling long-term investments in microgrid technologies that are safe, sustainable, and secure.
Elements of regulatory frameworks

**Standards:** Document, typically established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context.

**Technical regulations:** Regulations that provides technical requirements, either directly or by referring to or incorporating the content of a standard, technical specification or code of practice.

**Conformity assessment:** Demonstration that specified requirements are fulfilled. Specified requirements can be stated in normative documents such as regulations, standards, and technical specifications. This includes activities such as evaluation, testing, inspection, validation, verification, certification, and accreditation.

**Accreditation:** Third-party attestation related to a conformity assessment body, conveying formal demonstration of its competence, impartiality and consistent operation in performing specific conformity assessment activities.

**Surveillance:** Systematic iteration of conformity assessment activities as a basis for maintaining the validity of the statement of conformity. This can be pre-market testing or inspection, or post-market surveillance.

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How do strong regulatory frameworks for conformity assessment operate?

**Objectives**
- Consumer Protection
- Trade Facilitation
- Innovation

**Governance**
- Accreditation
- Conformity Assessment
- Market Surveillance

**Consensus-Based Standards**

*Strong frameworks must balance regulator, manufacturer, and consumer interests*
Roles of government and the private sector
World tour: United States

Consumer Safety, Trade Facilitation and Industry Growth

Accreditation
Accreditation required for mandatory govt schemes; Accreditor may be private, govt, or govt-backed, depending on the regulator or scheme.

Conformity Assessment
Varies by regulator. Mostly private sector; Open entry/exit of players based on qualification criteria.

Market Surveillance
Limited government infrastructure; Certification schemes embed surveillance.

Consensus-Based Standards
- Requirements are written into national law
- Longer process for updating
- Standards are published by the government
- Many are based on international standards

Public Private Partnerships
Optimize Resources

Characteristics
- Pre-market Orientation
- Reflects Public-Private Partner Orientation: OSHA, CPSC, FDA
- Regulator-oriented with Agency “Coordination”: Role of NIST
- Mix of Government- and Market-Driven Approaches
- High degree of product compliance

Uniqueness
- Standards and Conformity Assessment largely private sector/commercial activity
- Accreditation mix of private and government
- Government establishes parameters
- Tort and liability laws drive lawsuits
- Distinct Federal versus State government governance scope

World tour: Japan

Consumer Safety, Trade Facilitation and Industry Growth

Accreditation
Accreditation required for mandatory gov’t schemes; Accreditation body associated with government; Voluntary schemes may not require 3rd party accreditation.

Conformity Assessment
Open to ALL foreign providers who meet the qualification requirements of the scheme (e.g., DENAN, Electrical Safety Law).

Market Surveillance
A function of the government for mandatory schemes.

Consensus-Based Standards
- Requirements are written into national law
- Longer process for updating
- Standards are developed/published by the government
- Many are based on international standards

Free Market Supported by Severe Fines for Non-Compliance

Characteristics
- Laws governing product & consumer safety
- Some mandatory schemes driven by government
- Non-compliance punishable by law
- Market needs drive voluntary schemes

Uniqueness
- Most open market regarding use of third-party conformity assessment
- Level playing field for all CA providers meeting requirements, including competency, consistency and impartiality
Regulatory compatibility & microgrids

Regulatory cooperation: Preventing, reducing, or eliminating unnecessary regulatory differences to facilitate trade and promote economic growth, while maintaining or enhancing standards of public health and safety and environmental protection.

Cooperation Towards Compatibility

- Standards & technical regulations
- Conformity assessment
- Accreditation
- Surveillance
Regulatory compatibility – Recommendations

**International Standards:**
- The use of international standards as the basis of technical regulations or conformity assessment produces is key to greater regulatory alignment and reducing barriers to trade.
- International standards as defined in the WTO TBT Committee Decision on International Standards.  

**Technical Regulations:**
- Periodically review technical regulations and conformity assessment procedures to examine increasing alignment with relevant international standards, including review of any new developments in relevant international standards.

**Conformity Assessment:**
- The choice of conformity assessment procedures in relation to a specific product covered by a technical regulation or standard should include an evaluation of the risks involved, the need to adopt procedures to address those risks, relevant scientific and technical information, incidence of non-compliant products, and possible alternative approaches for establishing that the technical regulation or standard has been met.
- Article 6.4 of the WTO TBT Agreement: “Members are encouraged to permit participation of conformity assessment bodies located in the territories of other Members in their conformity assessment procedures under conditions no less favorable than those accorded to bodies located within their territory or the territory of any other country.”

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1. WTO | Principles for the Development of International Standards, Guides and Recommendations
2. WTO | Technical Barriers to Trade

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Regulatory compatibility – Recommendations

*Depends on the conformity assessment system. For third-party systems:*

**Accreditation**
- No discrimination against conformity assessment bodies whose accreditation body:
  - Operates in a territory with more than one accreditation body
  - Is a non-government body
  - Does not operate an office in the party's territory
  - Is a for-profit entity
- Consider approving or recognizing conformity assessment bodies accredited by an accreditation body that is a signatory to a mutual or multilateral recognition arrangement. For example, the International Laboratory Accreditation Cooperation (ILAC) and the International Accreditation Forum (IAF)

**Surveillance**
- Surveillance is active step to help ensure the continued validity of certification once on the market.
- Third-party certification often includes surveillance in the conformity assessment process.
- Third-party systems, like the U.S., build inspection/auditing into pre-market services so that post-market surveillance is less costly.
What does regulatory compatibility mean for microgrids?

Microgrids and component technologies experience significant challenges to demonstrating compliance

Example: Batteries

- Safety risks
- Accelerated product lifecycles
- Evolving regulatory landscape
- Limited local testing capabilities
- Supply chain issues
- Slow testing laboratory turnaround time

Compatible frameworks foster innovation, promote consumer safety, and facilitate trade and investment in microgrid frameworks

Key takeaways

1. Within regulatory frameworks, the relationship between governments and private sector varies across economies. That doesn't mean those frameworks incompatible with one another or international trade obligations.
2. There is value in public-private partnerships towards delivering on regulatory objectives/mandates.
3. It is important to help ensure that regulatory frameworks align with international trade obligations and tenets.
4. Regulatory compatibility is extremely important to enabling long-term investments in microgrid technologies that are safe, sustainable, and secure.
Thank you

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Workshop on Microgrids for a Just Energy Transition

Claire Marie Yvonne C. Lee
Sr. Policy and Finance Advisor
USAID Energy Secure Philippines
16 October 2023
Makati City, Metro Manila, Philippines

About the United States Aid International Development Energy Secure Philippines (USAID ESP)

Goal: Enhanced energy reliability and security given a unified power system

<table>
<thead>
<tr>
<th>Objective</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective 1</td>
<td>Improve Electric Utility Performance</td>
</tr>
<tr>
<td>Objective 2</td>
<td>Increasing Deployment of Advanced Energy Sources and Systems</td>
</tr>
<tr>
<td>Objective 3</td>
<td>Improve Electric Utility Performance</td>
</tr>
</tbody>
</table>
About the United States Aid International Development Energy Secure Philippines (USAID ESP)

**Energy Security and Resilience**

**Cybersecurity**

**Technology Innovations**

**Private Sector Engagement**

**Competition**

**Grants Under Contract Mechanism**

Achieved 5,307 MW, 500 MW Additional Generation as of FY 2023

Achieved $6.3 B, $750 M Private sector engagement as of FY 2023
Relevant Regulatory Frameworks

Case Study:
Productive Uses of Renewable Energy for Sustainable and Equitable Enterprises Development (PURESEED)
Project Overview

Productive Uses of Renewable Energy for Sustainable and Equitable Enterprises Development (PURESEED)

Project Implementer: One Renewable Energy Enterprises Inc.

Project Period: February 1, 2022 – January 31, 2024

Project Objective: To catalyze and facilitate the long-term realization of sustainable energy solutions to support productive uses of renewable energy in remote, off-grid, small island communities in the Philippines.

Note: The number of beneficiaries has changed since the September 2022 typhoon hit and the exclusion of the Gilutongan Island from the grant fund.
Shared Services Facility

**SHARED SERVICE FACILITY**

- **Water treatment & ice maker plant**
  Houses offices and machines for ice-making and reverse-osmosis (RO) desalination

- **Water storage & raw water source**

- **Solar dryer**
  Drying facility for seaweed

- **Solar still & compound parabolic collectors (CPC)**
  Used for Thermal Assisted Desalination; use of CPC enhance overall yield and reduce the size of the area needed for the solar still.

**Achieved**

- Additional Generation Capacity as of FY 2023
- **5,307 MW**
- **500 MW**

**Source:** One Renewable Energy Enterprises Inc.

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**Source:** One Renewable Energy Enterprise Inc.
Thank you for your attention.
Low-carbon Pathway to Energy Access and Rural Economic Development


July 2023
Sabah is home to 72% of unelectrified rural Malaysians, and 8 of 10 poorest districts in Malaysia (12 Malaysia Plan). Our demand map (heat map in previous slide) has identified these communities, and the roadmap creates the pathway to energy access for them.

The Sabah RE2 Roadmap is an action plan to support 100% rural electrification via renewable energy mini-grids.

**Outputs**
- 203 unelectrified villages are project-ready, after community consultations and feasibility studies.
- Launch model with 7 demo systems.
- Scale to 28 systems, implementing innovative financing mechanisms.
- Scale to 168 systems with an ecosystem of project developers, operators and community trainers and advisors.

**Outcomes**
- Community needs, aspirations, and energy demand are known; viability of renewable energy technologies, project economics and financial feasibility are validated.
- Planning models and technical and financial assumptions are validated, demonstrating impact on communities' climate resilience as a result of energy access.
- Pilot systems (from Phase 1) catalyse public and private investments in the project. This activates local capacity building in renewable energy technologies and accelerates adoption.
- Malaysia demonstrates a low-carbon pathway to universal electrification.
Policies that enable 100% rural electrification target

**BARRIERS**

- Electrification planning and coordination excludes communities & other potential actors
- Grid extension strategy is costly and slow for rural areas, and locally available resources are not fully taken into consideration
- Insufficient investment and finance

**RECOMMENDATIONS**

- An updated rural electrification roadmap & targets, with multi-stakeholder input
- A least-cost approach to rural electrification that prioritises mini-grids
- Build out an efficient and transparent delivery model to attract investment

**OUTCOMES & PROPOSED POLICIES**

- An equitable & just target of 100% by 2030
- Include (local) stakeholders (e.g. community-based organizations), feedback loops to ensure inclusion & reflect higher number of unelectrified (>400 communities) in planning
- Include socio-economic, sustainability goals
- Capitalise on mini-grids’ potential for cost reductions: e.g. RM30,000-65,000/connection vs RM100,000/connection for grid extension, & lower LCOE over system lifetimes
- Incorporate optimization modeling into planning activities
- Encourage private & international funding with an updated roadmap & improved programme delivery that derisks investment
- Co-develop and demonstrate a transparent delivery model that can attract international investment, and comply with their standards
- Incorporate financial incentives that encourage private sector investment in mini-grids and (productive end-use based) micro-enterprises

**BARRIERS**

- Current single owner system adds costly operational challenges, & does not consider other models
- There is a high entry barrier for participation, and developers are not incentivized to build sustainable systems
- Lack of guidelines and incentives to build sustainable systems risks systems being operated unsafely and unreliably

**RECOMMENDATIONS**

- Move beyond connections towards integrated, impact & evidence-driven multi-stakeholder delivery
- Develop & clarify guidelines, streamline project implementation
- Develop and implement a quality assurance framework

**OUTCOMES & PROPOSED POLICIES**

- Incorporate innovative business & delivery models, i.e. different combinations of ownership, financing, operational models & technology (based on local needs)
- Include energy access practitioners & community-based organisations in delivery
- Incorporate Productive Uses of Energy (PUE) & socio-economic opportunity in project planning
- Formulate appropriate mini-grid guidelines that facilitate scale-up & reduce entry barrier for lower-tier mini-grids (i.e. under 72 kWp)
  - Allow micro-utilities for rural, off-grid systems
  - All licensing to go through state actors
  - Clarify rules around EIA for micro-hydro
  - Consider registration and not licensing
- Streamline implementation to reduce barriers for delivery partners
- Training and capacity building for ecosystem actors
- Develop a quality assurance framework to ensure health, safety & environment requirements are met
- Avoid new standards & regulations with a high degree of specification that prevents a wide range of technical & delivery model flexibility
- Ensure ongoing monitoring & evaluation to ensure system operations & sustainability
Co-developing Regulations for Mini-grids

**Sabah RE2 Goal**: To create a space for distributed generation systems (i.e. mini-grids) to be legally owned, managed and safely operated by entities other than the state utility, while maintaining an appropriate and sufficient level of service and quality.

**Installer licensing**: Registration not licensing for off-grid installations under 72kW

**Retail licensing**: Allow for sales and flexible tariffs for rural network owners

**Asset ownership**: Allow for community ownership

**Standards and implementation guidelines**: Development and implementation of a Safety and Quality Assurance Framework for off-grid rural systems and networks

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**Quality Assurance Framework (QAF)**

A quality assurance framework in place of (highly specific) standards to ensure HSE requirements are met, improve M&E, standardization, while complying with existing standards, rules & regulations

1. **Level of service (LoS) defined and power reliability defined**
   - e.g. voltage imbalance, short/long voltage duration variations, frequency variations, transients and planned/unplanned SAIFI and SAIDI according to Base, Standard, High LoS.

2. **Matching technical standards**
   - Based on consensus on LoS, match minimum standards to meet agreed upon LoS.

3. **Iterating LoS and power reliability indicators**
   - Review LoS based on pilot projects.

4. **Iterating standards**
   - Ensure that minimum standards used for mini-grids are also cost-effective.
A mini-grid portfolio company will be established to implement the project.

DEMAND-SIDE CHALLENGES FOR RURAL MINI-GRIDS

Mini-grids cannot scale due to these common demand-related challenges:

- **Demand growth is slow** - customers are hesitant to pay connection fees or purchase and operate appliances if the costs and benefits of electricity service are unclear.

- **Capacity is underutilized** - excess capacity is required to handle mismatches in peak supply and peak demand.

- **Forecasts are unreliable** - demand estimation methods may not consider the impact of pricing and load management on user behavior and true willingness-to-pay.
THE OPPORTUNITY

Mini-grid developers need to **predict and manage** end-user behavior. This can only be done with effective **community engagement**.

Demand-side solutions and community engagement can shrink costs by over 20%, but there is a lack robust **tools, data, and methods**.

OUR SOLUTION

**COMET**

Mini-grid community engagement software for exploring electricity demand, value and cost.

- **BUILD CUSTOMER** UNDERSTANDING
- **VALIDATE** COMMUNITY LOAD PROFILES
- **ASSESS** WILLINGNESS-TO-PAY & PROJECT RISK
DEMAND EXPLORATION TOOL
✓ Explore mini-grid scenarios through workshop modules, with community members role-playing household and business electricity use.
✓ Generate load profiles, reports and data analysis on end-user demand and payments.

EDUCATIONAL TOOL
✓ Introduce appliance ratings, metering, billing and other mini-grid concepts through an interactive format.
✓ Facilitate discussions, learning, and consensus building in an inclusive & trust-building environment.

WORKSHOP MODULES:
- Demand exploration
- Demand stimulation
- Demand-side management
- Productive use of energy
- All-female workshops

COMET IN ACTION
- Bajura, Nepal (UNDP Nepal)
- Mata Redi, Sumba (MENTARI/HIVOS)
- Tongod, Sabah (RE2 Consortium)
- Cool Qaday, Somaliland (Innovate UK & SVRG)
The project is led by non-profit organizations with 95+ years of collective expertise in sustainable development.

TONIBUNG is an indigenous-led organization that develops sustainable alternatives to rural electrification. With a 32-year track record, it has built 38 community-owned renewable energy systems that benefitted 1,107 households.

Green Empowerment works with in-country organizations to extend renewable energy and WASH solutions to rural and indigenous communities. It has reached 483,309 people with 247 community infrastructure projects in 25 years.

PACOS Trust is a community-based organization dedicated to supporting indigenous communities in Sabah. It strives to empower indigenous communities through the systematic building and strengthening of independent community organizations.

Forever Sabah is a civil society organization that serves as a collaborative social movement with an aim to see the state of Sabah thrive through the use of local knowledge and experiences.

The initiative was awarded the Renewable Energy Markets Asia Awards for its revolutionary approach to region-wide rural electrification in Sabah. The Sabah RE2 consortium members have been supported and vetted by institutions such as the UNDP, UNICEF, USAID, Global Environment Facility, IUCN, WWF, and the Government of Malaysia, among many others.