

Smart Grid Transformation in the Power Distribution Sector (Re-tender) Philippines



Terms of Reference | Feb 9, 2024

This technical assistance (TA) instigates a holistic approach to smart grid transformation of the distribution sector and contributes to the deployment of renewable energy (RE) through embedded generation. The implementation of this TA includes identifying the key issues and proposing solutions to smart grid adoption for power distribution in the context of the Philippines Smart Grid Policy Framework. A financing framework will be presented with investment options that the Electric Cooperatives may consider for smart grid upgrading. Capacity-building activities are integrated accordingly to ensure the sustainability of the project outputs and that they can be replicated for future asset management. Ultimately, this TA will demonstrate smart grid transformation with increased RE adoption and enabling demand side management. This TA is aligned with ETP's third and fourth strategic outcomes: extending smart grids and building knowledge and awareness.

Table of Contents

I. Introduction	3
II. Summary	3
III. Project Details	3
A. Rationale	3
B. Impact	5
C. Outcomes and Outputs	5
IV. Project Deliverables	5
Deliverable 1: Inception Report	7
Deliverable 2: Smart Grid Capacity Building for NEA	9
Deliverable 3: Assessment Report on EC's Readiness for Smart Grid Adoption	9
Deliverable 4: Report on Financing the Distribution Smart Grid Investments	10
Deliverable 5: Investment Forums	11
Deliverable 6: Optimal RE System Design Report for 15 Electric Cooperatives and Capacity Building on RE-EGF	12
Deliverable 7: GIS Maps of the 15 Electric Cooperatives and Capacity Building	13
Deliverable 8: Monthly Progress Report	14
Details of Consultation Workshop Organization	14
Other key information:	14
V. Project Timeline	15
VI. Key Beneficiaries	16
VII. Results Based Monitoring Framework and Risks	16
A. Results Based Monitoring Framework	16
VIII. Qualification and experience of the service provider and evaluation criteria	17
A. Qualification and Experience of the Service Provider	17
D. Evaluation Criteria	18
Eligibility and Formal Criteria	18
Qualification Criteria	19
Technical Criteria	19
Section 1: Offeror's qualification, capacity and expertise	20
Section 2: Proposed Methodology, Approach and Implementation Plan	21
Section 3: Key personnel proposed and Sustainability Criteria	22
Annex 1. Donor map	26
Annex 2. Background information	27

I. Introduction

- 1 The Southeast Asia Energy Transition Partnership (ETP) brings together governments and philanthropies to work with partner countries in the region. ETP supports the transition towards modern energy systems that can simultaneously ensure economic growth, energy security, and environmental sustainability. To contribute to the achievement of the UN's Sustainable Development Goals (SDGs) and the Paris Climate Agreement objectives, ETP works in Southeast Asia, with a focus on three priority countries, namely Indonesia, the Philippines, and Vietnam. ETP's strategy is built around four interrelated pillars of strategic engagement that are squarely aligned to address the barriers to energy transition. These are (i) policy alignment with climate commitments, (ii) de-risking energy efficiency and renewable energy investments, (iii) extending smart grids, and (iv) expanding knowledge and awareness building.

II. Summary

- 2 This technical assistance (TA) focuses on the power distribution sector, specifically for the Electric Cooperatives (EC) through the National Electrification Administration (NEA). Currently, smart grid transformation is hampered by the unavailability of the Geographic Information System-based (GIS) distribution network map due to lack of capacity due to lack of resources. Furthermore, there is a lack of technical capability within NEA and the EC's to utilize the smart grid system for renewable energy (RE) system optimization. As such, this program has been designed to enable smart grid transformation (distribution network side) and demonstrate its applicability to increase RE in the power generation mix.
- 3 The proposed TA consists of three components. The first component focuses on enabling smart grid transformation in accordance with the Smart Distribution Utility Roadmap (SDUR) by conducting an assessment of the barriers to smart grid adoption by the EC's and developing the GIS-based map of the on-grid, backbone distribution network. Beyond the identification of the barriers, the assessment study will also present pragmatic solutions that the ECs and NEA may consider continuing with the smart grid transformation. The second component is designed to guide financing the smart grid investments and fulfilling the upgrades defined in the SDUR. The third component demonstrates the applicability of the GIS-based maps in allowing RE adoption through embedded generation. The provision of capacity building is also engrained accordingly in each of the project components. This TA is aligned with ETP's third and fourth strategic outcomes: extending smart grids and building knowledge and awareness.

III. Project Details

A. Rationale

- 4 The Philippine government envisions a smart grid system by 2040. In the Philippine Energy Plan (PEP) 2020-2040, the government affirmed its commitment to implement the Smart Grid Policy Framework as one of the strategies to achieve its sustainable energy agenda.
- 5 The National Smart Grid Policy Framework issued by the Department of Energy through Department Circular (DC) no. 2020-02-0003 institutionalizes the development and

- implementation of a smart grid in the Philippines. It provides an overall smart grid framework for the electric power industry covering generation, transmission, distribution, and market governance.
- 6 The Smart Grid Policy Framework defines a smart distribution utility as reliable, flexible, resilient, securely automated, and integrated with decentralized energy sources. It puts emphasis on the distribution sector's role in realizing a smart grid, and as such a leveling approach to upgrading was provided through the Smart Distribution Utility Roadmap (SDUR). It guides the distribution utilities of the network and metering infrastructure upgrades they need to implement to be able to become a smart grid by 2040. Annex 2 summarizes these requirements.
 - 7 In response to the Smart Grid Policy Framework and to help achieve the Philippines' sustainable energy goals,¹ NEA instituted the National Mapping Program for EC's, which NEA directs the ECs to transition to smart grids by developing the GIS-based maps of their distribution network and integrating Supervisory Control and Data Acquisition (SCADA) into their system.
 - 8 The development of the GIS-based distribution network map is a basic process but a critical first step in becoming a smart grid for distribution utilities. It will help them efficiently manage data for daily operations, asset management i.e. CAPEX planning and embedded RE generation, and disaster response. While NEA initiated the National Mapping Program and issued several Memorandum Circulars to institutionalize its implementation, only 25% of the EC's have developed their GIS distribution network map while only around 30% have proficiency in using the GIS tool.
 - 9 Beyond smart grid transformation, the use of GIS-based distribution network maps for asset management contributes to increasing RE in the power generation mix through embedded generation.² This enables a distribution utility to take part in power generation business within its franchise area by operating an embedded generation facility (EGF). However, this is regulated under the Implementing Rules and Regulations of NEA Reform Act of 2013³ since power generation is not the main mandate of a distribution utility. Should EC's engage in power generation, they must ensure that their operations will be more efficient while maintaining quality electricity services. At the demand side, the smart grid transformation process will enable distribution utilities to respond to differing signals, enhancing the distribution grid's efficiency.
 - 10 The Renewable Portfolio Standards (RPS)⁴ requires the EC's to source a portion of their energy supply from eligible RE facilities. In March 2022, the DOE adopted an increase in the annual

¹ The Clean Energy Scenario in the PEP 2020-2040 aims for 35% by 2030 and 50% by 2040 renewable energy in the power generation mix

² refers to power from generating units indirectly connected to the grid through the distribution system

³ Department of Energy. (2013). *DC 2013-07-0015 Prescribing the Implementing Rules and Regulations of Republic Act No. 10531*. DOE. Taguig.

⁴ Department of energy. (22 December 2017). *DC No. 2017-12-0015 Promulgating the Rules and Guidelines Governing the Establishment of the Renewable Portfolio Standards for On-Grid Areas*. DOE. Taguig.

incremental RE percentage from 1.00% to 2.52% to be able to meet the 35% by 2030 and 50% by 2040 clean energy scenario targets defined in the PEP 2020-2040.⁵

- 11 The development of RE embedded generation facilities (EGF) is one of the major plans of NEA to comply with RPS requirements and to address high electricity rates. Several guidelines have been developed to support NEA's plan such as the Guidelines on EC Investment⁶ and Advisory on EC's RE Project Investment with Private Sector Participation,⁷ while several others have been drafted⁸ subject to NEA Board approval. However, NEA and the ECs currently do not have the technical capability to implement an RE EGF project.

B. Impact

- 12 It is envisioned that the impacts of this technical assistance will enable a smart distribution system that is reliable, flexible, resilient, and securely automated for interoperability by 2040.

C. Outcomes and Outputs

- 13 The successful implementation of this project will facilitate the transformation to a smart distribution utility and contribute to the Philippines' clean energy goals. It will also improve the capacity and build the capability of NEA and the ECs for smart grid implementation. As such, the expected outcomes of this technical assistance are as follows:
 - a. Smart distribution utilities become Level 1 smart grid
 - b. Enable investments for smart grid implementation
 - c. Enhance the capacity of distribution energy administrators and electric cooperatives for smart grid implementation
- 14 The primary outputs of this project are
 - a. Assessment Report on EC's Readiness for Smart Grid Adoption
 - b. Report on Financing the Distribution Smart Grid Investment
 - c. Renewable Energy Embedded Generation Optimisation Reports of 15 ECs
 - d. Geographic information system map of the backbone distribution network of 15 ECs
 - e. Investment forums
 - f. Capacity building workshops for NEA and Electric cooperatives

IV. Project Deliverables

- 15 In line with the outputs and outcomes expected from this project (see Project Details), this section provides additional information on specific deliverables that will be required to accomplish the above project outputs.

⁵ Department of Energy. (16 March 2022). *Advisory on the Submission of 2022 RPS Reportorial Requirements*.

⁶ NEA. (2022). *NEA Memorandum no. 2022-12 Policy on EC Investment*. U.P. Law Center. Quezon City.

⁷ NEA. (2022). *NEA Memorandum no. 2022-51 Advisory on the Electric Cooperatives' Renewable Energy Project Investment with Private Sector Participation Consistent with its DDP, PSPP and RPS Compliance*.
<https://www.nea.gov.ph/ao39/issuances/memorandum-to-ecs/category/266-2022-memo>

⁸ Draft document on Implementing Guidelines for RE EGF and Guidelines for JV Agreements between ECs and Private Entities

16 Table 1 outlines the key deliverables that are expected in this project. Additional details on associated activities for each deliverable follow Table 1.

Table 1. Key deliverables

#	Deliverables	Target delivery and payment date	% Payment
1.	Inception Report	Month 1	15%
2.	Smart Grid Capacity Building for NEA	Month 4	10%
3.	Assessment Report on EC's Readiness for Smart Grid Adoption	Month 6	15%
4.	Report on Financing the Distribution Smart Grid Investments	Month 12	15%
5.	Conduct of Investment Forums	Month 14	5%
6.	Optimal RE System Design Report for 15 electric cooperatives and Capacity Building to the EC's	Month 17	20%
7.	GIS maps of the 15 electric cooperatives and Capacity Building to the ECs	Month 19	20%
8.	Contract Monitoring Monthly Progress Report: In addition to the listed deliverables, the consultant will need to provide monthly progress reports as per the provided template which will be shared during the project kick-off stage. Failure to submit this report may result in the payments being withheld.	Monthly	N/A

17 The project implementation framework is designed to be delivered based on three components:

18 **Component 1: Facilitating Smart Grid Transformation.** The first Component is focused on kickstarting the process towards the realization of a smart distribution utility vis-a-vis the National Smart Grid Policy. This is through the analysis of the SDUR and understanding the gaps and challenges by the ECs to its implementation and by initiating the Geographic Information System (GIS) map of the 15 EC's.⁹

19 **Component 2: Enabling Smart Grid Investments.** The second component conducts a study of the financing gaps and opportunities for smart grid investments. It leverages the outputs of

⁹ QUEZELCO I, AURELCO, ORMECO, PALECO, PANELCO I, PELCO III, ILECO II, SAMELCO I, SAMELCO II, NORECO I, BILECO, AKELCO, LEYECO V, DORECO, SIARELCO

Component 1 and ensures that related smart grid upgrades are sustained for the realization of the succeeding levels of the SDUR.

- 20 **Component 3: Accelerating Renewable Energy Deployment through Embedded Generation.** The third Component supports the accelerated deployment of renewable energy sources through embedded generation by leveraging the Components 1 and 2 results. This entails building the capability of NEA¹⁰ and priority ECs¹¹ in planning for an RE EGF through simulations and optimisations.
- 21 A **project technical working group (TWG)** shall be established to provide technical advice and support for the delivery of the project outputs and tasks, ensuring that key stakeholders are consulted in the process. The Consultant shall act as its Secretariat and shall assist NEA in convening the members. The TWG members shall be identified and agreed upon with the Technical Services Department, but the Consultant could recommend members whose roles will be beneficial to the distribution smart grid transformation and will remain neutral and practical. As the TWG Secretariat, the Consultant is responsible for arranging the meetings, documenting minutes and tracking action items, documentation as per Table 2, and coordinating with the TWG members. The Consultants will also collate and maintain all relevant documents, presentations, and other materials resulting from the TWG meetings. Ownership of all official documents must be transferred to the Technical Services Department at the end of the technical assistance.
- 22 The Consultant should plan to hold and prepare the logistics of five TWG meetings, initially set in months 2, 4, 7, 12, and 18 from project kick-off, covering the different phases of implementation of the project components. A post-TWG Report shall be submitted and reporting requirements can be found in the Details of Consultation Workshop Organization section.
 - a. The TWG meetings will be held at the NEA Conference Room located in Metro Manila¹² and will make available an online platform for the hybrid participation of the ECs
 - b. Hybrid, with live interpretation through Zoom or other software
 - c. Half-day meetings, inclusive of one coffee break and lunch¹³
 - d. At a minimum, 23 offline participants per meeting

Deliverable 1: Inception Report

- 23 The Consultant shall prepare the project inception report based on the agreed timeline of implementation and methodology, and any other agreements made during the kick-off meeting. As a deliverable, the Inception Report ensures that project expectations are aligned with the understanding of the Consultant. It shall contain, as a minimum:
 - a. Introduction and project background
 - b. Scope of services

¹⁰ Renewable Energy Development Division (REDD)

¹¹ QUEZELCO I, AURELCO, ORMECO, PALECO, PANELCO I, PELCO III, ILECO II, SAMELCO I, SAMELCO II, NORECO I, BILECO, AKELCO, LEYECO V, DORECO, SIARELCO

¹² These meetings shall not incur additional non-personnel costs.

¹³ Bidders shall propose non-personnel costs for the arrangement of lunch boxes for 23 pax for 5 meetings. These costs will be paid as a lumpsum with deliverables 1, 3, 4, 6 and 7.

- c. Methodology and Workplan, including approach, methodology, and project Gantt chart. The approach and methodology shall detail how each deliverable will be met and what each submission will contain with an Annotated Outline of the main deliverables
- d. Capacity building Plan, which details the workshop design for NEA and the 15 ECs on GIS mapping development and updating, and RE embedded generation simulations
- e. Stakeholder Analysis, which includes an audience mapping, analysis, and communication/ outreach plan
- f. A Donor Coordination Strategy, explaining how project outputs will leverage and complement ongoing and planned projects from other development partners¹⁴
- g. Project management inclusive of organizational chart detailing key personnel, their roles and responsibilities, as well as their locations (strong in-country team and project management is required), and project quality assurance
- h. Risk assessment, which includes the risks, mitigation actions, and assumptions
- i. Monitoring and Evaluation Framework, presented in the form of the ETP Results Based Monitoring Framework (RBMF)¹⁵
- j. Communications Plan, identifying the suitable media channels for communicating the project and the rationale for choosing them as described in Table 2.

24 The Consultant shall hold and organize the first TWG meeting after the project kick-off. For details of the TWG, refer to Paragraph 22.

Table 2. Minimum Requirements of the Communications Plan

Item	Communications materials	Quantity (minimum)
1	Social media posts (liaising with ETP)	1 per public workshop/ event
2	Opinion editorial article	2
3	Online presentations of project progress and highlights to the ETP Secretariat and/or ETP Funders	1 (1 hour maximum)
4	Maintain/develop a database of photographs/ videos/ vox pops from events/ activities	2 high-quality images per workshop/event Min. 2 high-quality short videos (raw footage) (2-3 mins) per workshop/event (ideally, key speeches and/or highlights reel)

¹⁴ development partners pertain to other UN agencies, Philippines' bilateral partners, multilateral development banks, non-government organisations

¹⁵ See Section VII

Deliverable 2: Smart Grid Capacity Building for NEA

- 25 The Consultant shall plan, organize, and deliver two capacity building workshops for NEA on the subjects of GIS map development and its use in smart grid asset management and RE embedded generation for an optimized system. The consultant shall prepare the logistics of the consultation workshops following the details below.¹⁶
- 26 The workshop on GIS will focus on the development, use, and updating of the GIS-based distribution network maps and how they contribute to the smart grid vision. The logistical arrangements are required as follows:
 - a. Three full-day workshops in a meeting venue/hotel (up to 4-star) located in Metro Manila, inclusive of two coffee breaks and lunch each day
 - b. 20 offline participants¹⁷
 - c. two nights of hotel accommodation for 20 pax
- 27 The workshop on RE embedded generation will focus on simulations to determine the optimal RE embedded system configuration based on the optimal mix and size of technologies that minimize the life cycle cost of energy over the defined analysis period. The analysis will also include determining the potential connection point of the RE EGF to the ECs distribution network.
 - a. Three full-day workshops in a meeting venue/hotel located in Metro Manila, inclusive of two coffee breaks and lunch each day
 - b. 15 offline participants
 - c. Two nights of hotel accommodation for 15 pax
- 28 A post-workshop report shall be submitted two weeks after the completion of the workshops, documenting the event. At the minimum, the following must be reported in the submission:
 - a. Agenda
 - b. Gender-disaggregated attendance sheets
 - c. Summary of discussions and agreements
 - d. Copy of the workshop materials
 - e. Final outputs of the workshop
 - f. Photo and video documentation as per Table 2

Deliverable 3: Assessment Report on EC's Readiness for Smart Grid Adoption

- 29 The Consultant shall conduct assessments of the barriers to smart grid transformation and develop pragmatic solutions to address these as part of Component 1. The assessment study aims to provide an understanding of the gaps and challenges encountered by the ECs in following the Smart Distribution Utility Roadmap (SDUR). As a result, the study will recommend pragmatic solutions that NEA and the ECs may consider to continue with the smart grid transformation following the development of the GIS maps and Investment Plan. Associated activities are outlined below.

¹⁶ Bidders shall provide a breakdown of all non-personnel costs associated with travel, workshop organization, hotel accommodation, etc. in the financial proposal. The payment for logistical arrangements will be released as a lumpsum together with deliverable 2 report.

¹⁷ Participants are primarily from NEA Engineering Department and REDD

- a. Conduct coordination meetings with the NEA Technical Services Department and ECs to gather inputs and understand the current environment. The meetings shall be held in the government beneficiary's premises, no additional logistical arrangement is required for these meetings.
 - b. Review related policies, institutional, and governance frameworks on smart grid adoption and implementation.
 - c. Analyze the barriers to smart grid adoption by the ECs in terms of policy and regulations, institutional frameworks and governance structures, technology, and finance. Within the context of the SDUR, assess the progress of the ECs, identifying which have implemented smart grids.
 - d. Provide recommendations of pragmatic solutions that NEA and the ECs may adopt to address the barriers identified, in alignment with the SDUR and in consideration of EC performance level; the recommendations should be aligned with the national strategy for smart grid deployment by ECs, required from NEA as per the National Smart Grid Policy (see Section 7.3.2 of DC 2020-02-0003).
 - e. Develop an Assessment Report that details the results of the study and hold a presentation meeting to NEA.
 - f. Conduct one half-day TWG meeting to gather inputs from and the guidance of the members. Refer to para 22.
- 30 The Consultant shall organize a presentation meeting for NEA (half-day meeting) to discuss the key findings of the assessment. The schedule is to be finalized with the NEA Office for Technical Services. The following arrangements are required:
- a. The Consultant shall hold the presentation meeting in the NEA Conference Room located in Metro Manila¹⁸
 - b. Hybrid modality to allow for both online/offline participation of ECs
 - c. Half-day meeting, inclusive of one coffee break and lunch¹⁹
 - d. At minimum, 15 offline participants
 - e. Post-workshop report

Deliverable 4: Report on Financing the Distribution Smart Grid Investments

- 31 Under component 2, this deliverable recommends financing and investment suitable for the ECs smart grid upgrading. These should be consistent with the SDUR and will consider the results of the Assessment Study, policies, and regulations that govern EC operations, GIS maps as an asset management tool, and EC performance. The associated studies shall also consider the nature of a cooperative's business model, as well as its organization under Presidential Decree 269, or as amended.
- 32 The Consultant shall determine the finance resource needed by the ECs to upgrade to a smart grid vis-a-vis the SDUR through integrated resource planning. It shall consider options such as organic funds, resilience funds, and other options (e.g. bonds), among others. This ensures that

¹⁸ This meeting shall not incur additional non-personnel costs for meeting venue.

¹⁹ The bidders shall propose costs for coffee break snacks and lunch during the half-day presentation meeting. This will be paid as a lumpsum together with deliverable 3.

sufficient and appropriate finance mechanisms are identified for the smart grid upgrades. When potential resources are identified, the Consultant is then expected to conduct analyses of the investment principles for the ECs for smart grid transformation in consideration of the SDUR and EC performance level, among others. An Investment Plan framework shall be developed as part of the report. It will detail investment options, the financing framework identified earlier, technology transfer mechanisms, associated risks, and implementation timeline. Refer to Section 7.3.1 of DOE DC 2020-02-0003 on NEA's provision of concessional loans for smart grid projects by the ECs. The key provisions of the Finance Report shall be presented to NEA and should be considered as part of the agenda of the Investment Forums.

- 33 A TWG meeting shall also be organized for the Component 2 activities and outputs, to provide guidance and strengthen the delivery of the outputs. Refer to para 22.
- 34 A presentation meeting to NEA shall be organized to discuss the key findings of the Financing Report. The schedule is to be finalized with the NEA Office for Technical Services.
 - a. The Consultant shall hold the presentation meeting in the NEA Conference Room located in Metro Manila²⁰
 - b. Hybrid modality to allow for both online/offline participation of ECs
 - c. Half-day meeting, inclusive of one coffee break and lunch²¹
 - d. At minimum, 15 offline participants
 - e. Post-workshop report

Deliverable 5: Investment Forums

- 35 The Consultant shall organize three Investment Forums, in collaboration with NEA to bring together ECs, technology providers, financing institutions, and development partners for opportunities for smart grid investments. It should be considered as an avenue to present the key provisions of Deliverable 4. The Investment Forums will showcase available resources and mechanisms for accessing financial and technological requirements for smart grid including RE embedded generation, bringing together key stakeholders.²²
- 36 Three Investment Forums shall be organized in collaboration with NEA. In planning for the Investment Forum, the Consultant shall work closely with the NEA Office for Technical Services and potential host EC to define the theme, develop the agenda, and identify potential venue, date, participants, and speakers/presenters. In designing the technical and financial proposals, the following must be considered:
 - a. A one-day event for each forum in a hotel venue (up to 4-star hotel) in Luzon, Visayas, and Mindanao, inclusive of two coffee breaks and lunch
 - b. An estimated total of 260 participants for all three events²³
 - c. Hotel accommodation for two nights for seven NEA representatives
 - d. Transportation for the Consultant
 - e. Post-forum report

²⁰ This meeting shall not incur additional non-personnel costs for meeting venue.

²¹ The bidders shall propose costs for coffee break snacks and lunch during the half-day presentation meeting. This will be paid as a lumpsum together with deliverable 4.

²² Bidders shall propose non-personnel costs for the arrangement of the three investment forums including travels, hotel accommodation, etc. Deliverable 5 will be paid as a lumpsum after the completion of all three forums and submission of post-forum report.

²³ An estimated number of participants will be 124pax for Luzon and 68pax for Visayas and Mindanao, totaling 260pax.

Deliverable 6: Optimal RE System Design Report for 15 Electric Cooperatives and Capacity

Building on RE-EGF

- 37 This deliverable covered under Component 3 primarily aims for the deployment of renewable energy embedded generation. It builds upon the results of Deliverables 2, 3, and 6 (of Components 1 and 2). Using the geodata established from Component 1, the Consultant will use these in the RE EGF optimization simulations and ensure that NEA and the 15 ECs²⁴ are capacitated on this subject. Specifically, the Consultant shall:
- a. Coordinate with NEA REDD on all RE EGF activities.
 - b. Conduct a simulation of possible combinations of viable embedded RE systems that will meet the electricity demand of 15 ECs. This shall ensure that a combination of energy purchases, energy generation, and energy storage meets load demand at each time step (interval). The simulation tool shall be reliable and usable within NEA's capacity.
 - c. Determine the optimal RE embedded system configuration based on the optimal mix and size of technologies that minimize the life cycle cost of energy over the defined analysis period. The analysis will also include determining the potential connection point of the RE EGF to the ECs distribution network.
 - d. The GIS map developed in Component 1 would be an important input to the simulation. The results will determine optimal RE system configurations and their potential connection point within the distribution system that has the least life cycle cost of energy over a defined analysis period and will meet the electricity demand. The Consultant should also consider demand-side management of the ECs. With the information, the ECs may then refer to the Finance Report developed in Component 2 to determine the best financing mechanism for implementing their RE EGF. The simulation shall be done in collaboration with NEA-REDD and the selected ECs to ensure capability building, allowing them to replicate it in future CAPEX planning.
- 38 A TWG meeting shall also be organized to provide guidance and strengthen the delivery of the outputs. Refer to para 22.
- 39 The expected output is the corresponding RE EGF Optimization Reports of the 15 ECs. Simulation and analysis shall be done in collaboration with NEA REDD and the 15 ECs²⁵ to enhance capability building.
- 40 A two-day workshop for each of the 15 ECs shall be planned, organized, and delivered. There will be a total of 15 workshops to be organized on RE EGF as there are 15 selected EC beneficiaries. There should be at least five participants from each EC, totaling 75 participants from the 15 ECs. Each of the workshops is estimated to be carried out in two full days. At the minimum, it shall cover simulations, optimization, and results assessment. The workshop requirements are provided below. The requirements for each workshop are as follows:

²⁴ QUEZELCO I, AURELCO, ORMECO, PALECO, PANELCO I, PELCO III, ILECO II, SAMELCO I, SAMELCO II, NORECO I, BILECO, AKELCO, LEYECO V, DORECO, SIARELCO

²⁵ QUEZELCO I, AURELCO, ORMECO, PALECO, PANELCO I, PELCO III, ILECO II, SAMELCO I, SAMELCO II, NORECO I, BILECO, AKELCO, LEYECO V, DORECO, SIARELCO

- a. In-house capacity-building workshops shall be held at the EC conference/meeting room²⁶
- b. Two full-day meetings, inclusive of two coffee breaks and lunch per day²⁷
- c. At a minimum, five in-person participants from each EC per workshop
- d. Post-workshop report, requirements can be found in Details of Consultation Workshop Organization section

Deliverable 7: GIS Maps of the 15 Electric Cooperatives and Capacity Building

41 One of the first steps in becoming a smart distribution utility is establishing the GIS-based network map of a distribution utility. In doing this, the Consultant shall work closely with NEA Engineering Department to establish communication with the selected ECs subject to the GIS mapping assistance. The scope of this project is for 15 pre-selected ECs.²⁸ The associated tasks include the following:

- a. Conduct data collection in close collaboration with the 15 ECs
- b. Conduct a TWG meeting to gather inputs from and the guidance of the members. Refer to para 22.
- c. Create the geodatabase and GIS maps of the ECs grid-connected, backbone distribution network, which shall include the following at the minimum:
 - i. Sub-transmission data (covering only MV line)
 - ii. Distribution substation data
 - iii. Primary line and Pole data
 - iv. Protective devices and other equipment (AVR and Capacitor data)
- d. Conduct QA/ QC for the process

42 The expected output is the GIS map of each EC and corresponding knowledge materials to be referenced for future updating. It must officially be submitted to the ECs, and to NEA Engineering for information, and the Consultant shall ensure that these are all working in their system. As such, the GIS software to be used shall be usable in reliable and open-access software.

43 A three-day workshop for each of the 15 ECs shall be planned, organized, and delivered by the Consultant. This means that there will be a total of 15 workshops to be organized on GIS as there are 15 selected EC beneficiaries. There should be at least five participants from each EC, totaling 75 participants from the 15 ECs. Each of the workshops is estimated to be carried out in three full days. It shall cover the development, use, and updating of the GIS-based distribution network maps in the context of smart grid. The workshop requirements are provided below.

- a. The workshop will be held at the EC conference/ meeting room and shall provide the necessary resources for effective delivery and knowledge transfer.²⁹

²⁶ These meetings shall not incur additional non-personnel costs for the meeting venue.

²⁷ Bidders shall propose non-personnel costs for the arrangement of coffee breaks and lunches for 5 pax for 15 meetings. The cost will be paid as a lumpsum together with Deliverable 6.

²⁸ QUEZELCO I, AURELCO, ORMECO, PALECO, PANELCO I, PELCO III, ILECO II, SAMELCO I, SAMELCO II, NORECO I, BILECO, AKELCO, LEYECO V, DORECO, SIARELCO

²⁹ These meetings shall not incur additional non-personnel costs.

- b. Three full-day meetings, inclusive of two coffee breaks and lunch per day³⁰
- c. At a minimum, five in-person participants from each EC per workshop
- d. Post-workshop report, requirements can be found in Details of Consultation Workshop Organization section

Deliverable 8: Monthly Progress Report

- 44 In addition to the listed project outputs, the Consultant/ lead Firm shall submit monthly progress reports using the provided template. This will be shared during the project kick-off stage.

Details of Consultation Workshop Organization

- 45 The consultant is expected to handle all tasks related to the workshop including organizing the logistics, inviting participants and speakers, booking the venue, and executing the actual workshop, and documenting the event. Bidders shall provide a breakdown of all non-personnel costs in the financial proposal. The payment for logistical arrangements for the TWG and presentation meetings, Investment Forums, and workshops will be released as a lumpsum together with Deliverables 2 - 7.
- 46 The detailed agenda needs to be discussed with ETP prior to the workshops. Gender and social inclusion considerations have to be taken into consideration. All key stakeholders related to the topic, particularly governmental entities, should be engaged. Journalists should be invited to disseminate the findings of the workshop, if deemed necessary and subject to the beneficiary's approval.
- 47 The Consultant is required to submit a post-workshop report as part of the deliverables that includes the following components:
- i. Description of the workshop (e.g., background, objective, organisation)
 - ii. Workshop agenda and participant components
 - iii. Workshop proceedings (e.g., summary of presentations, key points raised, important insights, significant outcomes or decisions)
 - iv. Gender considerations
 - v. Stakeholder engagement
 - vi. Monitoring and implementation
 - vii. Media and communication
 - viii. Conclusion and next steps

Other key information:

- 48 A public-facing, publishable Executive Summary (maximum 4 pages) in professional English must be submitted with each deliverable, except for the GIS maps, Workshop Reports, and Activity Reports.

³⁰ The bidders shall propose costs for coffee break snacks and lunch for the 15 three-day workshops. This will be paid as a lumpsum together with deliverable 7.

- 49 A public-facing, PowerPoint presentation highlighting key information must be submitted with each deliverable, except for the Workshop and Activity Reports.
- 50 All project deliverables and presentations must be submitted in English.
- 51 All deliverables are subject to review by ETP, and beneficiary entity(ies) where applicable, before approval. If there are comments and suggestions, the deliverables need to be revised accordingly before payment is released.
- 52 The Consultant is required to update the results and achievements of the project in accordance with the agreed project-level Results-Based Monitoring Framework (RBMF), as per the approved template. All results, where applicable, must be gender disaggregated.
- 53 The Consultant is required to organize and execute all aspects of knowledge management events, including organization and logistics.
- 54 The Consultant must consider and highlight specific gender considerations in their proposal.
- 55 The Consultant must be available to attend one (1) in-person workshop with the ETP secretariat in the region. The costs for this will be covered outside the financial scope of this proposal.
- 56 The Consultant, or an active organization within the applying consortium, shall have an in-country, local partner fully operating in the Philippines through the project timeline.

V. Project Timeline

- 57 The project will require 19 months. The actual project timeline will be presented by the Consultant and agreed upon in the Inception Report.

Table 3. Proposed timeline of the project's deliverables

Deliverables	Indicative timeline of implementation
Inception phase	Month 1
Technical working group meetings	Months 2, 4, 7, 12, 18
Assessment of EC's Readiness for Smart Grid Implementation in the Distribution Sector and presentation meeting to NEA	Months 2 to 6
GIS mapping for 15 electric cooperatives and delivery of related capacity building	Months 2 to 19
Smart Grid Capacity building for NEA	Month 4
Developing the report on Financing the Distribution Smart Grid Investments and presentation meeting to NEA	Months 7 to 12

Deliverables	Indicative timeline of implementation
Conduct of three Investment Forums	Month 14
Simulations for RE Embedded Generation, delivery of related capacity building, and development of the RE Optimization Reports	Months 15 to 17

VI. Key Beneficiaries

58 The key beneficiaries of this project are provided in Table 4.

Table 4. List of beneficiaries of this project

Beneficiary	Benefit	Explanation
National Electrification Administration	Direct	NEA's main mandate is to pursue rural electrification by empowering the electric cooperatives with the changes in the Philippines electric power industry brought by the Electric Power Industry Reform Act of 2001. As the main government body with responsibility over the electric cooperatives, capacitating the NEA on smart grids will ensure the sustainability of the project outputs.
Electric Cooperatives	Direct	The electric cooperatives, together with other distribution utilities, are responsible in implementing the smart grid provisions in the Smart Grid Policy Framework. Capacitating and assisting them on smart grid implementation will help the Philippines pursue a low carbon (RE and EE implementation) development pathway for the power sector.

VII. Results Based Monitoring Framework and Risks

A. Results Based Monitoring Framework

59 The Results of the Project are monitored through the following Framework in Table 5. All reports will update the achievement of the indicators.

Table 5. Results Based Monitoring Framework Outline

INDICATORS	TARGETS
IN 3.1-01 - No. of technical recommendations and solutions implemented by the grid operators for planning and operation, leading to smart grid	1 report on Assessment of EC's Readiness for Smart Grid Adoption
IN 3.1-02 - No. of technical design, demo, modelling projects supported for smart infrastructure	<ul style="list-style-type: none"> • ≤ 15 GIS maps part of the backbone distribution network • ≤ 15 Renewable Energy Embedded Generation Optimisation Reports
IN 4.1-01 –No. of studies, research, new evidence gathered and published, for raising awareness, improving knowledge base, driving decisions, and dissemination	1 report on Financing the Distribution Smart Grid Investments
IN 4.1-02 - No. of trainings, knowledge sharing events, and/or awareness workshops organised at national and regional levels building institutional capacity and knowledge networks	<ul style="list-style-type: none"> • At least 3 Investment forums • At least 4 capacity building workshops on GIS mapping and RE embedded generation optimisation
IN 4.1-02A - Total no. of attendees	<ul style="list-style-type: none"> • At least 260 attendees to the Investment Forums • At least 5 participants from each electric cooperative and NEA in each capacity building workshop, totaling 75 participants
N 4.1-02B - Total no. of female attendees	At least 40% female participants in each knowledge raising and awareness event
IN 4.1-03 - No. of articles, press-releases on social-media, and mass-media, for outreach	At least 2 articles in ETP website and/or reputable online platforms
IN 4.1-04 - Total no. of entities supported through Technical Assistance	<ul style="list-style-type: none"> • NEA - Technical Services Department • 15 electric cooperatives

60 The results are reported with additional supporting information and evidence where applicable and necessary.

VIII. Qualification and experience of the service provider and evaluation criteria

A. Qualification and Experience of the Service Provider

61 The consultant's project team should demonstrate the capacity to execute the works and should include all essential roles filled with personnel with relevant experience. CV's of the personnel proposed should be used to verify this information.

62 The following are the **minimum positions** that should be included on the team. Bidders should make an assessment of the additional positions needed (if any) to complete the assignment as per the Terms of Reference:

- a. Project Team Lead
- b. Smart Grid Expert
- c. Renewable Energy Expert
- d. Geospatial Specialist
- e. Energy Finance Expert
- f. Knowledge Management Specialist (should be based in the Philippines)

63 Additional positions such as the ones suggested below, may be proposed to effectively implement and execute the work plan. The additional experts must have at least a first-level university degree (Bachelor's degree or equivalent) and experience in relevant subjects.

- a. Technical Coordinator
- b. Surveyor

B. Considering the importance of close coordination with stakeholders in the PHILIPPINES, it is expected that the team proposed consists of consultant(s) who understand the local context in the PHILIPPINES.

C. The bidder should also assign a Contract Manager who would liaise on the non-technical part of the contract implementation, including coordination, liaising with key counterparts, liaising with UNOPS on the submission of invoice and payment-related documents.

D. Evaluation Criteria

Eligibility and Formal Criteria

E. The *criteria contained in the table below will be evaluated on **Pass/Fail** basis and checked during Preliminary Examination of the proposals.*

Criteria	Documents to establish compliance with the criteria
1. Offeror is eligible as defined in Instructions to Offerors, Article 4. In case of JV, all JV members should fulfill this requirement	<ul style="list-style-type: none"> Form A: Joint Venture Partner Information Form, all documents as required in the Form, in the event that the Proposal is submitted by a Joint Venture. Form B: Proposal Submission Form
2. Completeness of the Proposal. All required Questionnaires (if any), Returnable Bidding Forms, and other documentation requested	<ul style="list-style-type: none"> All documentation as requested under Instructions to Offerors Article 10, Documents Comprising the Proposals

Criteria	Documents to establish compliance with the criteria
under the Document Checklist section have been provided and are complete	
3. Offeror accepts UNOPS General Conditions of Contract as specified in Section IV: Contract Forms	<ul style="list-style-type: none"> Form B: Proposal Submission Form

Qualification Criteria

F. The criteria contained in table below will be evaluated on Pass/Fail basis and checked during Qualification Evaluation of the proposals.

Criteria	Documents to establish compliance with the criteria
<p>1. The company should have a minimum of FIVE (05) years of continuous experience in delivering similar projects in the past with a track record of success.</p> <p>In the case of JV, at least one of the JV members should fulfill this criteria</p>	<ul style="list-style-type: none"> Certification of incorporation of the Offeror Form F: Performance Statement Form
<p>2. Offeror must provide a minimum of two (02) customer references from which similar services have been successfully provided, within any of the last FIVE (05) years.</p> <p>In the case of JV, the customer references of JV members can be combined</p>	<ul style="list-style-type: none"> Form F: Performance Statement Form
<p>3. Financial Capacity/financial stability: Bidder should have minimum annual turnover of 400,000 USD in any of the past two (02) years.</p> <p>In the case of a joint venture, annual turnover is calculated based on the total annual turnover of the JV members.</p>	

Technical Criteria

G. Technical evaluation will be carried out to bids that pass the eligibility, formal and the qualification criteria, with requirements as follows:

- a. The maximum number of points that a bidder may obtain for the Technical proposal is 80. To be technically compliant, Bidders must obtain a minimum of 56 points
- b. Minimum pass score: 70% of maximum 80 points = 56 points

H. Technical proposal points allocation

Section number/description		Points Obtainable
1.	Offeror's qualification, capacity, and expertise	20
2.	Proposed Methodology, Approach, and Implementation Plan	32
3.	Key Personnel proposed and Sustainability Criteria	28
Total Technical Proposal Points		80

Section 1: Offeror's qualification, capacity and expertise

Section 1: Offeror's qualification, capacity and expertise		Points	Sub-points
1.1	Brief description of the organization, including the year and country of incorporation, and types of activities undertaken, including relevance of specialized knowledge and experience on similar engagements done in the past.	15	
	Bidders partnering up with Philippines-based entities and/or including a team of local experts to provide strategic consultation, coordination, and efficient implementation of activities is required.		
	1. Experience in projects of comparable size, type, complexity and technical specialty		6
	2. Experience in providing similar services in the region, especially in the Philippines		3
	3. Understanding of local context, and partnering up with a Philippines-based entity or including a team of local experts to provide for strategic consultations and coordination, and efficient implementation of activities.		6
1.2	General organizational capability which is likely to affect implementation: management structure, and project management controls.	5	

Section 1: Offeror's qualification, capacity and expertise		Points	Sub-points
	1. Management structure, management controls, and extent to which any part would be subcontracted		5
Total points for section		20	

Section 2: Proposed Methodology, Approach and Implementation Plan

Section 2: Proposed Methodology, Approach and Implementation Plan		Points	Sub-points
2.1	Description of the Offeror's approach including risk(s) and mitigation measure(s), and methodology for meeting or exceeding the requirements of the Terms of Reference	22	
	1. Description of the Offeror's approach to conducting the assessment study of EC's readiness for smart grid adoption		4
	2. Description of the offerer's localized approach to the identification of data sources, scenarios, issues, and data collection process in building and establishing the GIS maps of the electric cooperatives.		4
	3. Description of the Offeror's approach to developing the GIS-based distribution network map and capacity building.		4
	4. Description of the Offeror's approach to designing a financing roadmap and investment planning for smart grid upgrading		4
	5. Description of the Offeror's approach to delivering the renewable energy embedded generation report and capacity building activities		6
2.2	Quality Assurance Plan	5	
	A plan outlining how the bidder intends to ensure oversight and quality assurance throughout the assignment. Quality Assurance plan should include discussion on risk-assessment and its mitigation plan		5
2.3	Implementation Timeline	5	

Section 2: Proposed Methodology, Approach and Implementation Plan		Points	Sub-points
	Bidder submits a detailed implementation timeline which includes detailed activities to be undertaken during this assignment, and is completed with Gantt chart		5
Total points for section		32	

Section 3: Key personnel proposed and Sustainability Criteria

Section 3: Key personnel proposed and Sustainability Criteria		Points	sub-points
3.1	Qualifications of key personnel proposed aligned with the Terms of Reference	23	
	<p>Team Lead</p> <p>Education: Advanced university degree (Master's degree or equivalent) in Engineering, Energy, Management, Economics, Environment, Development Policies or related fields.</p> <p>First-level university degree (Bachelor's degree or equivalent) with 2 years of professional experience in related fields is considered equivalent.</p> <p>Experience:</p> <ul style="list-style-type: none"> A minimum of 7 years experience in implementing projects related to power distribution systems, smart grids, or renewable energy where 3 years is of experience in leading a project team is required Previous experience working in the Philippines energy sector is required Experience in engagement with electric cooperatives and/or National Electrification Administration, Department of Energy, and other relevant energy agencies in the Philippines is required Computer literacy in Google Suites and/or Microsoft packages (MS Word, MS Excel, MS Access, MS PowerPoint) is required Language proficiency in English is required 	4.5	Education: 1.0 Experience: 3.5
	<p>Smart Grid Expert</p> <p>Education: Advanced university degree (Master's degree or equivalent) degree in Engineering or relevant subject.</p>	4	Education: 1.0 Experience: 3.0

Section 3: Key personnel proposed and Sustainability Criteria		Points	sub-points
	<p>First-level university degree (Bachelor's degree or equivalent) with 2 years of professional experience in power distribution networks and smart grid systems is considered equivalent.</p> <p>Experience:</p> <ul style="list-style-type: none"> • A minimum of 5 years experience is required • Experience in providing analysis and designing power distribution systems and smart grid is required • Previous experience working in the Philippines energy sector is preferred • Experience in engagement with distribution utilities or electric cooperatives and/or National Electrification Administration and other relevant energy agencies in the Philippines is preferred 		
	<p><u>Renewable Energy Expert</u></p> <p>Education: Advanced university degree (Master's degree or equivalent) in Engineering, Energy, Environment, or related subject.</p> <p>First-level university degree (Bachelor's degree or equivalent) with 2 years of experience in renewable energy and distributed energy generation is considered equivalent.</p> <p>Experience:</p> <ul style="list-style-type: none"> • A minimum of 5 years experience is required • Experience in renewable energy project development for distributed energy generation is required • Experience in implementing renewable energy project/s in the Philippines power sector is required • Professional experience working with distribution utilities in the Philippines is preferred 	4	<p>Education: 1.0</p> <p>Experience: 3.0</p>
	<p><u>Geospatial (GIS) Specialist</u></p> <p>Education: Advanced university degree (Master's degree or equivalent) in Engineering, Physics, Environmental Management, or relevant subject.</p> <p>First-level university degree (Bachelor's degree or equivalent) in Engineering, Physics, Environmental Management, or relevant subject plus 2 years of</p>	4	<p>Education: 1.0</p> <p>Experience: 3.0</p>

Section 3: Key personnel proposed and Sustainability Criteria		Points	sub-points
	<p>professional experience in related fields is considered equivalent.</p> <p>Experience:</p> <ul style="list-style-type: none"> • A minimum of 5 years experience is required • Professional work experience with GIS software suite and common extensions i.e. QGIS or other comparable GIS tools is required • Experience in implementing energy, environmental, or climate change projects on the application of geospatial data analysis and management is required 		
	<p><u>Energy Finance Expert</u></p> <p>Education: Advanced university degree (Master's degree or equivalent) in Finance, Economics, Business, Engineering, relevant subject in finance.</p> <p>First-level university degree (Bachelor's degree or equivalent) in Finance, Economics, Business, Engineering, relevant subject in finance plus 2 years of related professional experience is considered equivalent.</p> <p>Professional certifications such as Chartered Financial Analyst (CFA) or Certified Public Accountant (CPA) are considered an asset.</p> <p>Experience:</p> <ul style="list-style-type: none"> • A minimum of 5 years experience is required • Experience in financial analysis of energy projects, covering identifying and developing finance frameworks and investment schemes, is required • Previous experience with a project on the Philippines' energy sector is preferred 	4	<p>Education: 1.0</p> <p>Experience: 3.0</p>
	<p><u>Knowledge Management Specialist</u></p> <p>Education: First-level university degree (Bachelor's degree or equivalent) in Social Sciences, Communication, Environment, Climate Change, or relevant subject.</p> <p>Experience:</p> <ul style="list-style-type: none"> • A minimum of 5 years of professional experience is required • Experience in leading and managing capacity-building sessions and stakeholder engagement activities is required 	2.5	<p>Education: 1.0</p> <p>Experience: 1.5</p>

Section 3: Key personnel proposed and Sustainability Criteria		Points	sub-points
	<ul style="list-style-type: none"> Experience in working with the Philippines' distribution sector, particularly with the electric cooperatives is required <p>Other requirement:</p> <ul style="list-style-type: none"> Must be based on the Philippines 		
3.2	The bidder shall demonstrate its organization's commitment to mainstreaming gender equality and social inclusion and provide a practical plan for implementing gender mainstreaming (and/or social inclusion) activities during the execution of the contract.	5	
Total points for section		28	

Annex 1. Donor map

Name of Organization	Topic and Detailed Activity
USAID Energy Secure Philippines (ESP)	<p>The ESP is a flagship project of USAID to support a more competitive, secure, and resilient Philippine energy sector. In its five-year implementation, which started in 2021, it will work with the Philippine government and private sector partners to improve the performance and efficiency of energy utilities, deploy renewable energy systems, enhance competition in the power sector, and address energy sector cybersecurity. ESP will mobilize more than USD 740 million in private sector investment and help develop at least 500 megawatts of clean energy generation capacity.</p> <p>Most recently, USAID provided GIS-mapping support for SOCOTECO II's distribution network. In ETP's selection of beneficiary ECs, it will consider ECs that do not have a GIS map yet but with the capacity and commitment to become a Level 1 smart grid.</p>
GIZ Clean, Affordable and Secure Energy for Southeast Asia (CASE)	<p>CASE supports an energy transition with ambitious climate goals in the Southeast Asian region. This Project is developing evidence-based solutions and building societal support to address the challenges faced by decision-makers. CASE is also supporting coordination in the region's power sector by providing technical and policy support and facilitating dialogue concerning energy issues. It has developed a knowledge platform and is also participating in the regional specialist dialogue as part of the ETP.</p>

Annex 2. Background information

- 1 The government of the Philippines recognizes the need to transform the power grid into a smart grid system. This has been institutionalized through the National Smart Grid Policy Framework.³¹
- 2 The National Smart Grid Policy Framework defines a smart distribution utility as reliable, flexible, resilient, securely automated, and integrated with decentralized energy sources. With an emphasis on the distribution sector, the Smart Distribution Utility Roadmap (SDUR) was developed. It provides guidance to the distribution utilities of the network and metering infrastructure requirements they need to install and implement to be able to become a smart grid by 2040.
- 3 These requirements are provided in order by which the upgrades should be installed and implemented and are defined by a level. The higher the level means a higher degree of being a smart grid system.
- 4 Table 1 summarizes the requirements/ smart grid upgrades for each SDUR level.

Table 1. SDUR Levels

	Network	Metering Infrastructure
Level 0	Have yet to initiate any Smart Grid plans and programs	Have yet to initiate any Advanced Metering Infrastructure (AMI)
Level 1	Initiated the integration of GIS maps, SCADA, reclosers, sectionalizers, load break switches, fault circuit, and indicators	Initiated the installation of Automatic Meter Reading (AMR)
Level 2	Initiated the installation of remote voltage regulators and capacitor banks; initiated the implementation of Distribution Management System (DMS) and Outage Management System (OMS)	Initiated the implementation of AMI
Level 3	Initiated the integration of Advanced Distribution Management System (ADMS), Smart Distribution Automation (SDA), and Smart Substation Automation (SSA)	Initiated the scale up of AMI
Level 4	Full implementation of SDA and SSA	Full implementation of AMI

³¹ Department of Energy. (2023). *Circular no. DC 2020-02-0003 Providing a National Smart Grid Policy Framework for the Philippine Electric Power Industry and Roadmap for Distribution Utilities*. DOE. Taguig.