Asia-Pacific
Economic Cooperation

Advancing Free Trade
for Asia-Pacific Prosperity

APEC Workshop on Microgrids for a Just Energy Transition

APEC Energy Working Group

December 2023

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Economic Cooperation

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APEC Project: EWG 04 2023S

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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.

The workshop organized in Manila, The Philippines brought together policy makers, industry representatives, and key experts.

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:

Category:	**Number:**
Total participants:	43
Male/Female:	36 male, seven female
Public/Private:	International organizations: two • ASEAN Center of Energy • Asia Pacific Energy Research Centre (APERC) Private Sector: 27 Public Sector: 14
Economies:	Six economies: • Hong Kong, China • Japan • Malaysia • The Republic of the Philippines • Chinese Taipei • United States

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.

Agenda	
13:00 – 13:05	**Opening remarks** • The U.S. Department of Energy – **Dr. Cary N. Bloyd, Ph.D.,** Senior Advisor, Electricity Infrastructure & Buildings Division, Pacific Northwest National Laboratory
13:05 – 14:00 (55 minutes)	**Session 1 – Microgrid Innovation** Combination of cross-sectoral panelist presentations (5 minutes each) and facilitated Q&A, discussion and brainstorming, focused on cutting edge microgrid technologies and approaches. **Proposed panelists:** • **Marc Louie L. Olap**, Chief Science Research Specialist, Rural Electrification and Management Division, Electric Power Industry Management Bureau, Philippines Department of Energy • **Dr. Cary N. Bloyd, Ph.D.**, Senior Advisor, Electricity Infrastructure & Buildings Division, Pacific Northwest National Laboratory – *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* • **Dr. Chi-Wen Liao**, Deputy Division Director, Low-Carbon Energy & Energy Storage Technology Division, GEL, Industrial Technology Research Institute (ITRI)

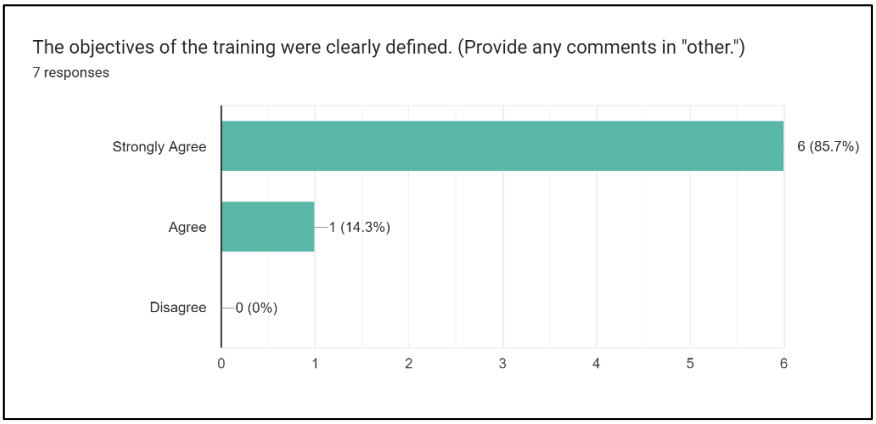
	Moderator: Christian Roatta, Senior Trade & Multilateral Affairs Specialist, UL Solutions
14:00 – 15:00 (60 minutes)	**Session 2 – Microgrid Sustainability, Safety, & Science** Combination of cross-sectoral panelist presentations (5 minutes each) and facilitated Q&A, discussion and brainstorming, focused 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 (30 minutes)	**Coffee and networking break**
15:30 – 16:30 (60 minutes)	**Session 3 – Compatible Regulatory Frameworks for Microgrids** 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
16:30 – 17:00 (30 minutes)	**Session 4 – Next Steps and Potential Projects** Facilitated plenary discussion to document major findings, identification of project ideas, and conclusions.

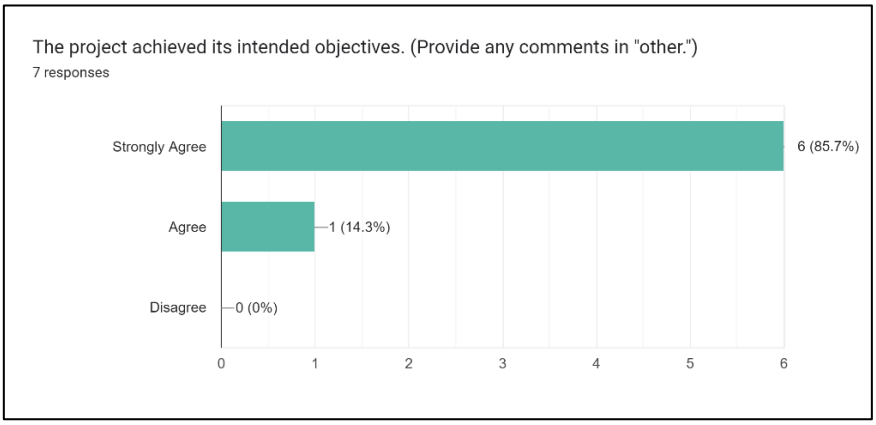
	• **<u>Moderator:</u> Dr. Cary N. Bloyd, Ph.D.**, Senior Advisor, Electricity Infrastructure & Buildings Division, Pacific Northwest National Laboratory • All speakers invited to provide brief thoughts and takeaways, followed by general Q&A

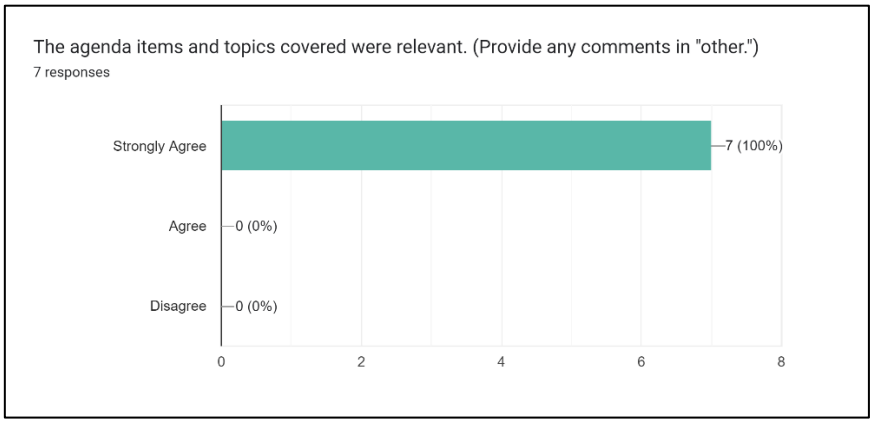
VIII. APPENDIX II: EVALUATION SURVEY RESPONSES

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.

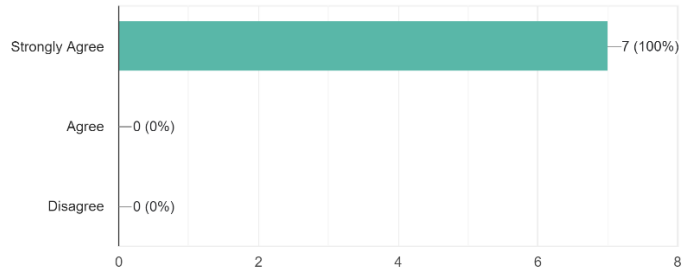






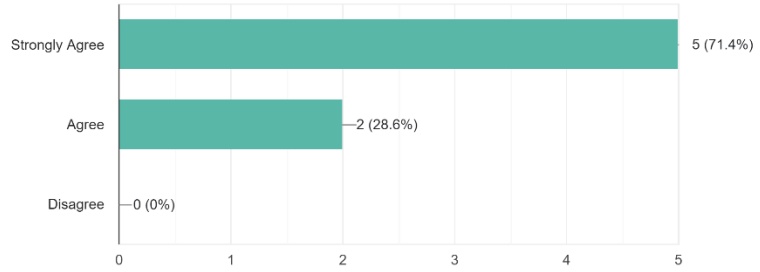
The content was well organized and easy to follow. (Provide any comments in "other.")

7 responses



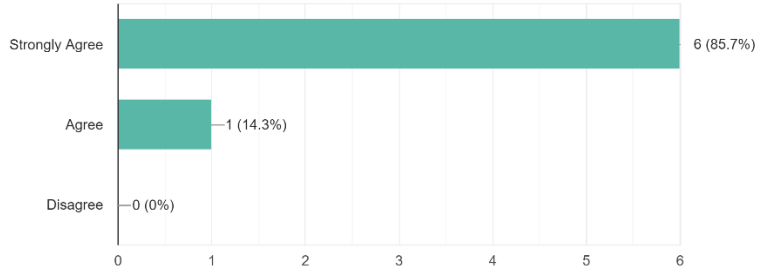
Gender issues were sufficiently addressed during implementation. (Provide any comments in "other.")

7 responses



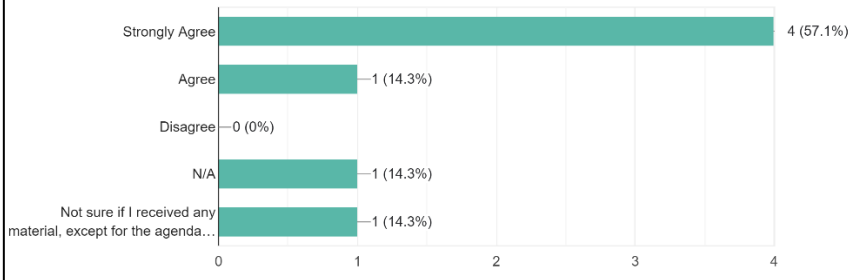
The trainers/experts or facilitators were well prepared and knowledgeable about the topic. (Provide any comments in "other.")

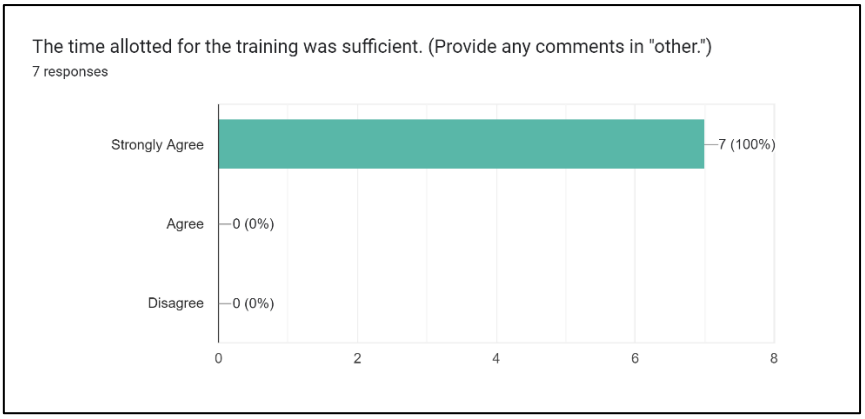
7 responses

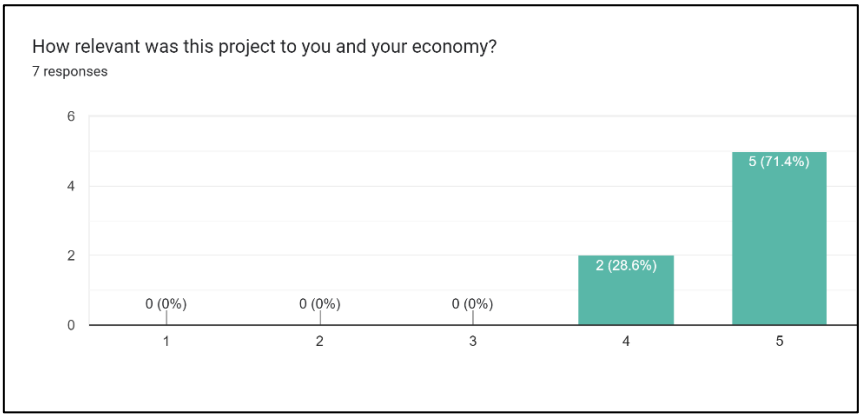


The materials distributed were useful. (Provide any comments in "other.")

7 responses





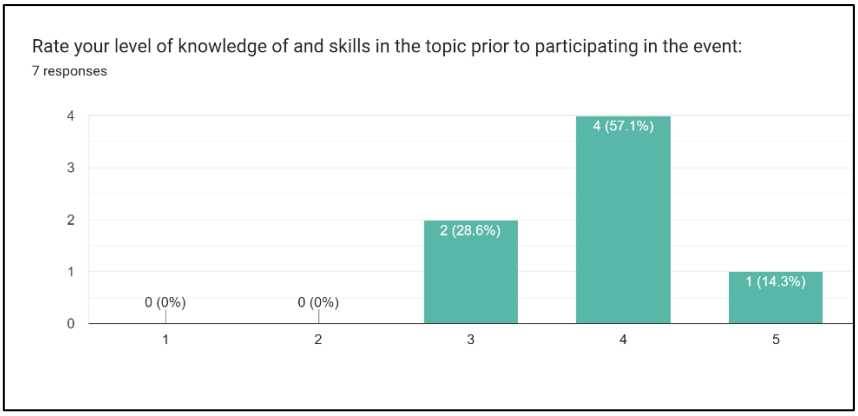


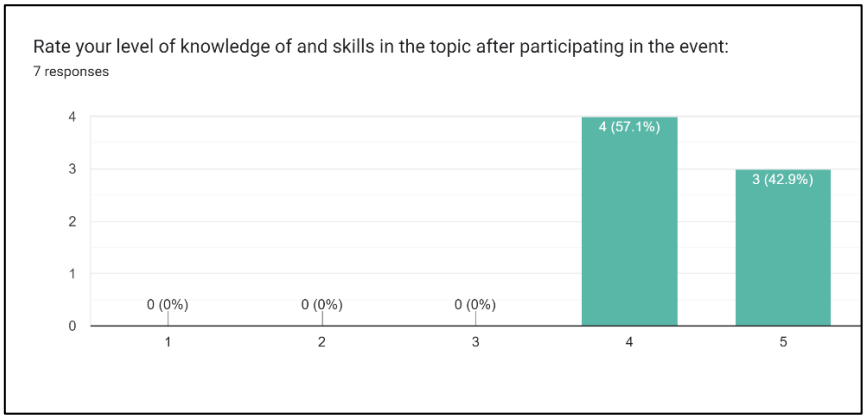
In your view what were the project's results/achievements? (Seven responses)

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 offrgid 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

Gender	Last Name	First Name	Economy
Male	LUI	Marco	Hong Kong, China
Male	IKEDA	Takao	Japan
Male	SWEETNAM	Glen	Japan
Female	Abdullah	Maizakiah Ayu	Malaysia
Male	Hamzah	Amirul	Malaysia
Male	Andrion	Clarence	The Philippines
Male	Asana	Ramon	The Philippines
Male	Bobis	Gerard	The Philippines
Male	Buenviaje	Ronel	The Philippines
Male	Gadiano	Dave	The Philippines
Male	Jornales	Daniel Collin	The Philippines
Male	Layug	Jay	The Philippines
Female	Lee	Claire Marie Yvonne	The Philippines
Male	Loria	Vicente	The Philippines
Male	Olap	Marc Louie	The Philippines
Male	Ordaniel	Mark Joseph	The Philippines
Male	Pascual	Raymund	The Philippines
Male	Planas	Jaime	The Philippines
Male	Reyes	Jose Jr.	The Philippines
Male	Sunico	Theo	The Philippines
Male	Zagala	Manuel Luis	The Philippines
Male	Zamora	Christopher	The Philippines
Male	CHEN	CHUNG-HSIEN	Chinese Taipei
Male	Chi	Chun-Hsieu	Chinese Taipei
Female	Fan	An-Chi	Chinese Taipei
Female	HSU	Shih-Hua	Chinese Taipei
Female	Jhou	Sih-Ting	Chinese Taipei
Female	Kuo	Mei Lin	Chinese Taipei
Male	Liao	Chi-Wen	Chinese Taipei
Male	TSAI	Cho-Ting	Chinese Taipei
Male	TUNG	CHI-HSU	Chinese Taipei
Male	Wu	Keng-Tung	Chinese Taipei
Male	Bloyd	Cary	United States
Male	Hopkins	Jason	United States
Male	Kasdin	Matthew	United States
Male	Roatta	Christian	United States
Male	Ambrien	Jose	
Male	Dela Cruz	Ricardo	
Male	REMB - Stakeholder	REMB - Stakeholder	
Male	Su	Yiyuan William	
Male	Tan	Bayani	
Male	Zagala	Manuel Luis	
Female		Louisa	

X. APPENDIX IV: PRESENTATION MATERIALS

The presentation materials are included in the order they were presented as per the agenda (See Appendix 1).

DEPARTMENT OF ENERGY

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

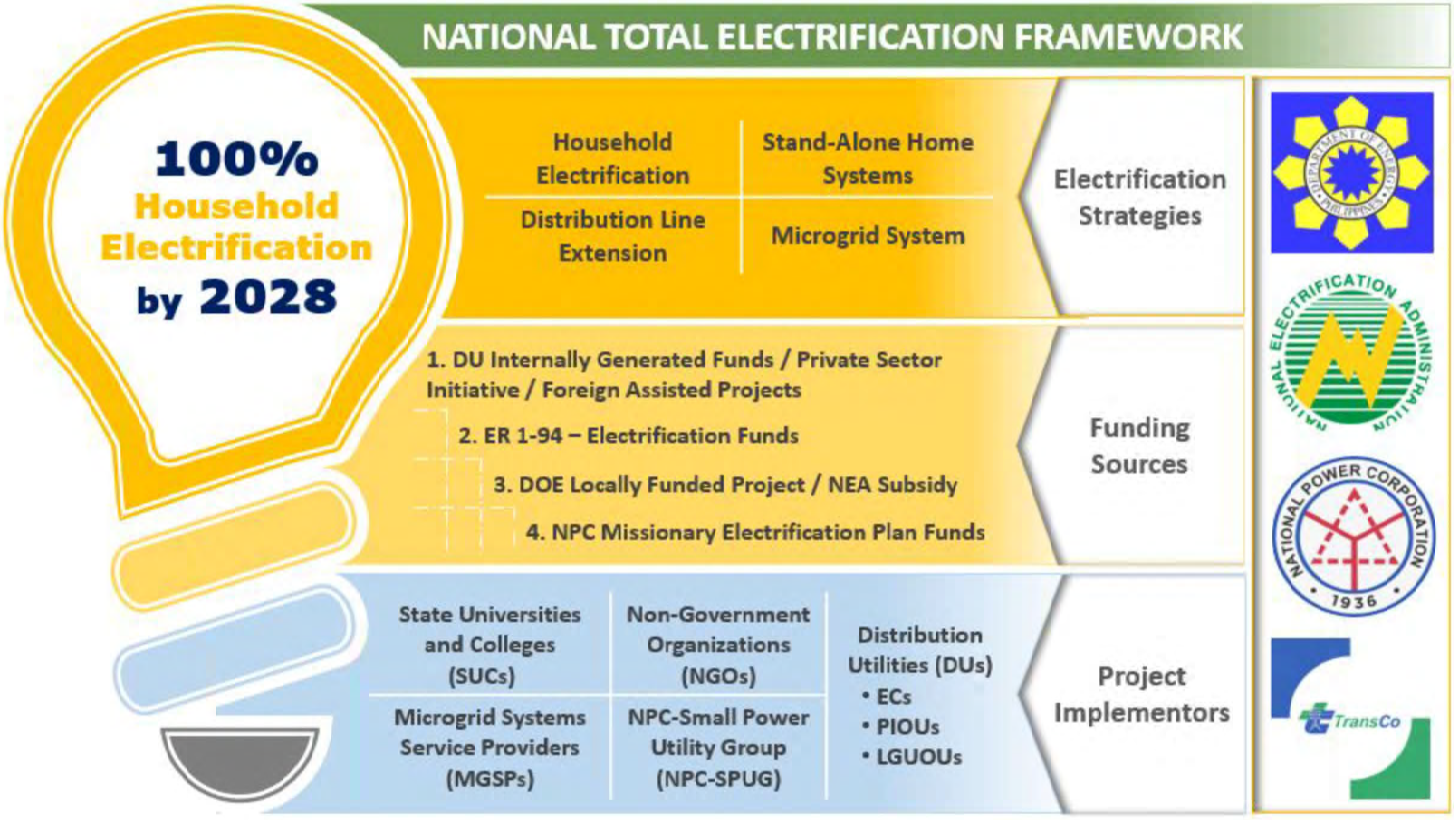
Total Electrification Directives

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

Total Electrification Directives



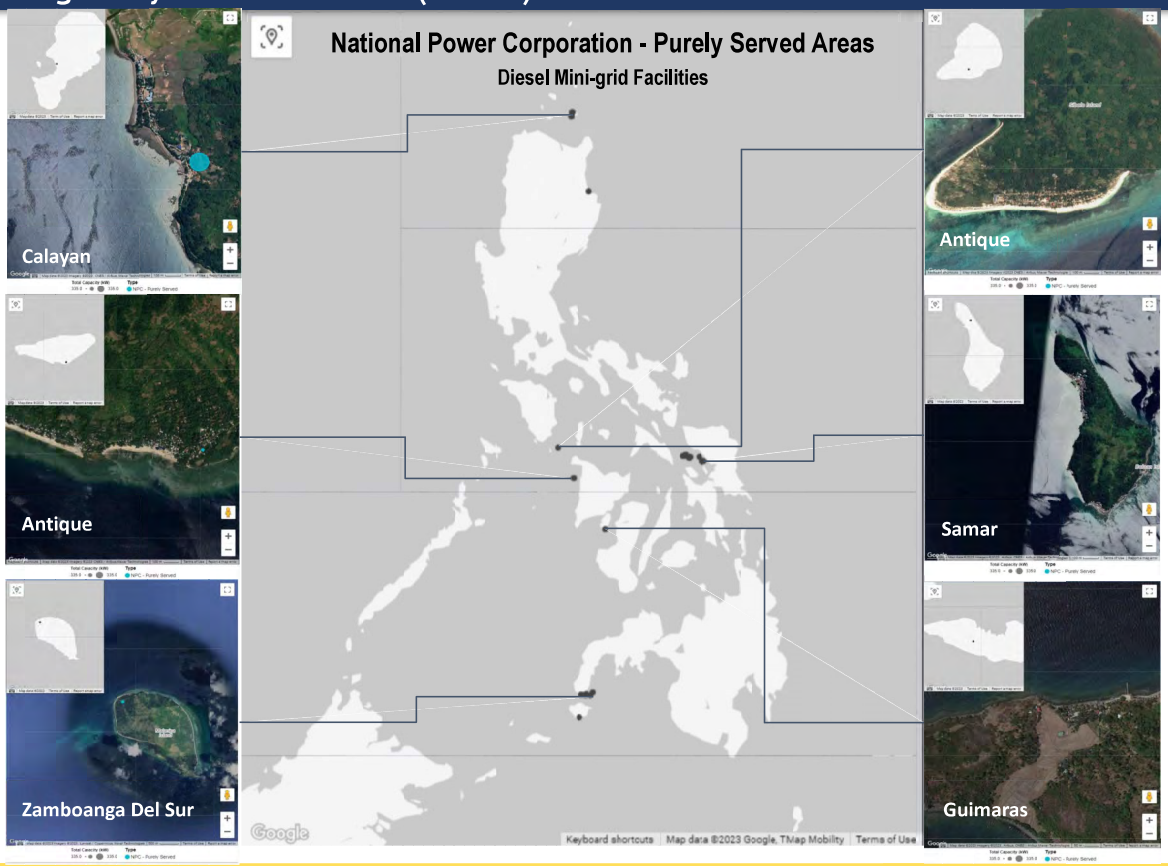
WHAT IS A MICROGRID SYSTEM?

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)

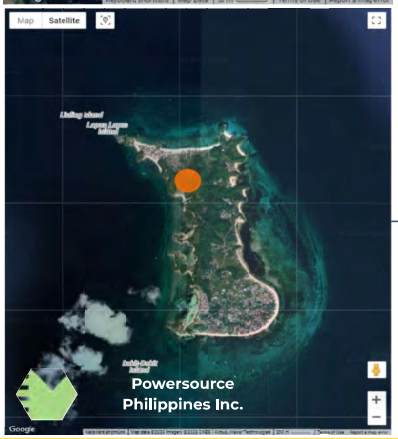
WHAT IS A MICROGRID SYSTEM PROVIDER (MGSP)?

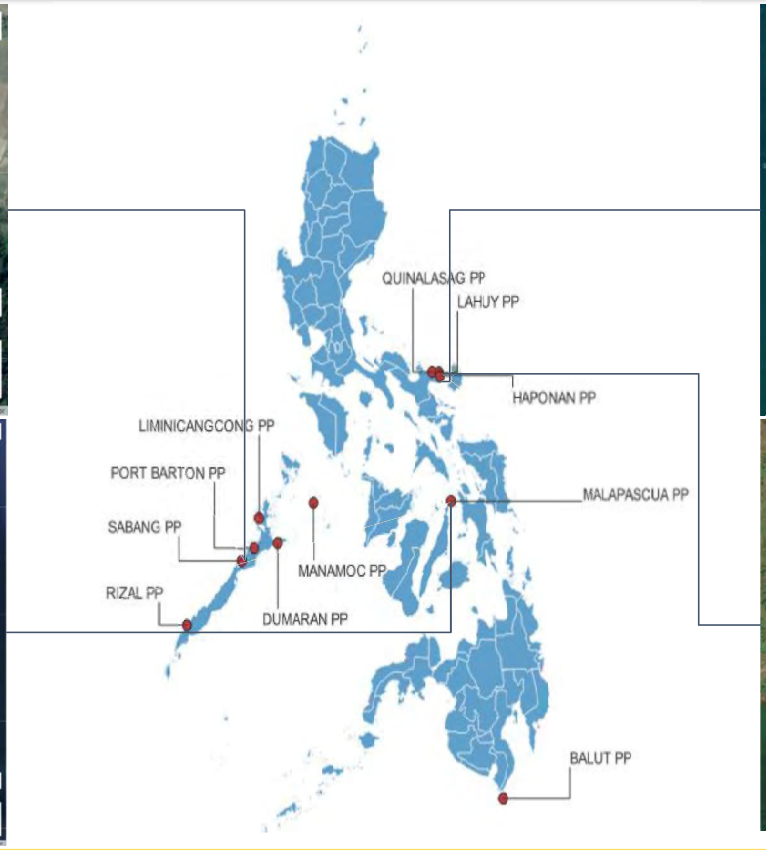
It refers to a **natural or juridical person** whose business includes the installation, operation, and maintenance of microgrid systems in unserved or underserved areas nationwide. (RA 11646, Section 4 (p), Definition of Terms)

Existing Microgrid Systems Provider (MGSP)



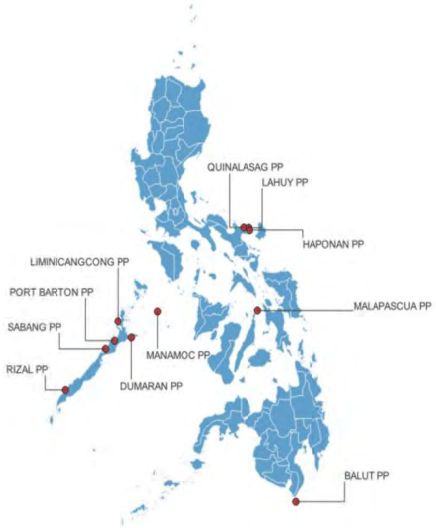
Existing Microgrid Systems Provider (MGSP)





Existing Microgrid Systems Provider (MGSP)

Project Location	Proponent	Technology	Approved Tariff	Served Customers	Average Demand Load(kW)
Malapascua, Daan-Bantayan, Cebu	PSPI	Diesel 1.455 MW	<=40kWh = PhP12/kWh ; >40kWh = PhP 15/kWh	1,163	9,733.46 (Daily)
Liminangcong, Taytay, Palawan	PSPI	Diesel- .805 MW	PhP 9.12/kWh	1,020	3,682.50 (Daily)
Candawaga & Culasian, Rizal, Palawan	PSPI	Diesel - .43 MW	PhP 9.9082/kWh	1,062	2,934.52 (Daily)
Sitio Sabang, Puerto Princesa City, Palawan	SREC	**Diesel 1.2 MW + Solar-1.452 MWp, Battery Storage - 2.44 MWh**	PhP12/kWh for Residential & Public Bldgs ; PhP15/kWh for Commercial Bldg	588	2,589.65 (Daily)
Lahuy Island, Caramoan, Camarines Sur	FPIEC	**250 kWp Solar + 468 kW Diesel + 232 kWh Battery**	N/A	940	93,003.75 (Monthly)
Haponan Island, Caramoan, Camarines Sur	FPIEC	**107 kWp Solar + 104 kW Diesel + 232 kWh Battery**		133	
Quinalasag Island Garchitorena, Camarines Sur	FPIEC	**404 kWp Solar + 585 kW Diesel + 232kWh Battery**		1,376	
Brgy. Manamoc, Cuyo, Palawan	PSPI	0.216 MW Diesel		659	28,125 (Daily)
Brgy. Port Barton, San Vicente Palawan	PSPI	0.61 MW Diesel		610	3,138.71 (Daily)
Balut Island, Saranggani, Davao Occidental	PSPI	0.71 MW Diesel	9.5530/kwh	3570	6000 kW (Daily)

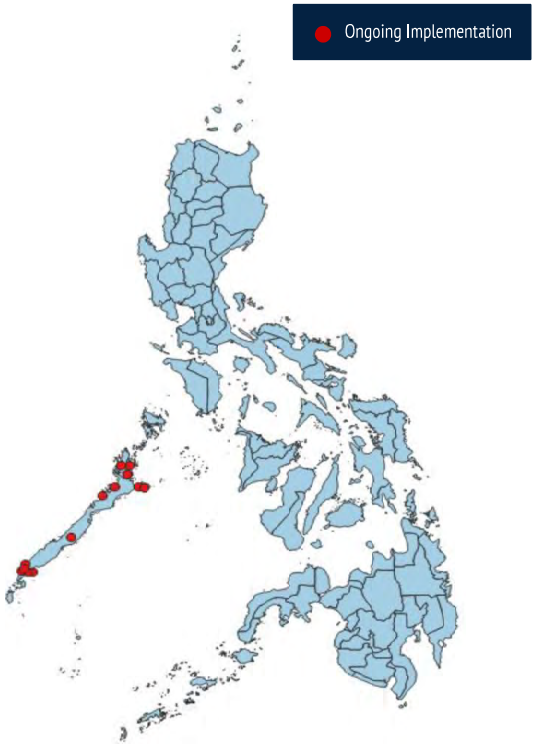


DEPARTMENT OF ENERGY EXISTING MICROGRID SYSTEMS PROVIDERS

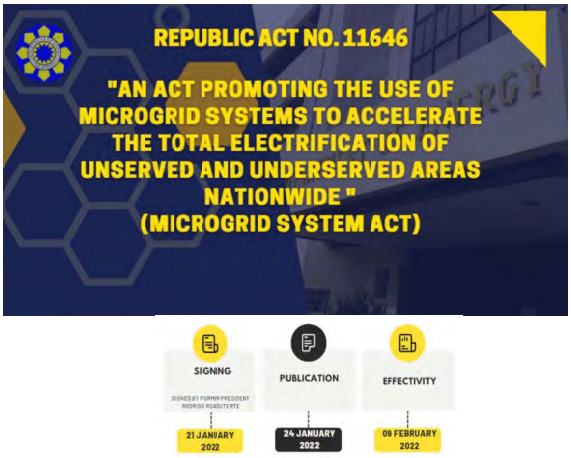
Existing Microgrid Systems Provider (MGSP)

ONGOING IMPLEMENTATION

MGSP Service Areas	DU	Potential HHs	MGSP	Capacity/ Technology
Sto. Tomas Dumaran Palawan	PALECO	678	ARC	Solar - 151 kWp BSS -193 kwh Diesel -83 kW
Bohol Dumaran Palawan	PALECO		ARC	Solar - 227 kWp BSS -226 kwh Diesel -112 kW
Sarong Bataraza Palawan	PALECO	448	ARC	Solar - 151 kWp BSS -193 kwh Diesel -83 kW
Taratak Bataraza Palawan	PALECO	426	ARC	Solar - 227 kWp BSS -226 kwh Diesel -112 kW
Catalagbak Quezon Palawan	PALECO	381	ARC	Solar - 227 kWp BSS -226 kwh Diesel -112 kW
Taburi Rizal Palawan	PALECO	1400	ARC	Solar - 365 kWp BSS -411 kwh Diesel -224 kW
				Solar - 151 kWp BSS -193 kwh Diesel -83 kW
Canipaan Rizal Palawan	PALECO	645	ARC	Solar - 227 kWp BSS -226 kwh Diesel -112 kW
Latud Rizal Palawan	PALECO	560	ARC	Solar - 151 kWp BSS -193 kwh Diesel -83 kW
Alacalian Taytay Palawan	PALECO	631	ARC	Solar - 365 kWp BSS -411 kwh Diesel -224 kW
Bantulan Taytay Palawan	PALECO	773	ARC	Solar - 151 kWp BSS -193 kwh Diesel -83 kW
Silanga Taytay Palawan	PALECO			Solar - 227 kWp BSS -226 kwh Diesel -112 kW
Caruray San Vicente Palawan	PALECO	980	ARC	Solar - 365 kWp BSS -411 kwh Diesel -168 kW
				Solar - 151 kWp BSS -193 kwh Diesel -83 kW
Binga San Vicente Palawan	PALECO	351	ARC	Solar - 302 kWp BSS -275 kwh Diesel -168 kW
Bebeladan El Nido Palawan	PALECO	435	ARC	Solar - 365 kWp BSS -411 kwh Diesel -168 kW



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.

Competitive Selection Process for Microgrid System Provider

Sections 10 and 13 of the MGSA-IRR

"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;"

DEPARTMENT ORDER NO. DO2023-04-0012

Republic of the Philippines
DEPARTMENT OF ENERGY
(Kagawaran ng Enerhiya)

DEPARTMENT ORDER NO. DO2023-04-0012

CREATION OF THE SPECIAL BIDS AND AWARDS COMMITTEE PURSUANT TO SECTIONS 10 AND 11 OF DEPARTMENT CIRCULAR NO. DC2022-05-0017

WHEREAS, Republic Act (RA) No. 9136 or the Electric Power Industry Reform Act of 2001 (EPIRA) declares the policy of the State to ensure and accelerate the total electrification of the country and ensure the quality, reliability, and affordability of the supply of electric power;

WHEREAS, on 27 January 2022, RA 11646, titled "*The Act Promoting the Use of Microgrid Systems to Accelerate the Total Electrification of Unserved and Underserved Areas Nationwide*", was signed by then President Rodrigo R. Duterte and took effect on 09 February 2022;

WHEREAS, on 24 May 2022, the Department of Energy (DOE) issued Department Circular (DC) No. DC2022-05-0017, titled "*Rules and Regulations to Implement Republic Act No. 11645 (Microgrid Systems Act)*" or the MGSA-IRR, which took effect on 25 June 2022;

WHEREAS, Sections 10 and 13 of the MGSA-IRR mandate the 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;

NOW, THEREFORE, in consideration of the foregoing, the DOE hereby promulgates and adopts the following:

SECTION 1. CREATION AND COMPOSITION OF THE DOE SPECIAL BIDS AND AWARDS COMMITTEE FOR MGSP (MGSP-SBAC)

The MGSP-SBAC is hereby created which shall s
conduct of CSP for MGSP in DOE-declared unser

The MGSP-SBAC shall be composed of the

Chairman	:	Designated DOE BA
Vice-Chairperson	:	Designated DOE BA
Members	:	Director, Finance S Director, Legal Serv Director, Electric Po (EPIMB)

SECTION 7. EFFECTIVITY

This DO shall take effect immediately upon its issuance and shall remain in full force and effect until sooner modified or revoked in writing by the Secretary.

RAPHAEL P. M. LOTILLA
Secretary
APR 12 2023

Energy Center, Rizal Drive cor. 34th Street, Bonifacio Global C...
Tel. No. (Trunkline) (632) 8479-290...
Website: http://www.doe.gov.ph; Email: info@doe...

SPECIAL ORDER NO. SO2023-04-0054

Republic of the Philippines
DEPARTMENT OF ENERGY
(Kagawaran ng Enerhiya)

SPECIAL ORDER NO. SO2023-04-0054

CONSTITUTING THE SPECIAL BIDS AND AWARDS COMMITTEE FOR THE SELECTION OF THE MICRCGRID SYSTEMS PROVIDERS PURSUANT TO REPUBLIC ACT NO. 11646 OR THE MICROGRID SYSTEMS ACT

Pursuant to Section 12 (h) and (i) of the Republic Act No. 11646[1] and Sections 10 and 11 of Part IV of the Department of Energy (DOE) Department Circular (DC) No. DC2022-05-0017[2], the Microgrid System Provider – Special Bids and Awards Committee (MGSP-SBAC) is hereby constituted to ensure open, transparent, and efficient conduct of the competitive process in the selection of Microgrid Service Providers to provide electricity services in the DOE declared Unserved and Underserved Areas and CU identified Unserved Areas.

Further, Section 11.1.1 Part IV of the MGSA-IRR provides that an independent MGSP-SBAC shall be established to spearhead and manage the Competitive Selection Process (CSP) for MGSP.

Moreover, Section 11.2 Part IV of the MGSP-IRR states that the MGSP-SBAC TWG and MGSP BAC Secretariat shall be composed and headed by a regular or permanent employee, preferably an officer, to assist the MGSP-SBAC in the performance of its functions.

A. **Composition of the DOE Special Bids and Awards Committee for MGSP (MGSP-SBAC)**

Chairperson:	Undersecretary Giovanni Carlo J. Bacordo
Vice-Chairperson:	Assistant Secretary Mario C. M... CESO III
Members:	Director Agustus Ce... OIC-Director Myr... Director Irma C...

B. **Composition of Technical Working G...**

Head:	Director Amelia M...
Members:	Assistant Directo... Engr. Marc Louie...

F. Effectivity Clause

This Special Order shall take effect immediately upon its issuance and shall remain in full force and effect until sooner modified, amended, repealed, or revoked in writing by the Secretary.

RAPHAEL P.M. LOTILLA
Secretary
APR 12 2023

[1] Titled "An Act Promoting the Use of Microgrid Systems to Accele... Across Nationwide", or the Microgrid Systems Act (MGSA).
[2] Titled "Rules and Regulations to Implement Republic Act No. 116... (IRR).

Energy Center, Rizal Drive cor. 34th Street, Bonifacio Global C...
Tel. No. (Trunkline) (632) 8479-29...
Website: http://www.doe.gov.ph; E-mail: info@do...

Selection Process for Microgrid System Provider

Design of the microgrid system, i.e., generation and distribution, to meet the peak demand of the service area in accordance to the following:

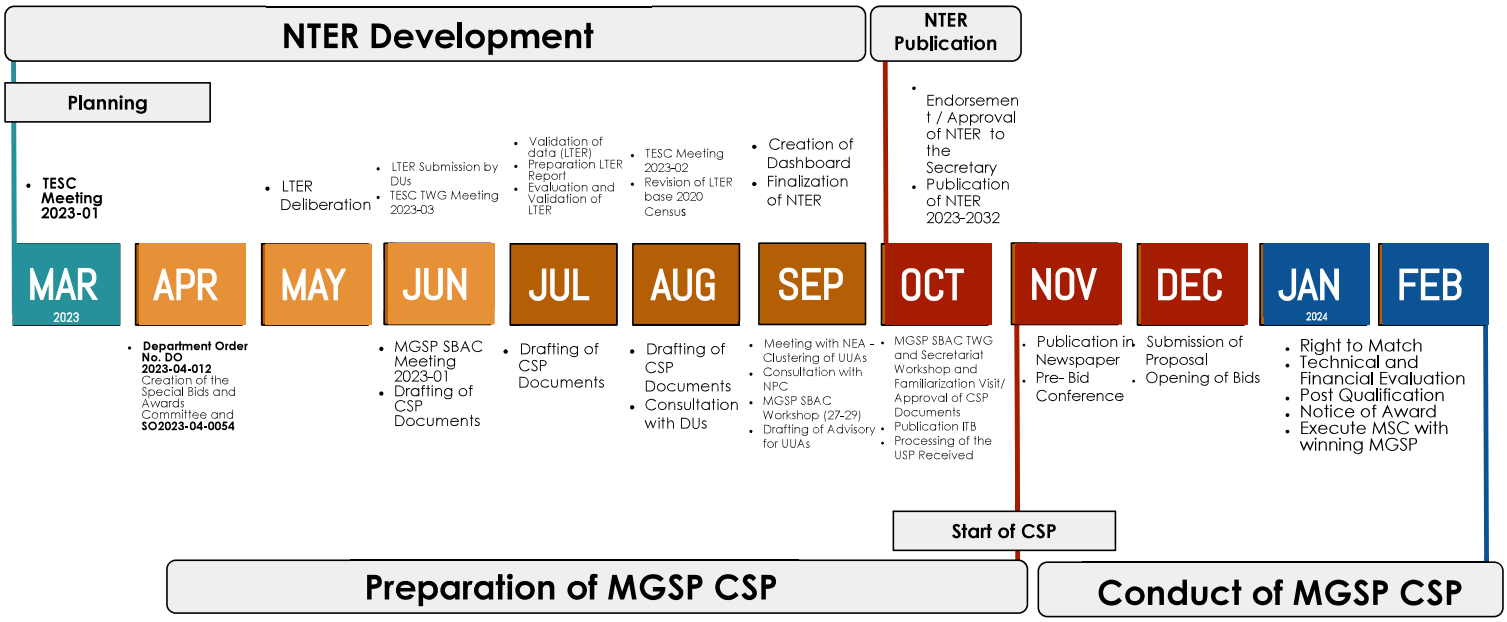
I. The Generating Facility shall comprise of at least 35% RE for the initial year to reach at least 50% by the end of the period, and can utilize:

   a. Purely Renewable Energy (RE) technology systems; or
   b. Combination of RE systems and conventional sources

II. The Generating Facility may be augmented by an Energy Storage System (ESS).

III. Distribution systems, metering and other associated requirements, to be constructed, operated, and maintained pursuant to the Philippine Small Grid Guidelines (PSGG) and Philippine Distribution Code (PDC)

Timeline - Pilot CSP for Microgrid Systems Provider



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.


DEPARTMENT OF ENERGY
Thank You
Email address: mllolap@doe.gov.ph
DOE website: www.doe.gov.ph

工業技術研究院
Industrial Technology
Research Institute

Development of Microgrid in Chinese Taipei

Green Energy & Environment Research Laboratories

Industrial Technology Research Institute

Oct, 2023

1

Outline

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

2

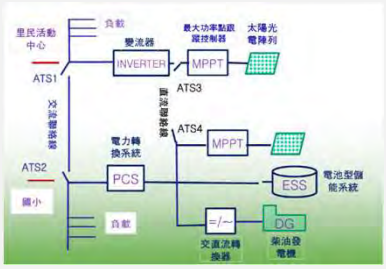
Functions of Microgrid

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

3

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.



4

Microgrid for R&D

ITRI Southern campus

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

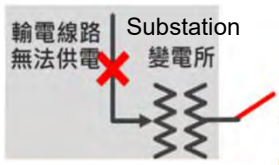
Features

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

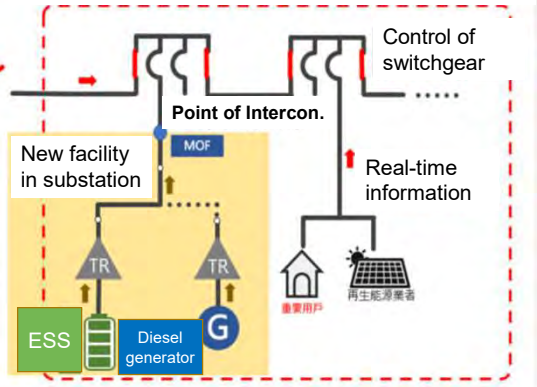
5

Microgrid for feeder-level stand-alone operation

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



Energy management for stand-alone operation



- 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

6

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

7

Asia-Pacific Economic Cooperation

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF ENERGY

ENERGY UTILIZATION MANAGEMENT BUREAU

The 61st Meeting of APEC Expert Group on Energy Efficiency & Conservation and 59th Meeting of APEC Expert Group on New and Renewable Energy Technology

"Reinforcing Relevant Laws for a Comprehensive Approach to Energy Efficiency and Conservation, Renewable Energy, Electric Vehicle, and Sustainability in the APEC Region"

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

Asia-Pacific Economic Cooperation

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Workshop on Microgrids for a Just Energy Transition

16 October 2023
Makati City, Metro Manila, Philippines

Asia-Pacific Economic Cooperation

Matt Kasdin

Director, Senior Counsel, Maxeon Solar Technologies

maxeon

Previous Experience:

United Nations Global Compact

PRI Principles for Responsible Investment

LATHAM & WATKINS LLP

IIX

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?*

Disclaimer: I am licensed to practice law in New York only. This presentation is for information purposes and does not constitute legal advice. If you have a legal issue, please consult with your legal counsel.

A Leading Provider of Premium Solar Technology

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

First >20% Efficient Solar Cell

First 400W Residential Panel

GEN 1	GEN 2	GEN 3	GEN 5 & 6	GEN 7	NEXT GENERATION
2004	2007	2015	2019	2023+	2024+
First commercially available IBC solar cells.	**New architecture.** First IBC laser processing, higher efficiency, lower cost.	**New architecture.** First commercial tunnel junction solar cells, higher efficiency.	**Simplified process.** Larger wafer size, reduced cost.	**New architecture.** Higher efficiency, inherently safer operation.	**Novel low cost metallization, radical process simplification.**

MAXEON SUSTAINABILITY FRAMEWORK

Purpose & Value:	Key Pillars:	Material Topics:	UN SDG Goals:
maxeon POWERING POSITIVE CHANGE 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**	**Environmental** Creating positive environmental impact to sustain our natural world by investing in technologies to combat climate change	• Energy and Emissions • Water Management • Waste • Circular Economy	7 AFFORDABLE AND CLEAN ENERGY 12 RESPONSIBLE CONSUMPTION AND PRODUCTION
	Social Creating positive value in society and communities by leading, partnering and supporting initiatives to enhance people's lives	• Occupational Health and Safety • Fair Labour and Human Rights • Employee Engagement • Learning and Development • Diversity and Inclusion • Community Investment	10 REDUCED INEQUALITIES
	Governance Creating positive economic value and maintaining ethics and integrity through responsible and transparent business practices	• Business Integrity and Ethics • Product Quality, Reliability and Safety • Sustainable Innovation • Customer Engagement and Satisfaction	16 PEACE, JUSTICE AND STRONG INSTITUTIONS

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

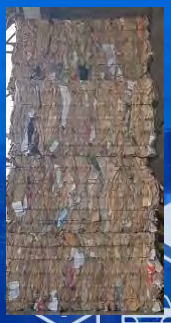
Waste Recycling Programs in the Philippines

Metal Wastes for Smelting

Foams for Pillows and Pellets for Reuse

Wood Wastes turned to Wood Furnitures

Cartons to Paper Pulp Manufacturing



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

Examples of Environmental Sustainability Initiatives in Mexico

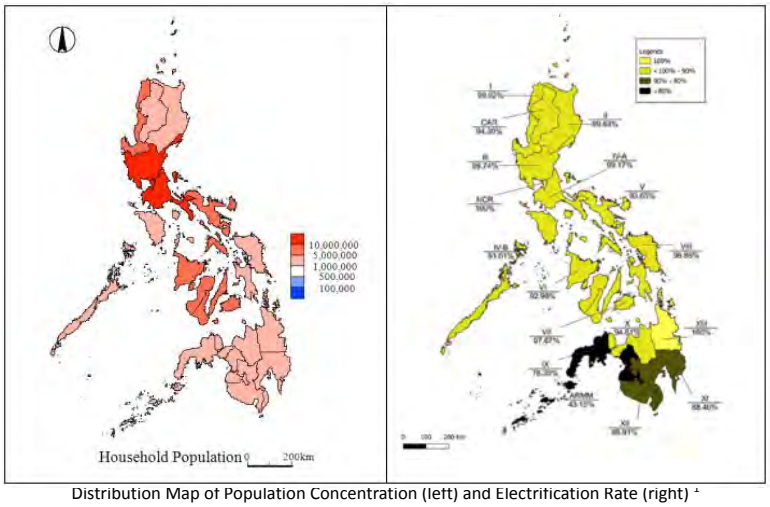
Installation of Solar Panels Across Our Manufacturing Site and Composting Garden

Composting Garden at Mexico Manufacturing Site Powered by Solar Panels

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

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



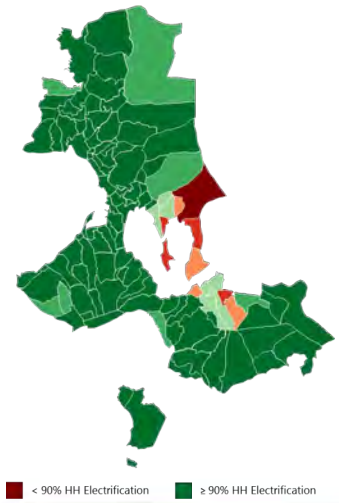
Distribution Map of Population Concentration (left) and Electrification Rate (right) [1]

- **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**

[1] *Asian Development Bank Institute. (2019, September). Securing Access to Electricity with Variable Renewable Energy in the Philippines: Learning from Nordic Model. Shinichi Taniguchi.*
[2] *Department of Energy. 2021-2025 Missionary Electrification Development Plan and 2020-2040 Philippine Energy Plan (PEP)*

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

HOUSEHOLD ELECTRIFICATION WITHIN MERALCO'S FRANCHISE AREA



"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

MERALCO

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

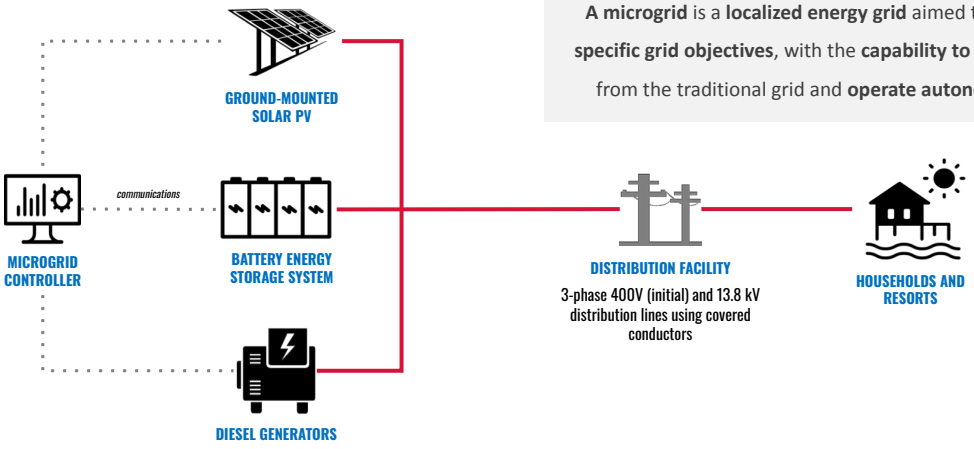
DEFECTIVE USUALLY AFTER 2-3 YEARS

Sizes range from 5 – 30 KVA

EMITS SIGNIFICANT AMOUNT OF CO_2

MERALCO

MERALCO explored a more sustainable, reliable, technological, and cost-effective solution to electrify remote and unviable areas

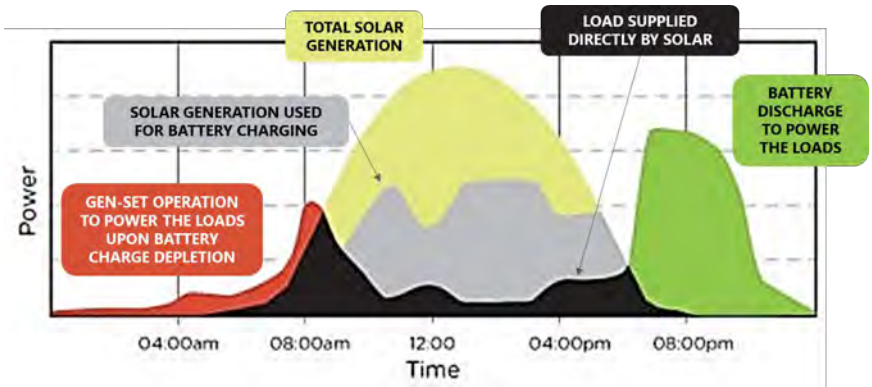


A microgrid is a **localized energy grid** aimed to achieve **specific grid objectives**, with the **capability to disconnect** from the traditional grid and **operate autonomously**

MERALCO

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

TYPICAL DAILY MICROGRID OPERATION USING SOLAR, BESS, AND DIESEL GENERATOR



- ✔ **Cheaper true cost of power** compared to 100% diesel generators
- ✔ **Displaces significant amount of fuel**
- ✔ **Environment-friendly**: massive reduction in carbon emissions

MERALCO

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.

Diesel Generator + Solar PV + Battery Storage

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

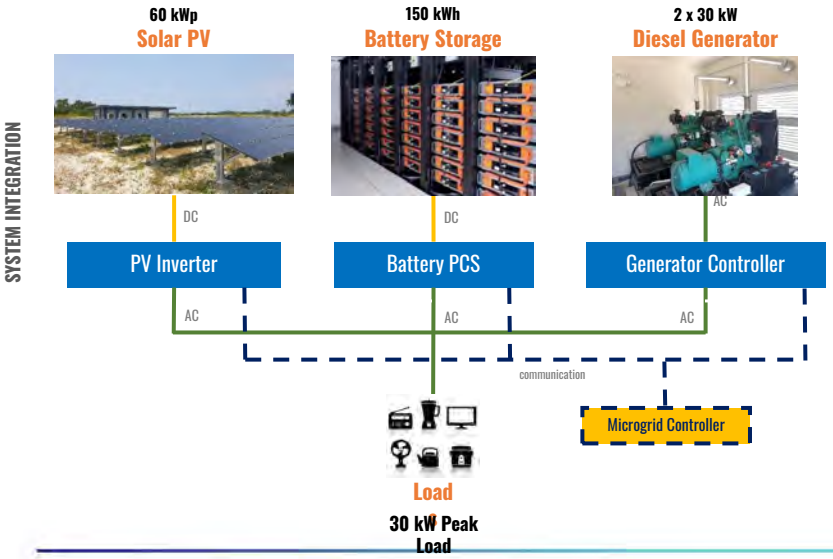
PROJECT SITE

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)

MERALCO

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



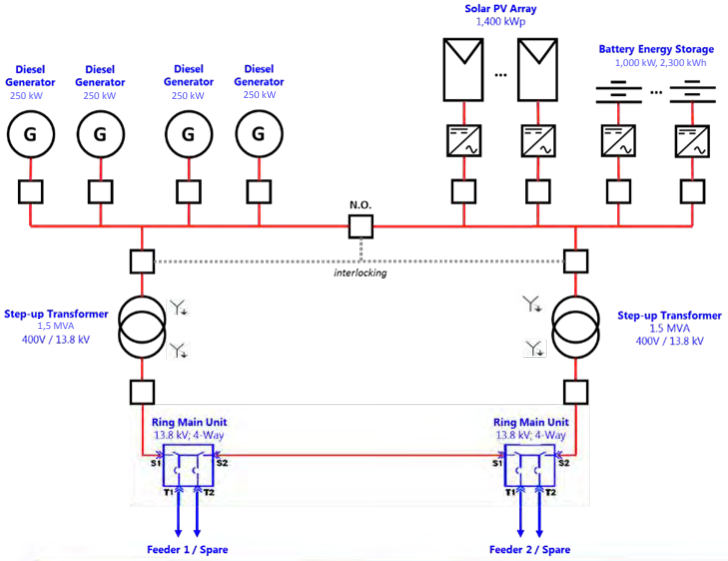
KEY SPECIFICATIONS

- 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**

MERALCO

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

MERALCO

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]**:

ALTERNATIVES	Estimated Levelized Cost of Electricity (LCOE)[2]
Development of a Microgrid with Hybrid System	**PhP 15.96 / kWh** (~ $ 0.32 / kWh)
Development of a Microgrid with Diesel Generators	PhP 30.70 / kWh (~ $ 0.61 / kWh)
Extension of Distribution Lines through Submarine Cables	PhP 34.23 / kWh (~ $ 0.68 / kWh)

- **Microgrid** with hybrid system yielded the **cheapest true cost of power**
- Use of Microgrids was deemed **most sustainable and green option** among all alternatives since it **significantly reduces carbon emissions**
- The cost optimization in Microgrids is mainly due to the high share of RE source (solar PV) which **driven the O&M cost down by significantly displacing diesel fuel**

[1] *LCOE calculations made for Cagbalete Microgrid Phase 2 project*
[2] *includes replacement costs, fuel, annual operation and maintenance costs*

MERALCO

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

MERALCO

Key challenges in developing Microgrids in the Philippines

Affordability

Regulatory Policies & Permitting

Logistics

Choice of Technology & System Optimization

Scalability

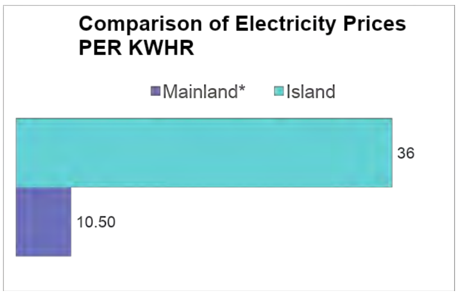
Sustainability

MERALCO

KEY CHALLENGES: Affordability

Rates imposed in Cagbalete Island

FLAT RATE PER APPLIANCE (Peso/day)	METERED RATE (Peso/kWh)
• 1 light bulb – Php 10 • 1 radio – Php 10 • 1 TV – Php 15 • 1 ref – Php 20	Php 31 – Php 36 per kWh

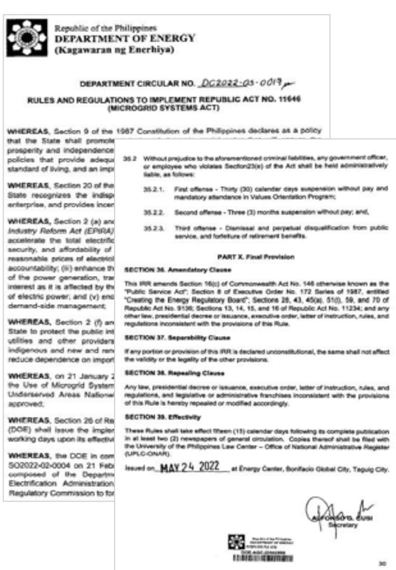


*latest 3-month average of a residential customer consuming 0 - 50 kWh; includes cross-subsidies

- 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

MERALCO

KEY CHALLENGES: Regulatory Policies and Permitting



Republic of the Philippines
DEPARTMENT OF ENERGY
(Kagawaran ng Enerhiya)

DEPARTMENT CIRCULAR NO. DC2022-05-0017

RULES AND REGULATIONS TO IMPLEMENT REPUBLIC ACT NO. 11646 (MICROGRID SYSTEMS ACT)

WHEREAS, Section 9 of the 1987 Constitution of the Philippines declares as a policy ...

35.2 Without prejudice to the aforementioned criminal liabilities, any government officer, or employee who violates Section23(e) of the Act shall be held administratively liable, as follows:

35.2.1. First offense - Thirty (30) calendar days suspension without pay and mandatory attendance in Values Orientation Program;

35.2.2. Second offense - Three (3) months suspension without pay; and,

35.2.3. Third offense - Dismissal and perpetual disqualification from public service, and forfeiture of retirement benefits.

PART X. Final Provision

SECTION 36. Amendatory Clause

This IRR amends Section 16(c) of Commonwealth Act No. 146 otherwise known as the "Public Service Act"; Section 8 of Executive Order No. 172 Series of 1987, entitled "Creating the Energy Regulatory Board"; Sections 28, 43, 45(a), 51(i), 59, and 70 of Republic Act No. 9136; Sections 13, 14, 15, and 16 of Republic Act No. 11234; and any other law, presidential decree or issuance, executive order, letter of instruction, rules, and regulations inconsistent with the provisions of this Rule.

SECTION 37. Separability Clause

If any portion or provision of this IRR is declared unconstitutional, the same shall not affect the validity or the legality of the other provisions.

SECTION 38. Repealing Clause

Any law, presidential decree or issuance, executive order, letter of instruction, rules, and regulations, and legislative or administrative franchises inconsistent with the provisions of this Rule is hereby repealed or modified accordingly.

SECTION 39. Effectivity

These Rules shall take effect fifteen (15) calendar days following its complete publication in at least two (2) newspapers of general circulation. Copies thereof shall be filed with the University of the Philippines Law Center – Office of National Administrative Register (UPLC-ONAR).

Issued on MAY 24 2022 at Energy Center, Bonifacio Global City, Taguig City.

Secretary

30

- 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

MERALCO

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

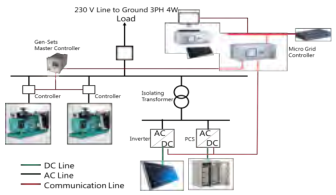
MERALCO

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

Optimization Software

GENERATION SCHEME	SOLAR PV	BATTERY STORAGE	DIESEL GEN-SET
Solar + Battery + Diesel Generator	57 kWp	143 kWh	22 kVA
Solar + Battery	199 kWp	286 kWh	
Diesel Generator			30 kVA



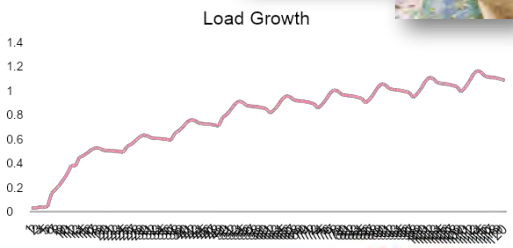
*based on a time-and-motion study conducted on similar installations

MERALCO

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

No provision for MV distribution system



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

MERALCO

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

Defective diesel generator in Cagbalete Island after only 4 years (~5,000 hrs) of operation

Solar panels installed in a house in Isla Verde now mounted on the roof using ropes only

MERALCO

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.

MERALCO

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.**

MERALCO

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

Safety. Science. Transformation.™

CLO23EV1271684

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.

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Regulatory frameworks & conformity assessment

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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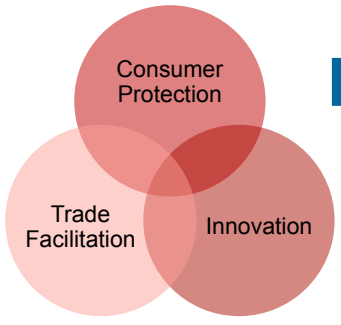
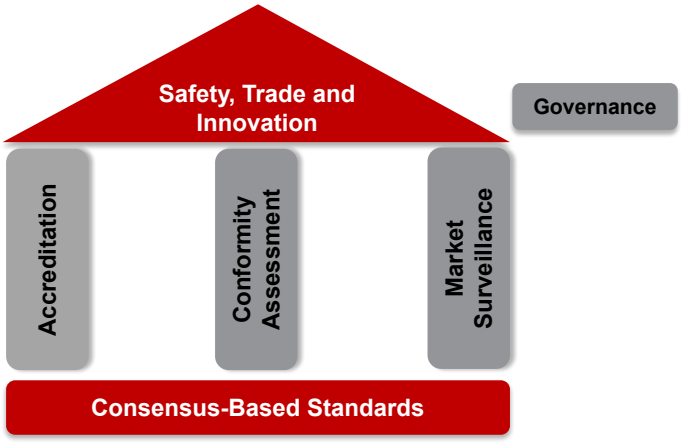
How do strong regulatory frameworks for conformity assessment operate?



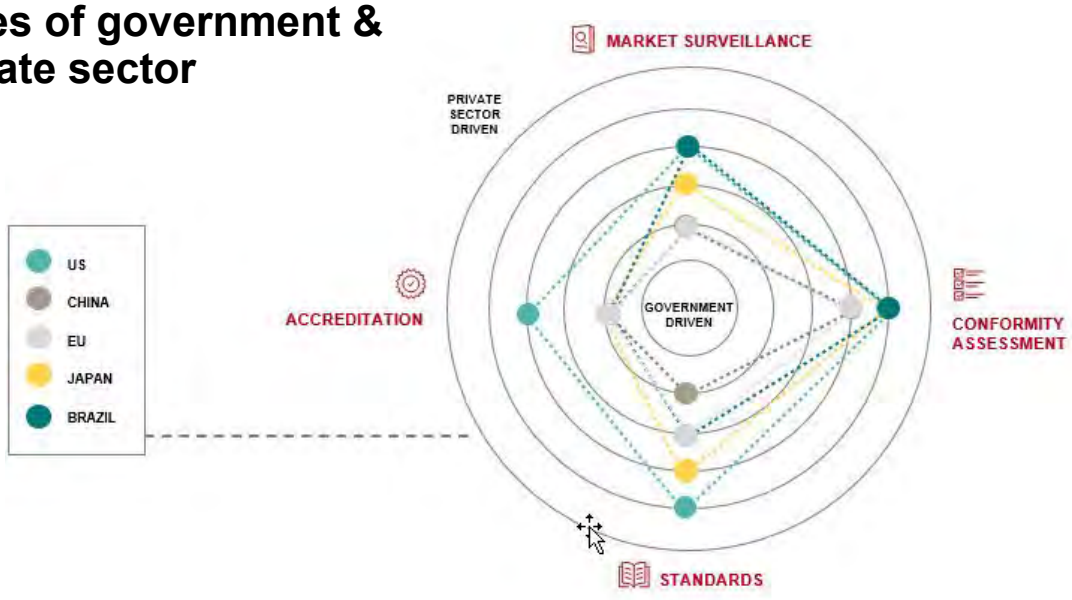
Objectives



Strong frameworks must balance regulator, manufacturer, and consumer interests

Roles of government and the private sector

Roles of government & private sector



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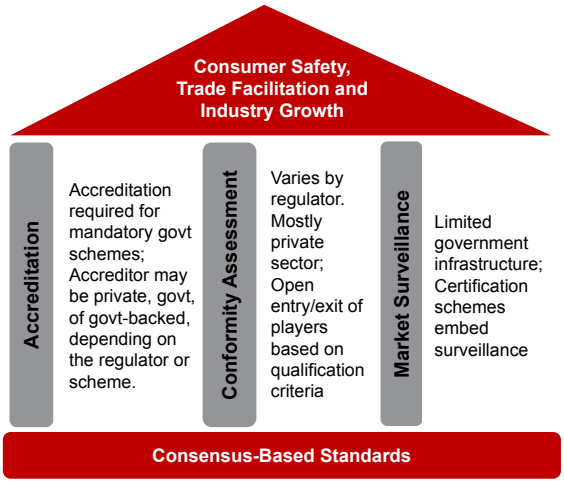
World tour: United States



- 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

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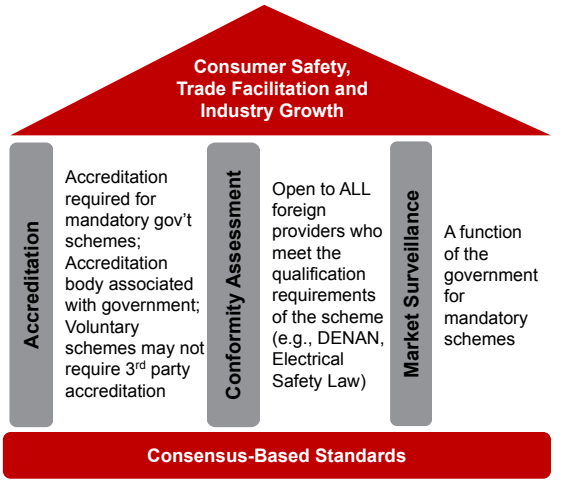
World tour: Japan



- 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

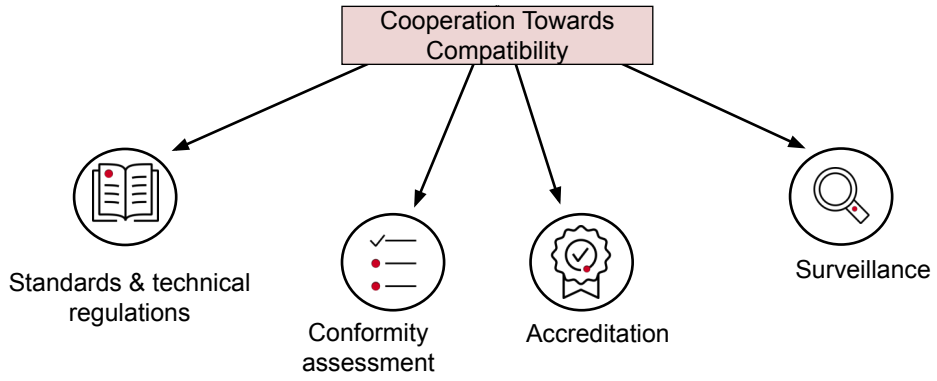
Uniqueness

- 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 compatibility

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.



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.[1]
- ***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."[2]

Solutions

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.

Solutions

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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Asia-Pacific Economic Cooperation

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF ENERGY

ENERGY UTILIZATION MANAGEMENT BUREAU

The 61st Meeting of APEC Expert Group on Energy Efficiency & Conservation and 59th Meeting of APEC Expert Group on New and Renewable Energy Technology

"Reinforcing Relevant Laws for a Comprehensive Approach to Energy Efficiency and Conservation, Renewable Energy, Electric Vehicle, and Sustainability in the APEC Region"

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

Objective 1	Improve Electric Utility Performance
Objective 2	Increasing Deployment of Advanced Energy Sources and Systems
Objective 3	Improve Electric Utility Performance

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


Energy Security and Resilience


Cybersecurity


Technology Innovations


Private Sector Engagement

Competition

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

Grants Under Contract Mechanism

Asia-Pacific Economic Cooperation

Relevant Regulatory Frameworks

Asia-Pacific Economic Cooperation

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

Asia-Pacific Economic Cooperation

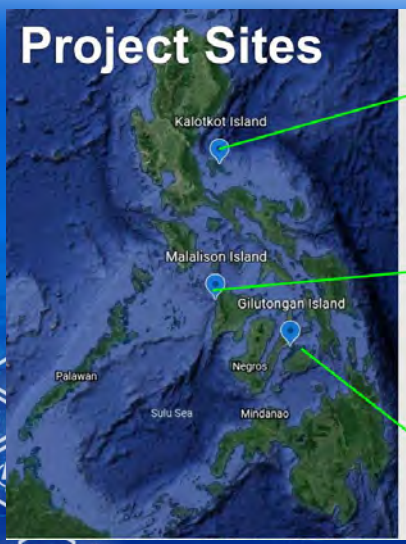
Project Overview

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.

Asia-Pacific Economic Cooperation

Project Sites



Calutcot Island, Quezon

- 2,235 people
- 432 households
- Fishing as the main livelihood

Gilutongan Island, Cebu

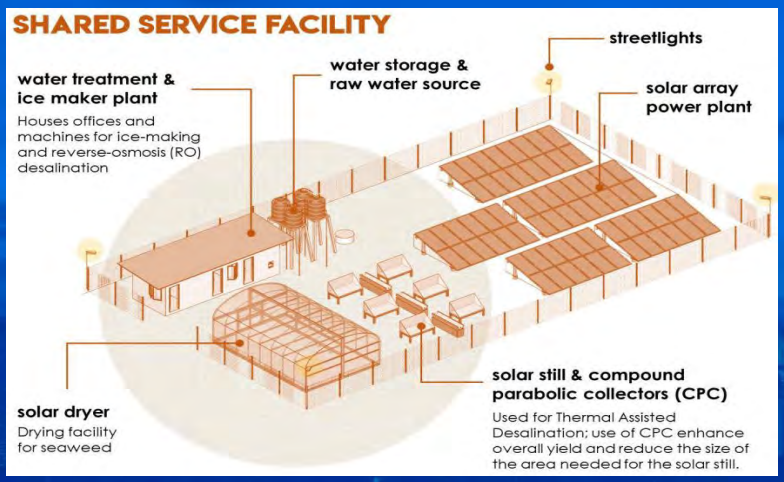
- 1,875 people
- 342 households
- Fishing as the main livelihood

Malalison Island, Antique (Reference Site)

- 800 people
- 200 households
- Fishing as the main livelihood

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



Source: One Renewable Energy Enterprises Inc.

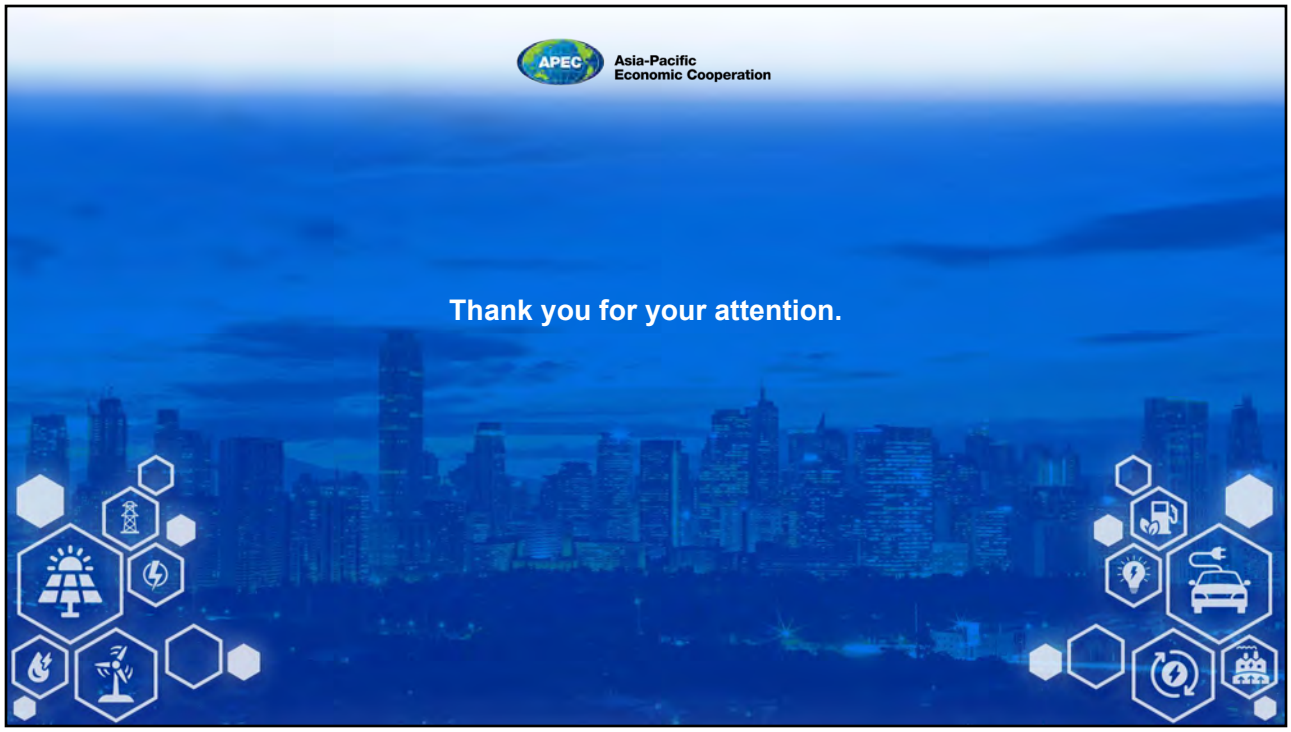
Source: One Renewable Energy Enterprise Inc.

Asia-Pacific Economic Cooperation

Challenges in Implementing Microgrid Projects

Asia-Pacific Economic Cooperation

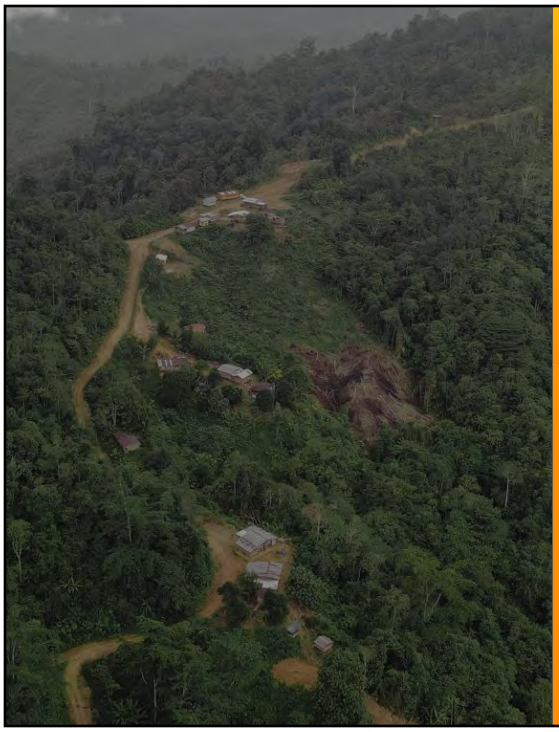
Opportunities and Recommendations


APEC
Asia-Pacific
Economic Cooperation
Thank you for your attention.

Low-carbon Pathway to Energy Access and Rural Economic Development

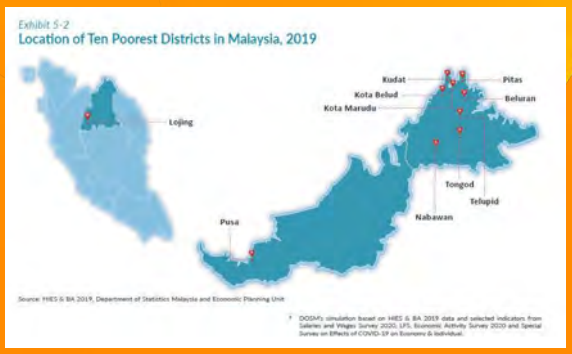
Sabah Renewable Energy Rural Electrification (RE2) Roadmap - a 10-year Action Plan for universal electrification in Sabah, Malaysia

July 2023



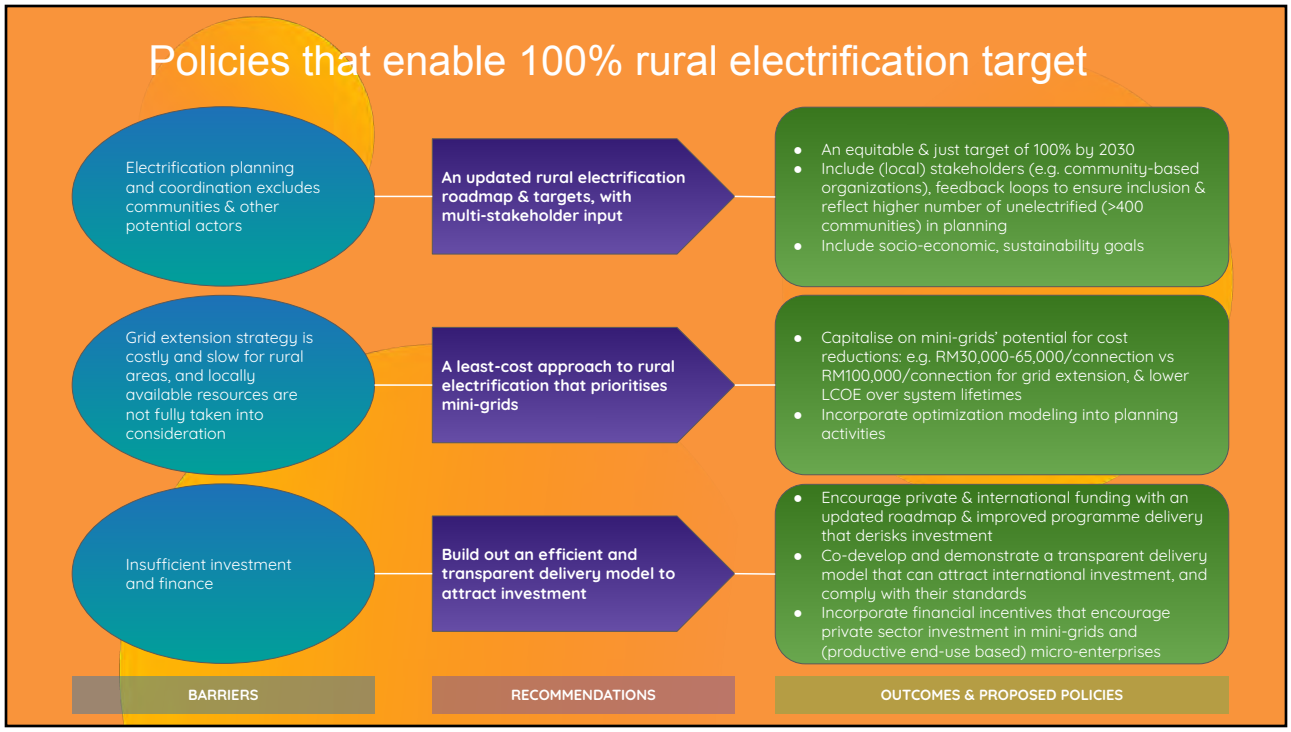
green empowerment
Village Solutions for Global Change since 1997

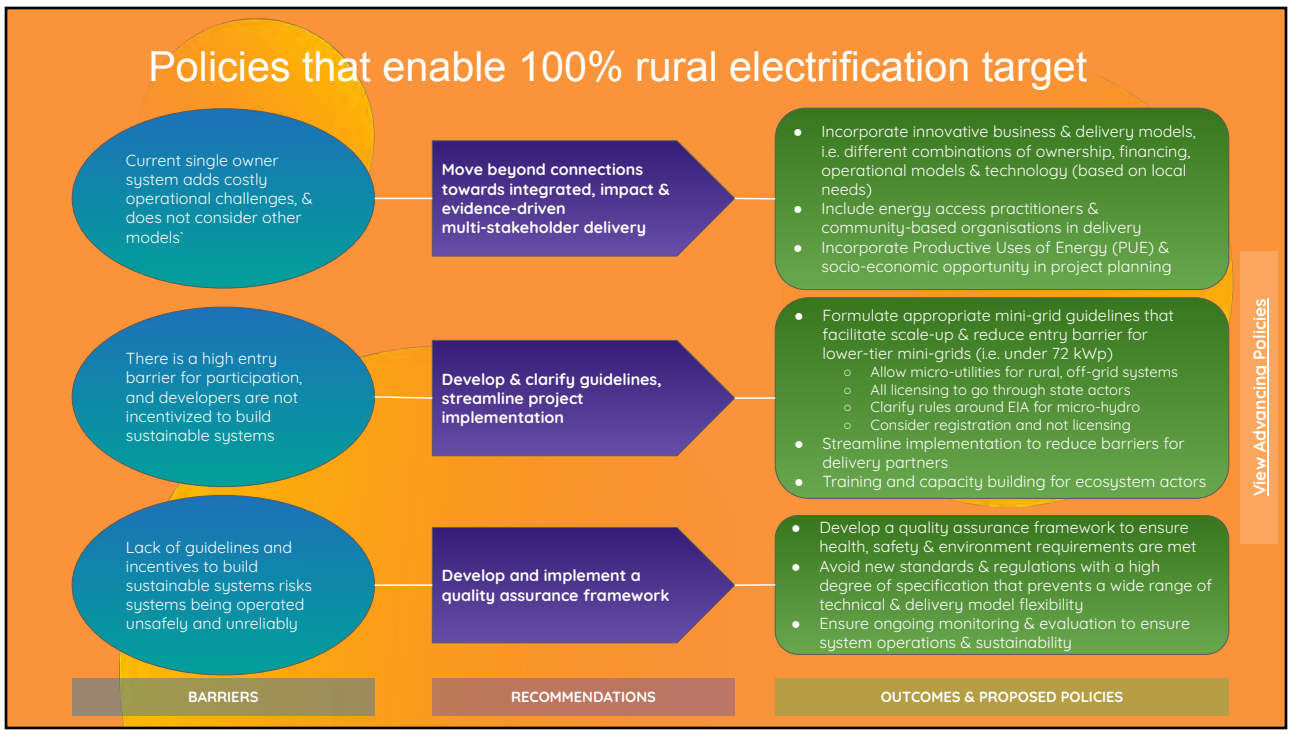
Sabah is home to 72% of unelectrified rural Malaysians, and 8 of 10 poorest districts in Malaysia (12 Malaysia Plan). Our demand map (heat map in previous slide) has identified these communities, and the roadmap creates the pathway to energy access for them.



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

	Prep stage	Phase 1: Pilot Stage	Phase 2: Pre-scale	Phase 3: Scale
	Year 1	Year 2 – 4	Year 5 - 7	Year 8 - 10
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
Electrification planning and coordination excludes communities & other potential actors
An updated rural electrification roadmap & targets, with multi-stakeholder input
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
Grid extension strategy is costly and slow for rural areas, and locally available resources are not fully taken into consideration
A least-cost approach to rural electrification that prioritises mini-grids
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
Insufficient investment and finance
Build out an efficient and transparent delivery model to attract investment
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
RECOMMENDATIONS
OUTCOMES & PROPOSED POLICIES


Policies that enable 100% rural electrification target
Current single owner system adds costly operational challenges, & does not consider other models`
Move beyond connections towards integrated, impact & evidence-driven multi-stakeholder delivery
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
There is a high entry barrier for participation, and developers are not incentivized to build sustainable systems
Develop & clarify guidelines, streamline project implementation
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
Lack of guidelines and incentives to build sustainable systems risks systems being operated unsafely and unreliably
Develop and implement a quality assurance framework
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
BARRIERS
RECOMMENDATIONS
OUTCOMES & PROPOSED POLICIES
View Advancing Policies

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

Quality Assurance Framework (QAF)

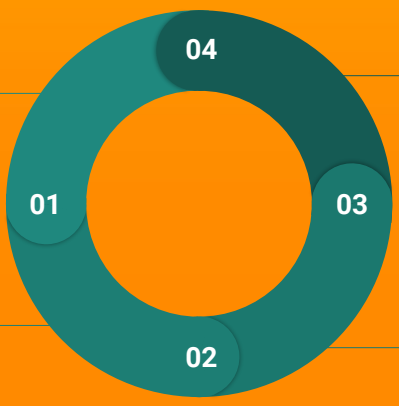
A **quality assurance framework** in place of (highly specific) standards to ensure HSE requirements are met, improve M&E, standardization, while complying with existing standards, rules & regulations

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 LoSs.

Matching technical standards

Based on consensus on LoS, match minimum standards to meet agreed upon LoS.



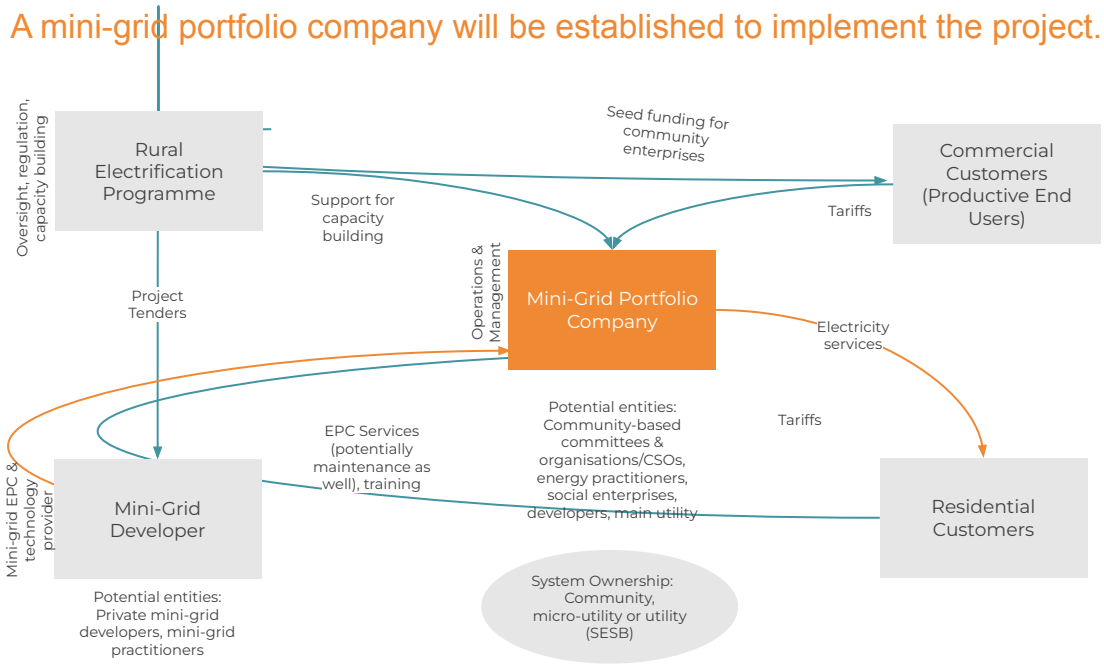
Iterating LoS and power reliability indicators

Review LoS based on pilot projects.

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.

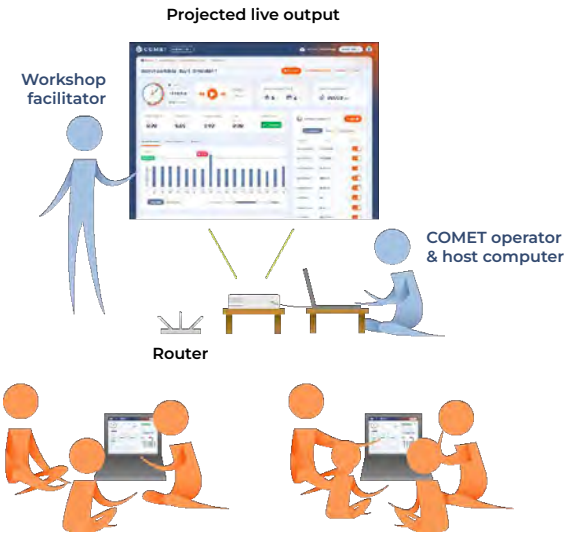
- BUILD CUSTOMER UNDERSTANDING
- VALIDATE COMMUNITY LOAD PROFILES
- ASSESS WILLINGNESS-TO-PAY & PROJECT RISK

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)


Tongod, Sabah (RE2 Consortium)


Mata Redi, Sumba (MENTARI/HIVOS)


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.

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.

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.

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.

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