NEW ENERGY NEXUS Philippines

PEOPLE OF ASIA FOR CLIMATE SOLUTIONS



# BRIDGING OPPORTUNITIES

**A Roadmap for China - Philippines Renewable Energy Cooperation**

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# Disclaimer

This report, **Bridging Opportunities: A Roadmap for China–Philippines Renewable Energy Cooperation**, was prepared by People of Asia for Climate Solutions (PACS) and New Energy Nexus Philippines (NEX).

The analysis focuses on identifying market conditions, barriers, and potential collaboration pathways between stakeholders in the Philippine renewable energy ecosystem and international partners, including Chinese renewable energy companies.

The purpose of this report is to contribute to dialogue on renewable energy development, technology cooperation, and entrepreneurship in the Philippines. The findings are based on available data, stakeholder consultations, key informant interviews, focus group discussions, and literature review conducted between August and December 2025.

This report does not attempt to analyze geopolitical issues, maritime territorial matters, or broader foreign policy considerations. The scope of this research is limited to renewable energy market dynamics, industry development opportunities, and potential collaboration models within the clean energy sector.

The insights and observations presented in this report reflect the information available at the time of the study. As market conditions, technologies, and policy environments continue to develop, some findings and perspectives may evolve with further research and stakeholder engagement.

The views expressed in this report are those of the authors and contributors and do not necessarily reflect the official positions of all partner organizations, participating stakeholders, or government agencies.

# Message of Support

*I was cycling through the narrow lanes in Binondo in 2024 when two neighboring shops caught my attention: a tea house and a hardware store. One displayed rows of tea jars and fine, delicate rice cakes, while the other had stacks of solar panels and flickering solar lamps. One was probably as old as the 400-year-old Chinatown, while the other seemed to have opened fairly recently.*

*They both meant the same things to me at that time: comfort, health, and safety.*

*These are the same ideals guiding the development of this report. We began this project in 2025, as the Philippines and China celebrated their 50 years of diplomatic relations. Anniversaries are always opportune moments to appreciate relationships that have endured everything, all the good and the bad, but more importantly, they drive motivation to plan for the future—a shared future.*

*After a year of dedicated research, we are proud to present "Bridging Opportunities: A Roadmap for Philippines-China Renewable Energy Cooperation."*

*The urgency of this roadmap cannot be overstated.*

*The Philippines is on the frontlines of the global climate crisis, which grows more severe and critical the longer global greenhouse gas emissions are not controlled. Yet paradoxically, the Philippines remains heavily reliant on imported fossil fuels from around the world, including oil and gas from the Middle East. When conflict erupted in Iran, the Philippines became the first nation to declare a state of national energy emergency.*

*A vicious circle the country should not have been trapped in.*

*The Philippines has the richest renewable energy resources in Southeast Asia. As a tropical archipelagic nation, it is blessed with intense sunlight, constant wind, mighty rivers, rhythmic ocean waves, and vast geothermal energy. Unfortunately, the Philippines has barely scratched the surface of these indigenous sufficient resources that readily guarantee the country's energy security.*

*Efforts to unleash clean and safe renewable energy in the Philippines are underway, but not fast or vast enough for a country considered to have the fastest-growing population in Southeast Asia, scattered across its more than 7,000 islands.*

*Centuries ago, traders arrived with tea, silk, and lumpia. Today, Chinese renewable energy technicians and business people are welcomed into the Philippines for a different kind of exchange. China has emerged as an undisputed global renewable energy leader.*

*In 2025 alone, China added more than 430 gigawatts of wind and solar power capacity, and electricity generation from renewable sources reached about 4 trillion kilowatt-hours, almost three times the combined power consumption of all Southeast Asian countries. This technological and manufacturing dominance positions China as an ideal partner to help unlock the Philippines' green potential.*

***This partnership is a smart investment in a shared future.*** *The two neighbors have been sharing tea, pancit, malunggay, and kangkong, but also typhoons, droughts, rising sea levels, and climate anxiety among the youth. Centuries ago, a cup of tea and rice cakes soothed both cultures. Today, solar panels and wind turbines shall calm our mutual angst and collective fears.*

*Comfort, health, and safety. The earth deserves it.*
*We all deserve it.*



**Xiaojun Wang**
Executive Director
People of Asia for Climate Solutions

# Message of Support

*As the Philippines works to meet its renewable energy targets and reduce its dependence on imported fossil fuels, the need for practical, scalable solutions has never been more urgent. This report provides a timely and grounded analysis of the country's renewable energy landscape, highlighting both the opportunities and the barriers that must be addressed to accelerate deployment.*

*At its core, the study highlights a key insight that* ***the energy transition is not only about technology, but about building strong local ecosystems.*** *Expanding renewable energy in the Philippines will require greater support for local developers, entrepreneurs, and service providers, alongside improved access to financing, technical expertise, and reliable supply chains.*

*Having worked closely with China's clean energy sector, I have seen how rapid scale-up was made possible through a combination of innovation, manufacturing strength, and sustained investment. There are important lessons from this experience that can help inform how countries like the Philippines can accelerate clean energy adoption while strengthening domestic capability.*

*This report highlights how collaboration can contribute to that goal. Partnerships between Philippine stakeholders and international renewable energy companies can help address existing gaps, particularly in financing, technology access, and technical capacity. At the same time, it is essential that these partnerships are structured in ways that create long-term value locally.*

*At New Energy Nexus, we are committed to supporting clean energy entrepreneurs and building stronger ecosystems across the regions we serve. We believe that empowering local innovators, while fostering meaningful collaboration, will be key to achieving a more inclusive and resilient energy transition.*

*We hope this report contributes to constructive dialogue among policymakers, industry leaders, and investors, and helps catalyze partnerships that advance the energy transition in the Philippines.*

**Andrew Chang**
CEO
New Energy Nexus



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# Acronyms

| | |
|---|---|
| **ASEAN** | Association of Southeast Asian Nations |
| **BESS** | Battery energy storage system |
| **BRIDGE** | Belt and Road for Initiative Directed towards Green Energy |
| **CREVI** | Comprehensive Roadmap for the Electric Vehicle Industry |
| **DE** | Designated Establishments |
| **DENR** | Department of Environment and Natural Resources |
| **DOE** | Department of Energy |
| **DTI** | Department of Trade and Industry |
| **DU** | Distribution Utility |
| **EC** | Electric Cooperatives |
| **EE** | Energy Efficiency |
| **EIA** | Environmental Impact Assessment |
| **EMB** | Environmental Management Bureau |
| **EPC** | Engineering, Procurement, and Construction |
| **ERC** | Energy Regulatory Commission |
| **EUMB** | Energy Utilization and Management Bureau |
| **EV** | Electric vehicle |
| **EVCS** | Electric vehicle charging stations |
| **EVIDA** | Electric Vehicle Industry Development Act |
| **EVOSS** | Energy Virtual One Stop Shop |
| **GEAP** | Green Energy Auction Program |
| **GEOP** | Green Energy Option Program |
| **GEMP** | Government Energy Management Program |
| **GW** | Gigawatt |
| **HVAC** | Heating, Ventilation, and Air Conditioning |
| **ICSC** | Institute for Climate and Sustainable Cities |
| **IFSAR** | Interferometric Synthetic Aperture Radar |
| **kW** | Kilowatt |
| **kWh** | Kilowatt-hour |
| **LCCAP** | Local Climate Change Action Plan |
| **LEECP** | Local Energy Efficiency and Conservation Plan |
| **LEP** | Local Energy Plan |
| **LGU** | Local Government Unit |
| **LiDAR** | Light Detection and Ranging |
| **LTO** | Land Transportation Office |
| **MEDP** | Missionary Electrification Development Program |
| **MW** | Megawatt |
| **MWh** | Megawatt-hour |
| **MSP** | Marine Spatial Planning |
| **NAMRIA** | National Mapping and Resource Information Authority |
| **NEA** | National Electrification Administration |
| **NIA** | National Irrigation Administration |
| **NGCP** | National Grid Corporation of the Philippines |
| **NPC** | National Power Corporation of the Philippines |
| **NREP** | National Renewable Energy Program |

# Acronyms

| | |
|---|---|
| **OCSP** | Open Competitive Selection Process |
| **OEP** | Ocean Energy Pathway |
| **OREEi** | One Renewable Energy Enterprise Incorporated |
| **OTEC** | Ocean Thermal Energy Conversion |
| **PACS** | People of Asia for Climate Solutions |
| **PEP** | Philippine Energy Plan |
| **PNOC-RC** | Philippine National Oil Corporation Renewables Corporation |
| **PSSEA** | Philippine Solar and Storage Energy Alliance |
| **PV** | Photo-voltaic |
| **QTP** | Qualified Third Party |
| **RA** | Republic Act |
| **RE** | Renewable energy |
| **REMB** | Renewable Energy Management Bureau |
| **RDF** | Refuse-derived fuel |
| **RPS** | Renewable Portfolio Standards |
| **RTD** | Round table discussion |
| **SC** | Service Contract |
| **SODAR** | Sonic Detection and Ranging |
| **SPECTRUM** | Solar Power Estimation of Capacities and Tracking Using Machine Learning |
| **SPUG** | Small Power Utilities Group |
| **TOE** | Tons of oil equivalent |
| **tWh** | Terrawatt-hour |
| **UP** | University of the Philippines |
| **USD** | United States Dollar |

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# EXECUTIVE SUMMARY



This report analyzes the Philippine renewable energy landscape across major technologies including solar, wind, geothermal, hydro, biomass, and ocean energy, while also considering related sectors such as electric vehicles and energy efficiency. The study combines desk research, stakeholder interviews, focus group discussions, and surveys to identify barriers and collaboration opportunities. The findings highlight major growth areas, industry challenges, and concrete pathways for partnerships that can accelerate the Philippines' clean energy transition.

# Executive Summary

**Bridging Opportunities: A Roadmap for China – Philippines Renewable Energy Cooperation** is a strategic initiative intended to catalyze cross-border collaboration in clean energy deployment. The roadmap aims to unlock Chinese-Philippine cooperation by providing an integrative analysis of the Philippines' renewable energy landscape covering solar, wind, geothermal, biomass, hydro, and ocean energy. It also touches on electric vehicles and energy efficiency. The opportunity mapping process seeks to reveal practical opportunities for cooperation between Chinese and Philippine companies to further accelerate RE adoption in the Philippines. The research was done through the comprehensive review of official reports and related literature, Focus Group Discussions (FGD), Key Informant Interviews (KII), and online surveys. Key industry stakeholders in the Philippines and China participated in the research process.

The consolidation of aggregated capacities for each technology provides an overview of the state of RE development in the Philippines:

| *Sector/Technology* | *Installed as of 2025* (MW)* | *Pre-Development / Development* (MW)* | *Target by 2050** (MW)* |
|---|---|---|---|
| ***Solar*** | *2,154* | *36,283* | *56,000* |
| ***Wind*** | *443* | *98,623* | *26,387* |
| ***Geothermal*** | *1,951* | *1,108* | *2,957* |
| ***Biomass*** | *591* | *271* | *749* |
| ***Hydro*** | *1,396* | *15,141* | *10,546* |
| ***Ocean*** | *0* | *34* | *0* |

**DOE List of Service Contracts*
***DOE Philippine Energy Plan (2023-2050)*

As presented, solar and wind dominate the RE landscape, with aggressive growths in installed capacity, pre-development projects, and long-term forecasts. Hydro, geothermal, and biomass continue to provide more energy-dense capacities but exhibit slower growth compared to solar and wind. Ocean energy and low enthalpy geothermal remain in nascent stages, with projects mainly in pre-development state.

In addition to renewable energy, the crucial sectors of electric vehicles (EV), energy efficiency (EE), and circular economy initiatives merit close attention as well. Electric vehicle growth is currently on a surge, with the government aiming to nurture its roll-out, and also aims to increase the number of electric vehicle charging stations (EVCS). Energy efficiency measures continue to be pushed and enforced with emissions avoidance targets ranging from a low of 8% to a high of 27% across different sectors. Circular economy efforts remain limited while renewable energy waste continue to mount, especially those coming from the solar PV industry.

# Executive Summary

The integrative analysis of all the secondary and primary data suggests six key Opportunity Pathways for Chinese-Philippines cooperation. These are the following:

Pathway 1 – **Leveraging Specialized Capabilities in the Large-Scale RE;**
Pathway 2 – **Enhancing Support for Urban Solar Applications;**
Pathway 3 – **Developing Holistic Project Packages for Underserved and Unserved Areas;**
Pathway 4 – **Mainstreaming Greenfield/Brownfield RE Technologies;**
Pathway 5 – **Supporting Circular Economy Initiatives;** and
Pathway 6 – **Partnering with Local Government Units to Energize Public Facilities.**

More granular niche opportunities (i.e., low hanging fruits) were initially studied and described to provide more practical approaches to the aforementioned opportunity pathways. These specific opportunities are the following:

**Niche Opportunity 1**
Rooftop Solar PV

*Current installed rooftop solar PV capacity is estimated at around 1,846MW, with total potential estimated at 106,000MW. Merely doubling the current installed capacity would translate to a market value of approximately USD1.6 billion (estimated at around USD890 per kilowatt of installed rooftop solar PV).*

**Niche Opportunity 2**
Microgrids and Solar Home Systems for Missionary Electrification

*Around 3.6 million households will require new electricity connection and services in the next three years. Out of this total number, 27% or 858,000 households will be energized through the installation of solar home systems, and 0.9% or 27,000 households will be energized through the deployment of microgrid systems. For the solar home system alone, the market size is estimated at around USD 517 million. A microgrid auction for 167 unserved and underserved areas is tentatively set to be conducted in early 2026.*

**Niche Opportunity 3**
Electric Vehicles and Solar PV Charging Station Integration

*The Philippine government aims to help establish around 7,300 EV charging stations by 2028. Using this figure, at an average of about 20 kilowatts of solar PV system per charging station (roughly equivalent to the size of an average gasoline station roof, 100 to 150 square meters), the target number of charging stations can potentially translate to around 146MW of aggregated generation capacity requiring an investment of around USD130 million (at around USD15,000 to USD18,000 per 20kW solar PV system).*

**Niche Opportunity 4**
Distributed Solar in Rural On-grid Areas

*Underserved areas in the Philippines i.e. those with only 5-16 hours of electricity daily and low power quality power, can benefit from distributed solar PV and energy storage, particularly for irrigation, cold storage, and mobile energy systems. On irrigation – at least 8,000 hectares of rice fields will require irrigation in the next 5 years, with solar PV powered irrigation as one of the key strategies. The cold chain industry attribute around 35% of its costs to electricity, requiring the scale-up of solar PV powered cold storage and container vans. Mobile energy systems also increase in demand as common service facilities and disaster response platforms.*

**Niche Opportunity 5**
Solar Panel Recycling

*The 1,650MW of installed solar capacity in the country is estimated to be using around 3.3 million solar PV modules with an approximate gross weight of 99,000 tons (using a 500-watt module as typical reference). On top of this, there are at least 1,000 registered rooftop net-metering solar PV systems amounting to around 167MW of capacity, and more seriously, there are tens of thousands of small solar PV systems in portable and off-grid mode that are not sufficiently accounted for. With current growth projections, it is estimated that the Philippines will have almost 1 million metric tons of solar PV module waste by 2050. Currently there are no substantial solar PV recycling projects or initiatives in the country.*

# Executive Summary

The Philippines' renewable energy sector presents diverse opportunities for China-Philippines cooperation. In order to further pursue the opportunities identified, the following next steps are recommended:

1. Organize bilateral and multilateral dialogues between selected Chinese and Philippine companies to expand the discussions on the niche opportunities.
2. Develop a specific program that would design and operationalize a long-term solar PV supply and technical support partnership between Chinese and Philippine Companies.
3. Facilitate discussions between the Chinese and Philippine companies and the Department of Energy to develop specific partnerships and programs (e.g. microgrid packages, EV-solar PV charging, solar panel recycling).
4. Conduct more in-depth studies and stakeholder dialogues for other technologies that may be considered as priorities for Chinese companies in consideration of their preferences and specialized capabilities.

By addressing challenges and leveraging these opportunities, Chinese and Philippine stakeholders can foster sustainable energy development, drive innovation, and contribute to the Philippines' clean energy transition. Strategic partnerships, supportive policies, and investments in emerging technologies and approaches will be critical to achieving these goals.

# Background

**Bridging Opportunities: A Roadmap for China – Philippines Renewable Energy Cooperation** is a strategic initiative co-led by People of Asia for Climate Solutions and New Energy Nexus to catalyze cross-border collaboration in clean energy deployment.

Despite 50 years of diplomatic relations and nearly 100 bilateral agreements between the Philippines and China, Chinese investment in the Philippine renewable energy sector remains significantly underleveraged—below 5%, compared to 20%+ in other ASEAN nations.

The roadmap aims to unlock Chinese-Philippine cooperation to accelerate the Philippines' transition toward its national targets of 35% renewable energy by 2030 and 50% by 2040. The country's current energy mix remains heavily reliant on fossil fuels (78%), with systemic barriers such as regulatory fragmentation, grid limitations, and a partnership gap stalling progress.

This joint project between PACS and NEX sought to build mutual understanding through stakeholder engagement, market mapping, and the creation of a collaborative roadmap for bridging opportunities. This will enable Chinese investors to identify viable ventures and de-risk investments, contributing to a more inclusive and competitive renewable energy landscape in the Philippines.

# Objectives and Methodology

The research was designed to generate a Project Opportunity Roadmap that outlines market barriers, case examples, and collaboration opportunities between Chinese enterprises and Philippine renewable energy stakeholders. The research has two key objectives:

- To prepare a cohesive situational analysis of the Philippine renewable energy sector and its allied industries with a focus on identifying key drivers and barriers to Chinese-Philippine partnerships; and

- To identify opportunities for partnerships and recommend initial approaches, strategies, and activities that will harness and nurture these opportunities.

In addition to these two main objectives, the research process was designed to lookout for prospects for immediate partnerships depending on urgent needs or opportunities that can be discovered during the course of the study.

The research was pursued through the iterative mix of secondary data analysis, key informant interviews, and focus group discussions. Regular check-ins, consultations, and feedback sessions were done in order to ensure timely course correction or reinforcement. The detailed research design can be found in Annex 36.

The rapid research covered all aspects of renewable energy in the Philippines with the intent to capture key opportunities and emerging trends. However, the coverage of all the technologies and allied industries were not in-depth inventories or assessments of each technology or subsector. More detailed analyses were done to the best extent possible for those that were considered priorities (solar, wind, geothermal).

Prioritization was pursued in the interest of defining focus areas, as this will enable a sharper definition of opportunities. This will in turn translate into more actionable recommendations.

Given the limited timeframe for this rapid research (less than 5 months), the methodology as described below maximized available secondary data and harnessed valuable primary date gathered from the various KIIs, FGDs, and surveys.

# RESULTS



This section presents the key findings from the analysis of national energy plans, service contract data, and other sectoral reports. It provides a comparative overview of the status, pipeline, and long-term projections of renewable energy technologies in the Philippines. The results reveal strong growth in solar and wind development, while geothermal, biomass, and ocean energy remain slower or emerging sectors. The analysis also identifies sector-specific constraints and areas where investment, technology transfer, and partnerships could help accelerate deployment.

# Results

The key findings of the secondary data analysis - particularly the review of the Philippine Energy Plan (2023-2050, Volumes I, II, and III), the National Renewable Energy Plan (2020-2040), the Comprehensive Roadmap for the Electric Vehicle Industry (2023), the Missionary Electrification Roadmap (2021-2025), and the Service Contract Lists of all renewable energy sectors (Department of Energy, all updated 2025) – are presented in the Project Opportunity Matrix (Annex 37). Subsectors under each major technology were further defined where relevant. The key finding from these documents were then interpolated with the results of the various FGDs and KIIs.

The summary consolidation of key information provides an **overview** of the renewable energy sector in the Philippines. This enables the comparison of the 'state of affairs' for each technology and reveals points of crowding (chokepoints) and points of low participation (gaps).

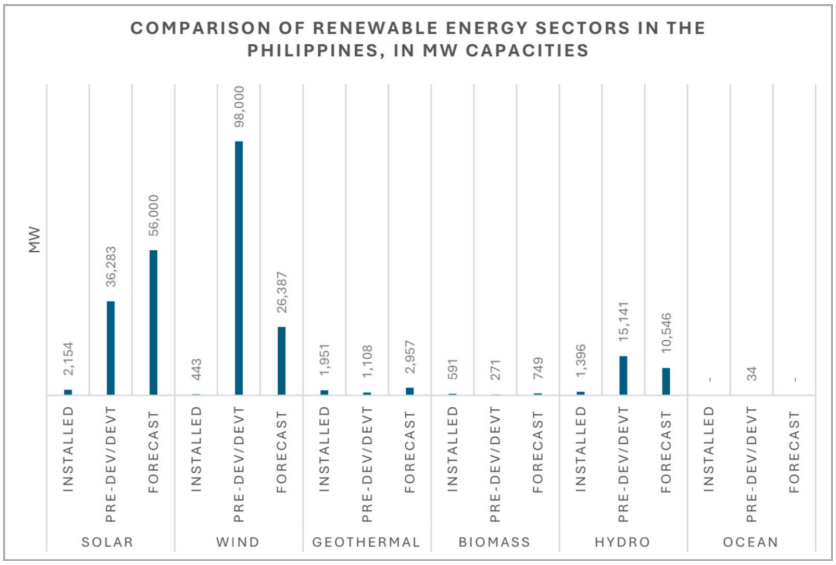



**Figure 1. Comparison of Renewable Energy Sectors in the Philippines**

Figure 1 presents the overview for all sectors and compares generation capacities in terms of projects already installed, those still in pre-development or development stage, and those still to be identified and included in the long-term projections indicated in the Philippine Energy Plan (2023-2050, Volume I). This figure immediately shows the hyperactivity in the solar and wind sectors, with hydro exhibiting reasonable levels of activity, and both geothermal and biomass showing low levels of activity, practically on a zero-growth trajectory. Ocean energy is apparently still in its greenfield stage.

For the two active sectors, it is important to note some key differences. Solar show aggressive growth; but nonetheless growing within the long-term projection stated in the Philippine Energy Plan. New areas of expansion such as floating PV and energy storage would support this movement.

# Results

Wind on the other hand shows what appears to be oversubscription with registered projects under predevelopment and development stages exceeding the forecast. This indicates various conditions, including possible speculations or land-banking. These possible reasons need to be further validated. With the long-term projected capacity lower than those registered under pre-development and development, the wind sector appears to be rapidly getting overcrowded, and the scenario could become more complex considering current uncertainties on transmission access, marine spatial planning, and environmental impact. Nonetheless, the government remains optimistic considering the high estimates of the country's offshore wind potential.

Geothermal, hydro, and hydro biomass may appear inactive, but they continue to provide more energy dense capacities compared to solar and wind. In terms of output, Figure 2 shows how hydro, geothermal, and biomass compare with solar and wind. The lower levels of activity in hydro, geothermal, and wind also indicate underlying conditions which would include but are not limited to perceived and actual levels of resource constraints, complexity, and risks. Waste-to energy projects under biomass would specifically exemplify these factors.

**Table 1. Summary of Challenges and Opportunities for Renewable Energy Sectors**

| Source | Challenges | Opportunities |
|---|---|---|
| **Solar Energy** | • *High upfront costs for rooftop solar installations.*<br>• *Limited financing options for residential and small-scale projects.*<br>• *Lack of standardized installation practices and after-sales support.*<br>• *Insufficient public awareness and education about solar benefits.*<br>• *Growing solar PV waste with no recycling initiatives.* | • *Utility-scale solar projects with aggressive growth targets (56 GW by 2050).*<br>• *Rooftop solar PV with an estimated potential of 106 GW.*<br>• *Solar PV integration with electric vehicle charging stations.*<br>• *Solar-powered irrigation and cold storage systems.*<br>• *Development of solar panel recycling initiatives.* |
| **Wind Energy** | • *Crowded pre-development / development space, with estimated service contract capacities substantially higher than long term targets.*<br>• *Grid access and connectivity remain congested and uncertain.*<br>• *Environmental concerns, especially for offshore wind projects.*<br>• *Lack of small wind applications for off-grid and microgrid markets.* | • *Utility-scale onshore and offshore wind projects with high growth potential.*<br>• *Offshore wind development supported by marine spatial planning and environmental impact assessments.*<br>• *Demand for auxiliary support systems like ports, logistics, and skilled labor.*<br>• *Hybrid systems combining wind with other renewable energy technologies.* |

# Results

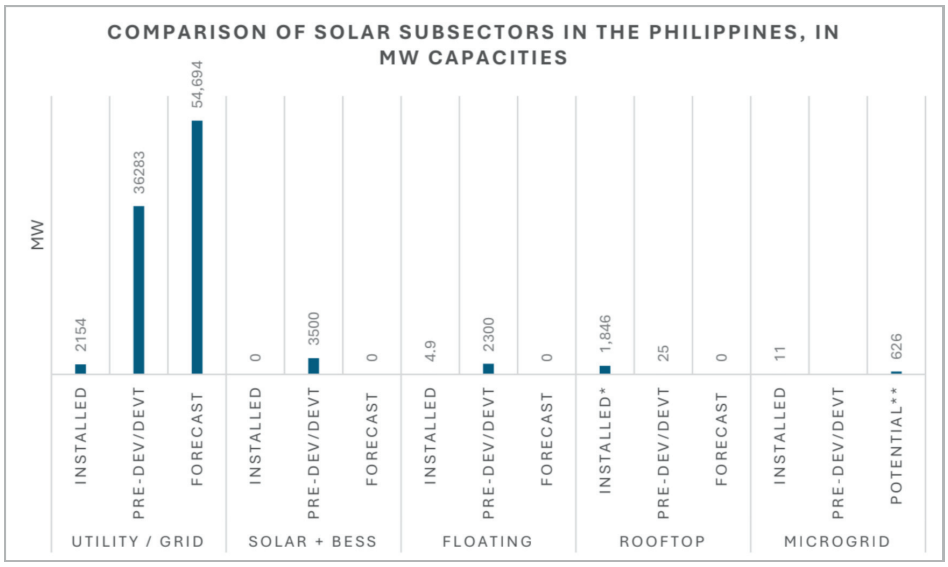
| Source | Challenges | Opportunities |
|---|---|---|
| **Geothermal Energy** | • *Slow growth trajectory with limited pre-development interest.*<br>• *High upfront costs and complex geological and hydrological studies.*<br>• *Limited development of low-enthalpy geothermal resources.* | • *Established geothermal sector with energy-dense capacities.*<br>• *Potential for low-enthalpy geothermal development in various provinces.*<br>• *Opportunities for technical assistance and specialized equipment.* |
| **Hydro Energy** | • *Pre-development / development capacities higher than long term targets.*<br>• *Environmental and social concerns related to large-scale hydro projects.*<br>• *Lack of consolidated data for micro-hydro projects.* | • *Significant growth potential with 15 GW in pre-development and 10 GW forecasted.*<br>• *Hybrid systems combining hydro with solar PV and battery energy storage systems.*<br>• *Micro-hydro projects for missionary electrification and productive use in remote areas* |
| **Biomass Energy** | • *Complex technologies and volatile feedstock supply.*<br>• *Fragmented waste collection systems and infrastructure.*<br>• *Conflicting policy goals (e.g., waste management vs. renewable energy development).* | • *Policy support for Waste-to-energy (WTE) projects.*<br>• *Modular configurations for methane capture and refuse-derived fuel (RDF).*<br>• *Small-scale biogas applications for household and agricultural use.* |
| **Ocean Energy** | • *Nascent stage with all projects in pre-development.*<br>• *High complexity and costs for resource assessments and environmental impact studies.*<br>• *Limited technical expertise and infrastructure for ocean energy development.* | • *Vast theoretical energy generation potential (170 GW).*<br>• *Development of tidal, wave, current, and ocean thermal energy technologies.*<br>• *Auxiliary support systems for marine environments, such as ports and logistics.*<br>• *First-mover advantage in ocean energy projects like the Capul Island Tidal Power Project.* |

Figure 2 provides more detailed comparisons across utility scale **solar projects**, solar PV with battery energy storage systems (BESS), rooftop solar, net metering, microgrid applications, and floating PV. As mentioned in the general comparisons, growth in utility scale / grid-tied PV is aggressive, rapidly increasing from a little more than 2GW of installed capacity to registered predevelopment and development projects at 36GW in the coming years. These capacities constitute the long-term target to install 56GW of solar PV capacity by 2050. Although to a much lesser extent compared to utility grid tied PV, both solar PV + BESS and floating PV also exhibit significant growth, moving from practically no installations to 3,500MW and 2,300MW of projects in development stages, respectively. The Meralco Terra Solar Power Project with battery energy storage system (BESS) has actually broken ground, and for floating PV, the Toledo City 4.9MW project has already been inaugurated.

# Results

The maturity and progress of solar PV technology and supply chain have solidified the growth of utility scale solar PV in the country. This is further reinforced with investor participation, with most of the movement driven by companies / project developers such as Sta Cruz, PV Sinag, Helios, Jobin, Solarace1, Ph Renewables, Solar Philippines, Nuevo Solar, Petro Solar, Citicore, Phinma, MSpectrum, and Solar Pacific. The DOE's policies and programs such as the Green Energy Auction and the facilitation of floating solar PV projects (such as the Laguna de Bay allocation) further bolstered the pipeline of solar PV projects.

With the rapid growth of mainstream utility scale solar PV, big ticket financing, supply, and EPC services will continue to be in demand. The entry of both BESS and floating PV further increase opportunities for investments and partnerships, including the supply of newer technologies and technologies such as inverter-battery systems for BESS and flotation systems and submarine interconnections for floating PV. These prospects are expected to strengthen further as DOE is now considering formulating a special policy that will allow project developers to build and operate their own transmission lines. These developments further increase the confidence of equity financing and venture capital fund managers, especially for those seeking high carbon yield investments (Clime Capital).




* Based on ICSC/SPECTRUM analysis; **Based on potential microgrids in SPUG areas

**Figure 2. Comparison of Solar Energy Subsectors in the Philippines**

While utility scale solar, solar + BESS, and floating PV continue to dominate the field, solar PV for rooftop, net metering, and micro-grids applications have barely made a dent in total potential demand even in terms of aggregate capacities. There appears to be a plateau in this subsector's performance despite recent excitement on supportive policies (e.g., net metering policy, GEOP, REC, Micro Grid), newer technologies (e.g., 500Wp bifacial panels), and innovative financing (e.g., 3-5 years to pay BOT offers from suppliers).

# Results

The aggregate capacity on rooftop solar installation, in the absence of official lists from DOE, was based on ICSC/SPECTRUM analysis (more details on this in the niche opportunities section), which sets the number at 1,843 MW. This would include grid-tied/net metering and own-use industrial, commercial, and residential installations. The industry participants state that there should be more rooftop solar installations if not for challenges such as (a) insufficient financing programs for residences and small buildings, (b) Inherently limited roof-space, (c) Complicated and long application process for grid tied connections / net metering, (d) Majority of electric cooperatives are not technically and physically ready for grid-tied solar or net metering, and (e) Limited capital of small and medium scale companies who are more focused retail-oriented markets (Sta Rosa and Dipolog FGDs, Open Solar KII). Micro Grids on the other hand have its own set of challenges including (a) Logistical difficulty, (b) Risk of loss, damage, and pilferage, (c) Higher overhead costs, (d) Tedious and costly pre-development, construction, and operations, and (e) Low carbon avoidance yields (KII: OREEi; KII: Clime Capital).




**Figure 3. Location of Utility-scale / Large Solar PV Projects (Source: NREP 2020-2040)**

# Results

Beyond the challenges associated with rooftop, net metering, and micro-gid solar PV, they still present a number of opportunities that can be considered. For all three subsectors, the interviews and focus group discussions reveal that a critical support needed is the provision of supplier financing, supplier inventory, and technical support - i.e., patient capital and expertise that can suit the long gestation of smaller projects. For micro-grids in particular, helping serve the last mile Small Power Utilities Group (SPUG) areas, which stands at a substantial aggregated 626MW capacity, offers relationship building opportunities with the Philippine government, local government units, and communities. A specific opportunity for Chinese companies is to provide longer payment terms for products and ensure technical support and warranty service for partner Philippine companies. In turn, inventory requirements can be aggregated and determined over many months enabling larger and more certain product orders from Chinese companies.

In terms of geographic concentration, Figure 3 shows the location of major utility scale solar, expectedly gravitating in Central Luzon.

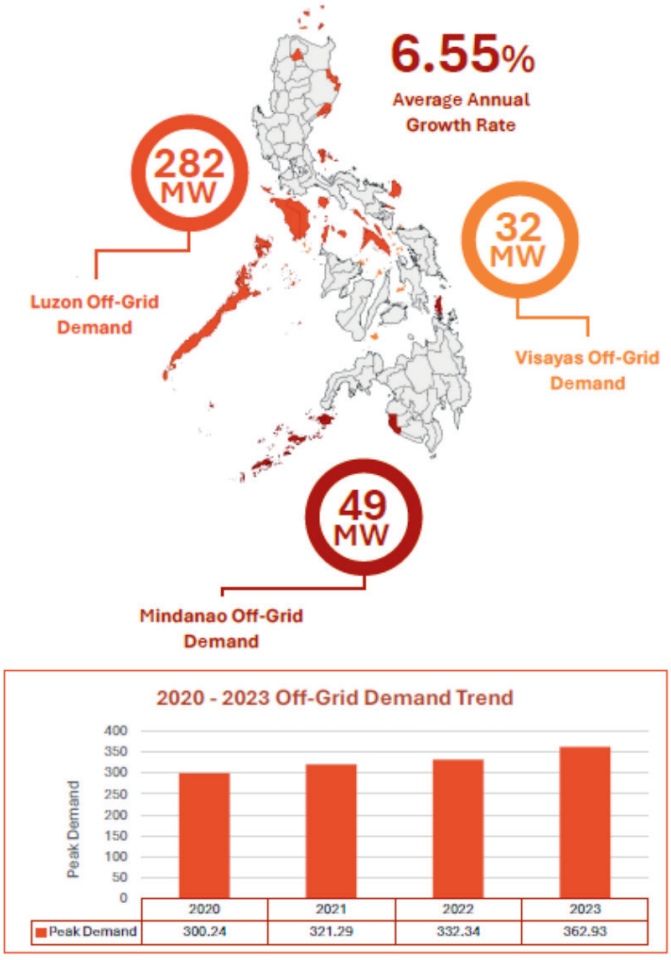



**Figure 4. Total Off-grid Demand Profile as of December 2023 (MEDP 2024-2028)**

# Results

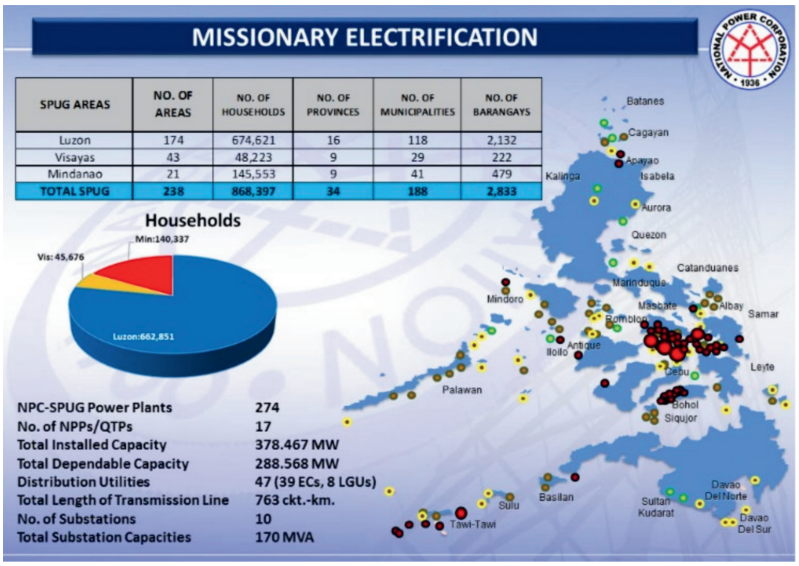



**Figure 5. National Power Corporation Missionary Electrification Status (2025)**

Figure 6 reiterates the overall assessment that the **wind sector** seems to be oversubscribed, indicating underlying reasons ranging from possible speculation to still evolving resource assessments. The optimistic outlook of onshore wind juxtaposes further with the standing issues on grid access and connectivity. Nonetheless, the trajectory towards more wind capacity remains robust with 26GW of projected long-term requirements, which is further reinforced by rapidly growing interest in offshore wind, with 178MW now on pre-development and 19GW foreseen to be developed in the coming years. Offshore wind, albeit beset with more complex concerns, appear to be moving forward, with progress being gained in marine spatial planning and the refinement of the Environmental Impact Assessment process (KII: Ocean Energy Pathway).

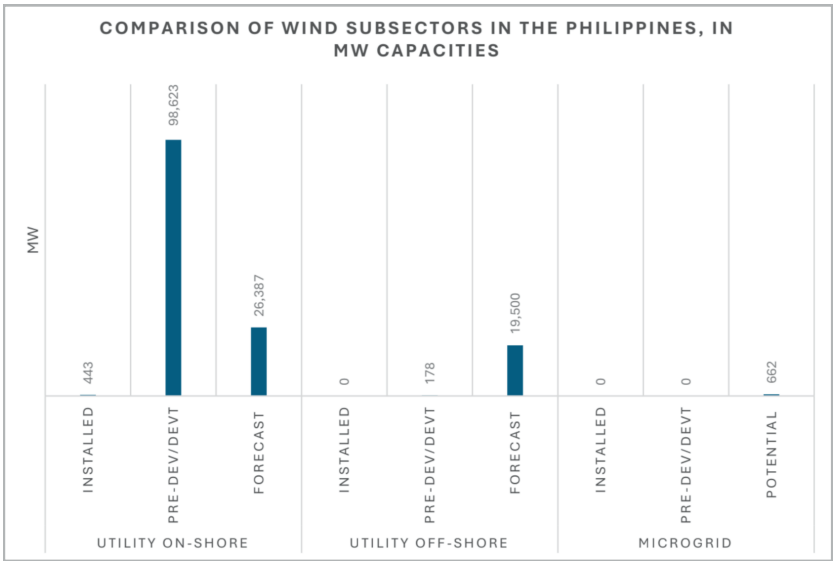



**Figure 6. Comparison of Wind Subsectors**

# Results

The optimistic outlook in the wind energy sector, especially for utility scale onshore and offshore projects is being driven by strong private sector interest and participation, with the likes of Northwind, EDC, North Luzon REC, Pililla Wind, Philippine Hybrid, Petrowind, and Guimaras Wind headlining installed capacities. This becomes even diverse in the pre-development space with various new companies getting into play namely: Airstream (12 projects,1.3GW); Apolaki (11 projects,1.7GW); Citicore (13 projects, 3.5GW); Cleantech (7 projects, 2.5GW); EDC (11 projects, 3.6GW); Energy Oasis (8 projects, 5.7GW); Envision (12 projects, 2.7GW); Giga (13 projects, 5.3GW).

Similar to solar utility scale projects, the rapid growth of utility scale onshore and offshore wind, will continue, sans any major concerns on marine spatial planning and environmental compliances. In this regard, demand for financing, technology supply, EPC services, and auxiliary services such as shipping and port management will continue to strengthen. The greater complexity for environmental impact assessment

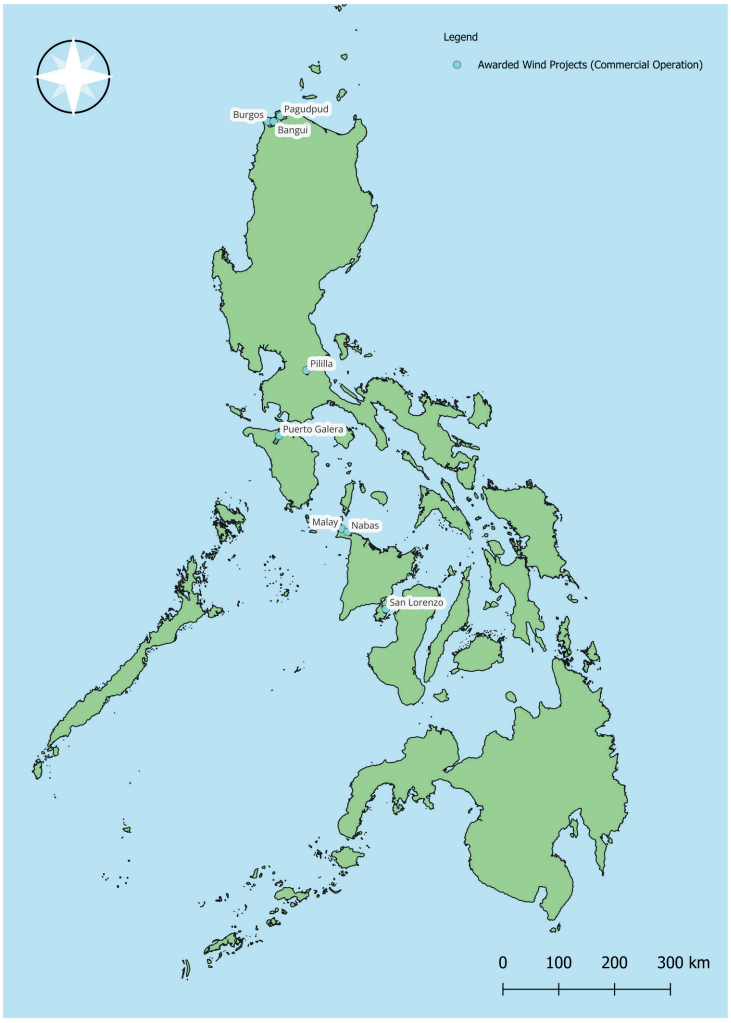



**Figure 7. Location of Utility-scale Wind Projects (Source: NREP 2020-2040)**

# Results

further adds to the need for specialized technologies and services e.g. LIDAR, SODAR (KII: OEP). Mainstream wind will also benefit from the plan of DOE to enable project developers to build and operate their own transmission lines in view of congestions and delayed project completion on the part of NGCP. Like large scale solar, these developments further increase the confidence of equity financing and venture capital fund managers, especially for those seeking high carbon yield investments (KII: Clime Capital).

Small wind applications in off-grid sites and micro-grid markets paint a story opposite to that of utility scale onshore and offshore projects. There are no reported or apparent wind projects that cater to these areas and the 662MW of aggregated SPUG requirement (currently, dominantly diesel powered) remain to be aspirational for RE replacement or complementation. This continues to stand as a potential market that remains unserved or underserved.

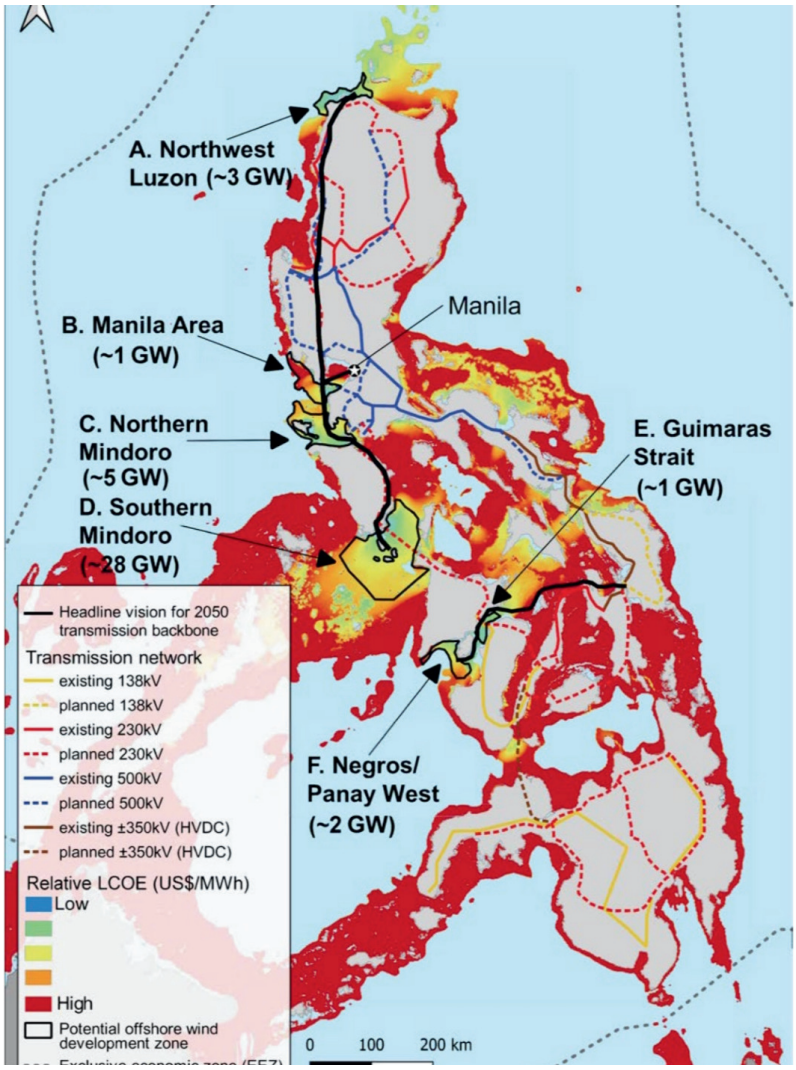



**Figure 8. Location of Potential Wind Energy Zones**

# Results

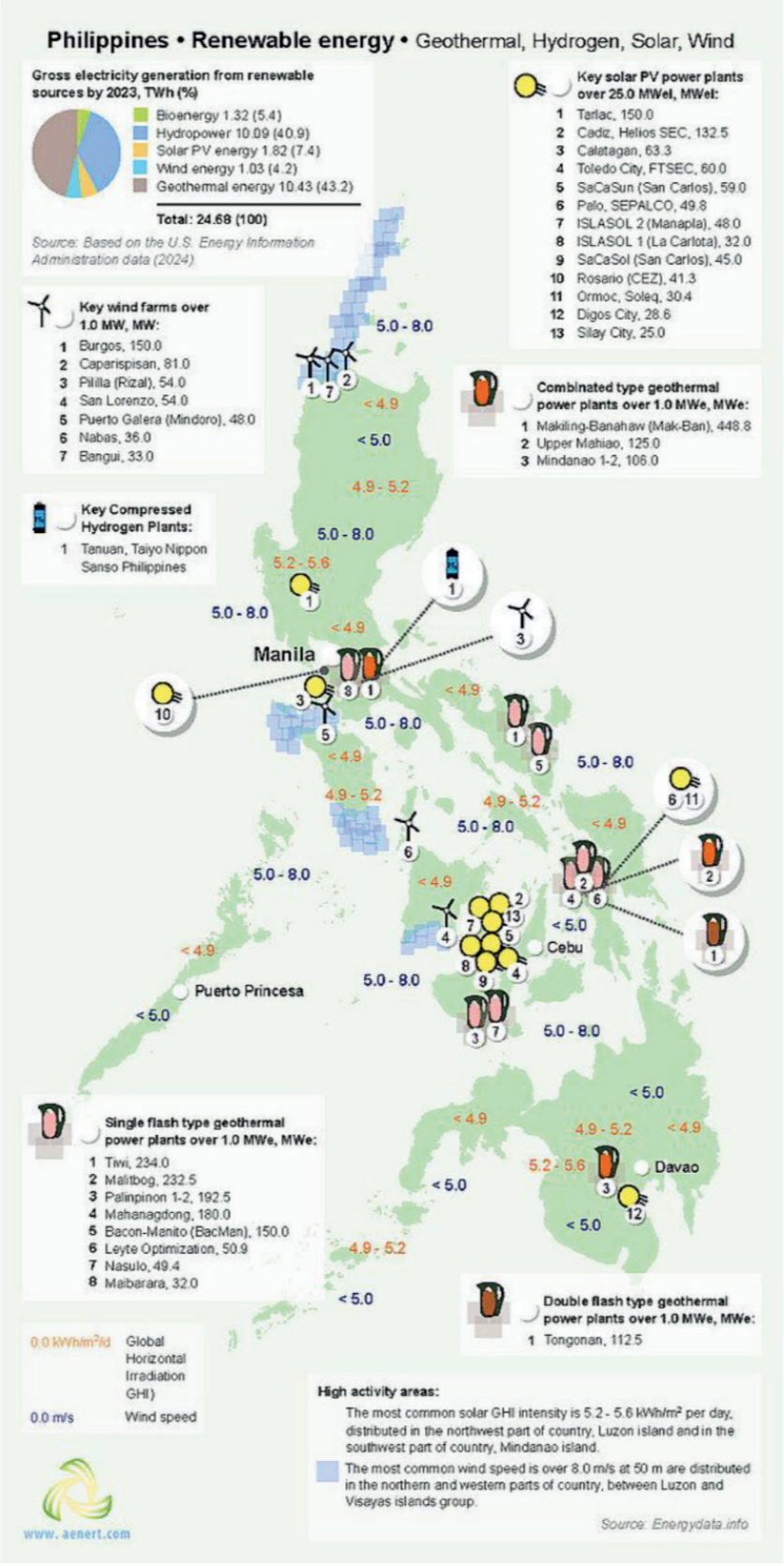



**Figure 9. Location of Major Geothermal, Hydro, Solar, and Wind Projects**

# Results

The **Geothermal Sector** continues on its traditional trajectory, with installed capacity still higher than pre-development interest. Forecast remains conservative, with additional capacity anticipated in the decades to come constituting just 70% of currently installed capacity. The field also continues to be dominated by a few long-time players in the geothermal industry namely EDC (3 projects, 772MW), AP Renewables (2 projects/692MW), and Greencore (2 projects, 315MW) for installed capacity. In the predevelopment space, EDC still leads (8 projects, 382MW), followed by PPCi/PGPC (3 projects, 206MW) and Pan Pacific (2 projects, 116MW). On the other hand, low enthalpy geothermal continues to be on the research and development space, with identified sites and studies in various stages located in Batangas, Cagayan, Camiguin, and Davao del Sur.

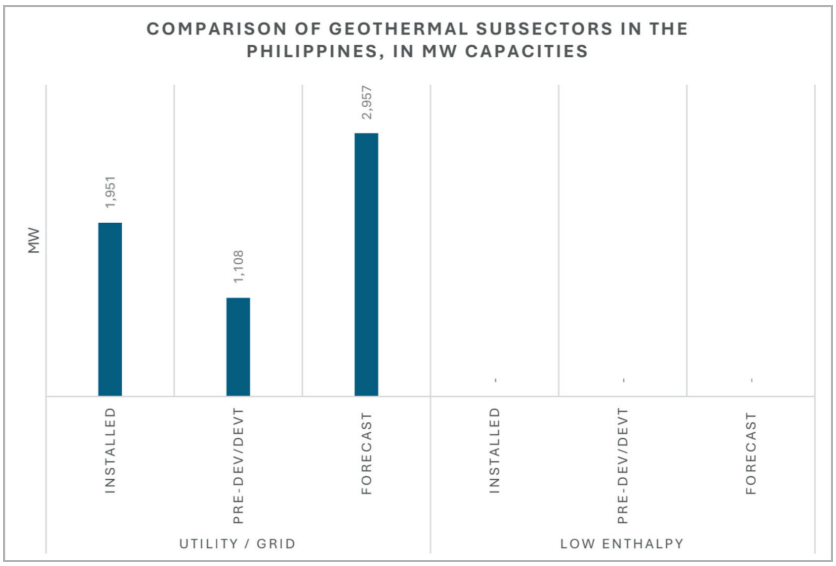



**Figure 10. Comparison of Geothermal Subsectors**

# Results

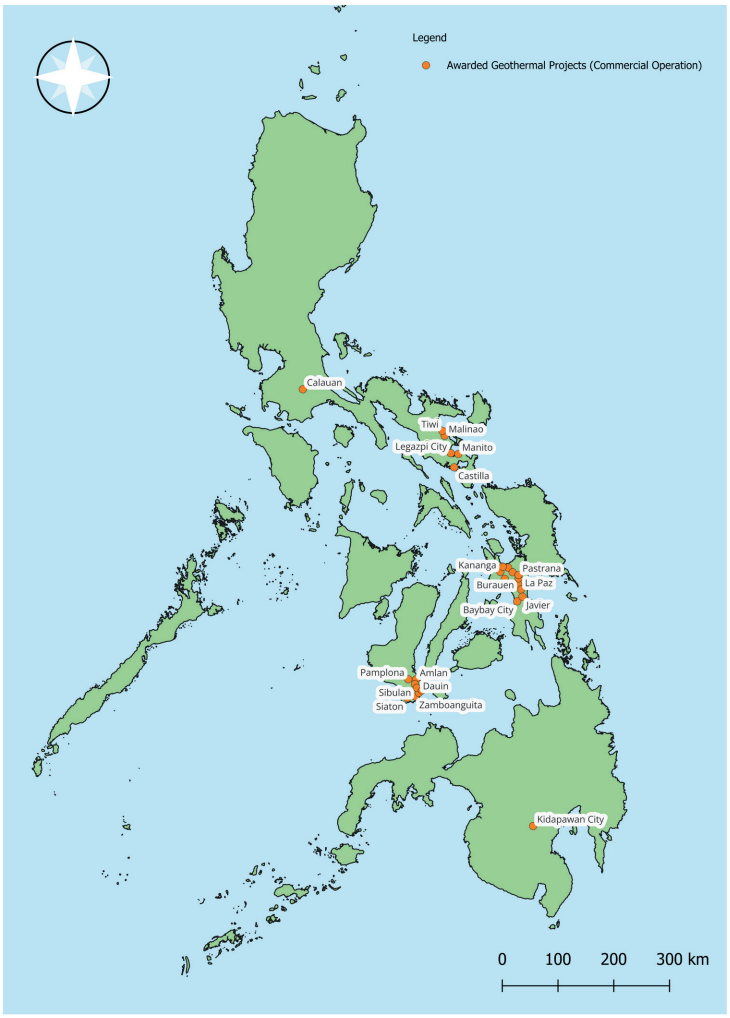



**Figure 11. Location of Installed Geothermal Projects (Source: NREP 2020-2040)**

# Results

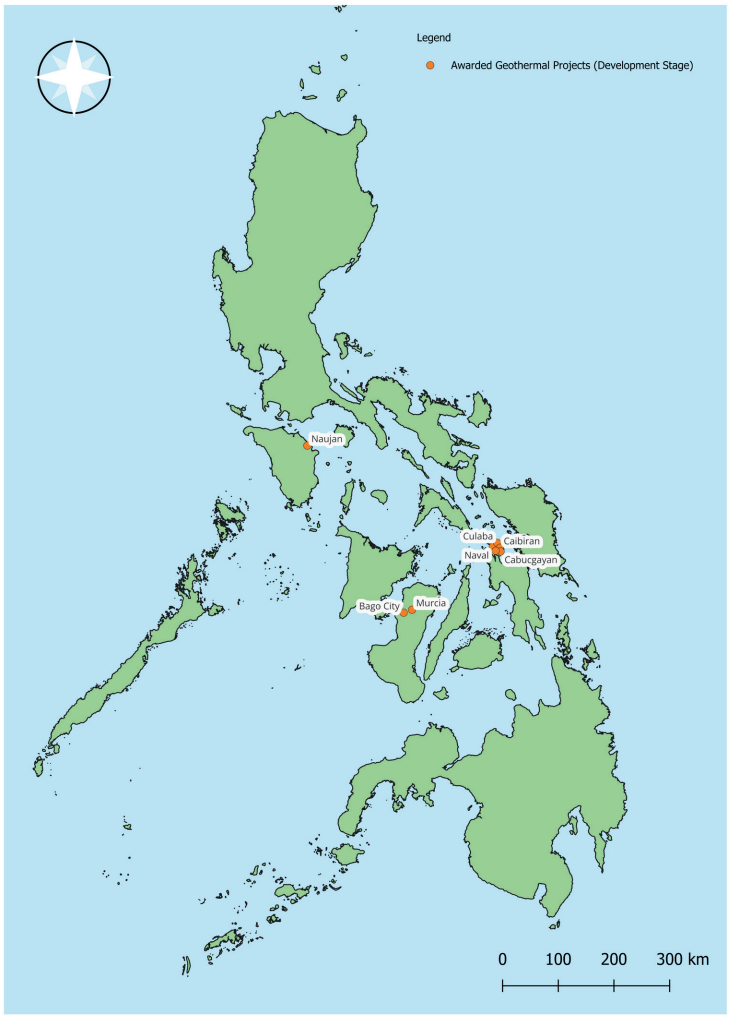



**Figure 12. Location of Geothermal Projects on Development Stage**

# Results

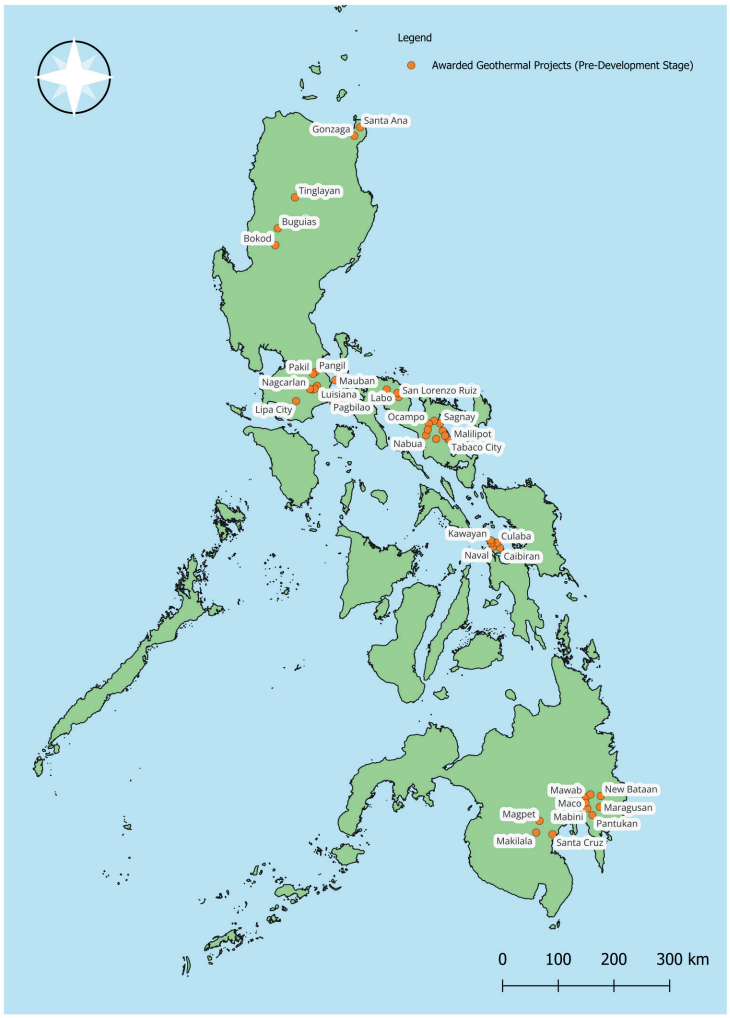



**Figure 13. Location of Geothermal Projects on Pre-Development Stage**

The **Biomass sector** also maintains its conservative path, with projects in the pre-development stage less than half of installed capacity. Forecast remains conservative, with additional capacity anticipated in the decades to come constituting just barely 19% of currently installed capacity. Highest installed capacities are evenly distributed among a few players namely Crystal Sugar (49MW), Biscom (48MW), Universal Robina (46MW), Victorias Milling (40MW), and Hawaiian Philippine Company (28MW). In the pre-development space, there are even fewer notable participants namely Manila Integrated Environment Corporation (100MW, WTE) and Victorias Milling (30MW).

Waste-to-energy projects are even lower with a total capacity of just over 9MW from a couple of operating projects namely Montalban Methane (8MW) and Pangea (1.5MW). Nevertheless, the pre-development space is showing some growth despite a comparatively lower portfolio of 133MW mainly from MIEC (100MW), Lecra (15MW), and

# Results

Green Atom (12MW). The push to increase more WTE project is evident with the DOEs recent Green Energy Auction announcement dedicated to WTE offers.

Various companies such as Green Alternative Technology Specialist, Satrap Power, FDR Integrated, and Waste and Resource Management Inc. are exploring refuse derived fuel and other newer technologies at lower scales. At even smaller-scales, the use of biogas for household cooking and other consumer-end applications (e.g. electricity for swine farms) are known to be widely adopted but aggregated data for this subsector are yet to be acquired.

Biomass energy, especially WTE, is known to be complex. The varied technologies coupled with the diversity and volatility of feedstocks primarily drives this complexity. For the WTE in particular, in addition to technology complexity, project development in this regard would involve dealing with complex and fragmented waste collection system and infrastructure, politicized waste collection contracts at local government level, and conflicting policy goals (RA9003 vs RA9513). Nonetheless, these challenges can be seen as opportunities that could require smaller novel approaches such as modular configurations for methane capture and refuse-Derived Fuel (RDF), alignment with long term waste reduction, and use of the project for non-power applications such steam production, fertilizer production, and the like.

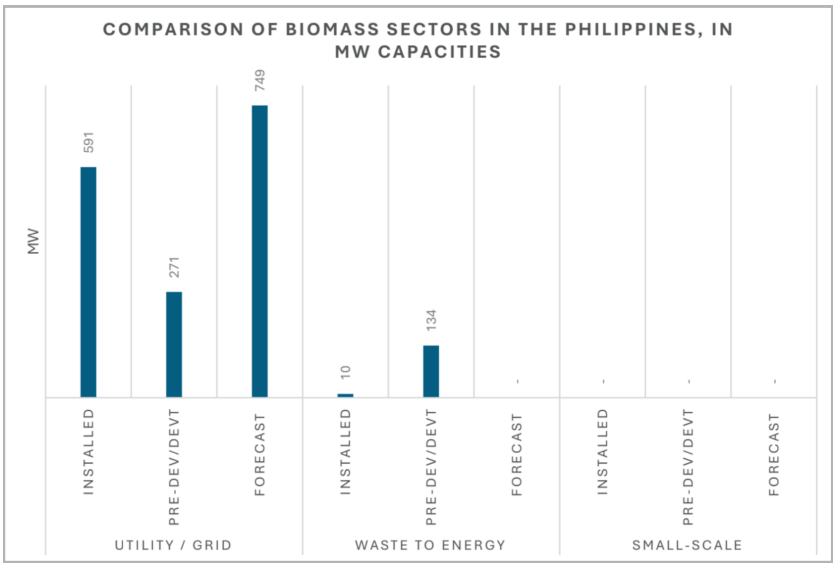



**Figure 14. Comparison of Biomass Subsectors**

# Results

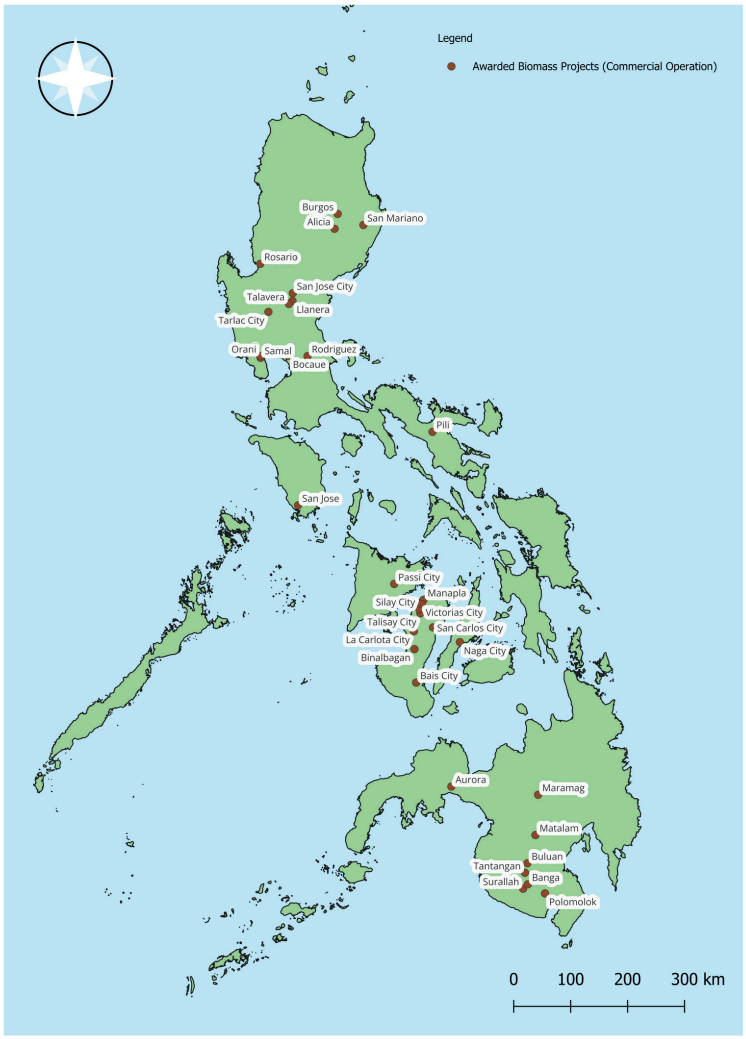



**Figure 15. Location of Biomass Power Plants (Source: NREP 2020-2040)**

# Results

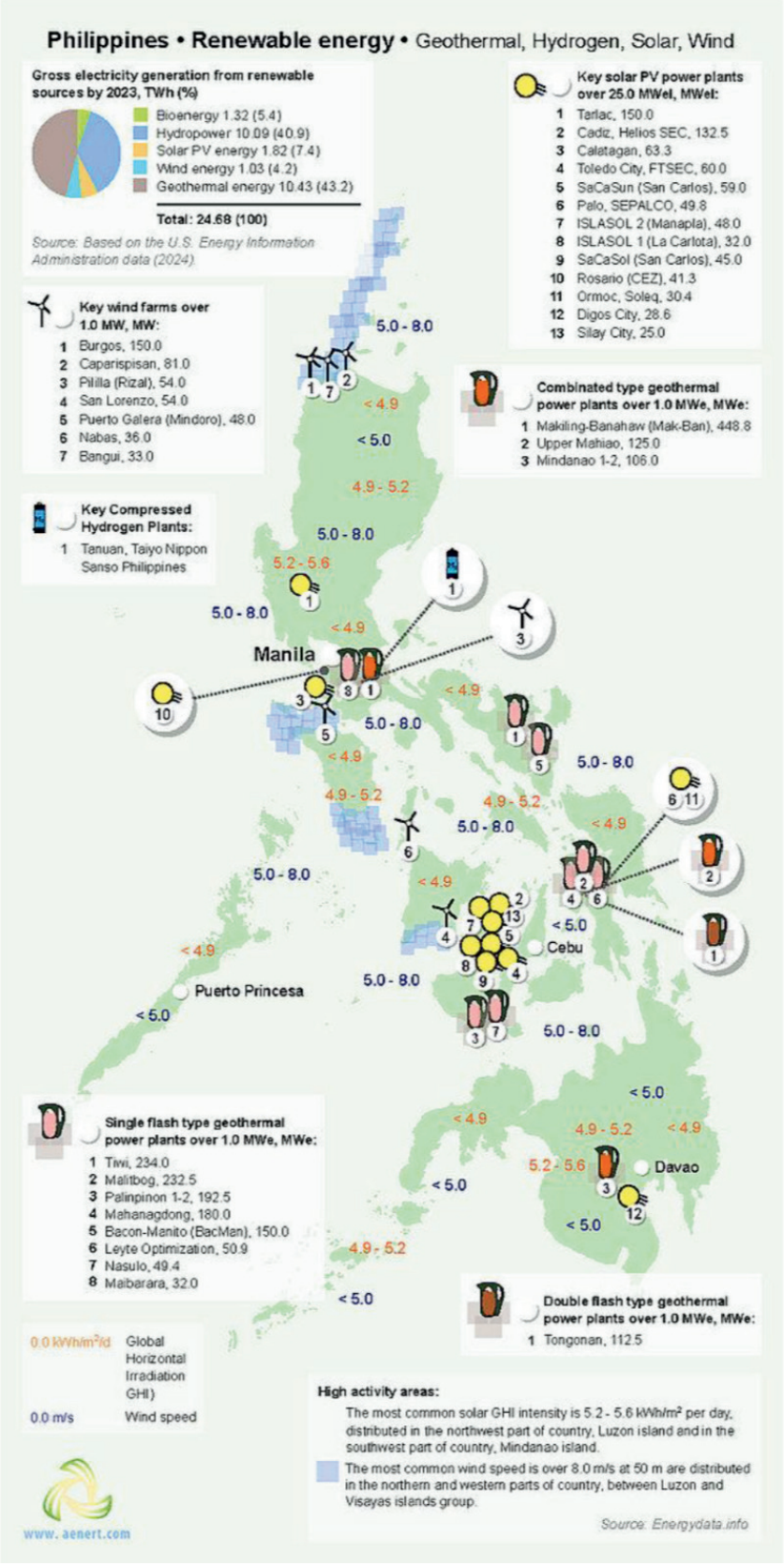
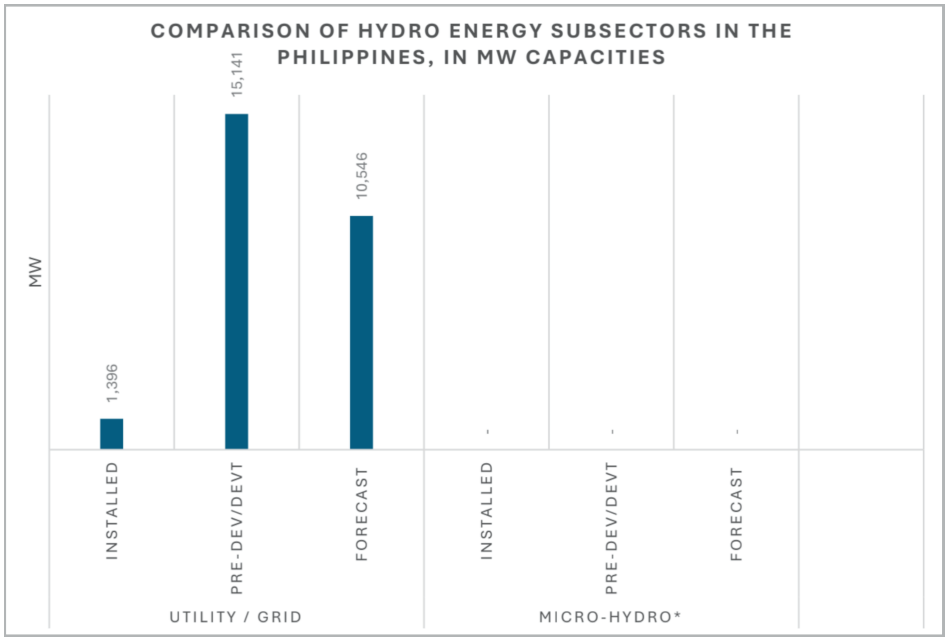



**Figure 16. Location of Biomass and Bioenergy Projects**

# Results

In terms of outlook, the **Hydro sector** is on a more active growth trajectory compared to geothermal and biomass. Its total installed capacity at 1,396MW runs a close third to solar and geothermal. The sector continues to be a pillar of the energy industry, playing multiple roles from being a major contributor to carbon emissions reduction to serving both as a baseload and/or spinning reserves. Hydro projects in pre-development stage total to around 15GW, which is over 1,000% of current installed capacity. The long-term projection for hydro capacity stands at 10GW. The slight oversubscription could be due to a number of factors including development of projects for embedded generation, own-use, and even speculation. These underlying factors need to be further validated.




* No available consolidated and official data

**Figure 17. Comparison of Hydro Subsectors**

The traditional players in the hydro sector continue to dominate the field and this would include SN Aboitiz (613MW,4 projects), Hedcor (201MW, 21 projects), FirstGen (132MW, 2 projects), and Luzon Hydro (74MW, 1 project). The list gets a bit more diverse in the pre-development phases which would include a longer roster of players such as San Roque Hydro (3,120MW/8 projects), Pan Pacific (2,817MW/9 projects), Ahunan Power (1,400MW/1 project), JBD Water (694MW/8 projects), Olympia Violago (600MW/1 project), Coheco Badeo (500MW/1 project), SN Aboitiz (396MW/4 projects), PSALM (360MW/1 projects), Repower (320MW/1 project), First Gen (260MW/5 projects), MGEN (250MW, 1 projects), Pulangui Hydro (250MW,1 project), Tagel Corp (196MW/28 projects), United Hydro (163MW/9 projects), EuroHydro (127MW/18 projects), King Energy (140MW/15 projects), and Alsons (123MW/11 projects).

# Results

At lower capacity scales and community-based levels, the micro-hydro sector is known to be dynamic and significant in terms of missionary electrification, micro-grid development, productive use, and embedded generation. However, a consolidated list is yet to be acquired or organized.

Micro-hydro proponents come from a diverse set of stakeholders including but not limited to local government units, civil society organizations, research centers, universities, private owners, suppliers, cooperatives, communities, and international organizations. One organization of note is SIBAT which has 29 micro-hydro projects in the Cordillera Region alone, with a total of 414kW capacity.

In terms of opportunities, the substantial growth of utility scale hydro projects offers not only direct participation in the development of the main projects, but more importantly, the potential provision of hybrid systems such as BESS and solar PV.

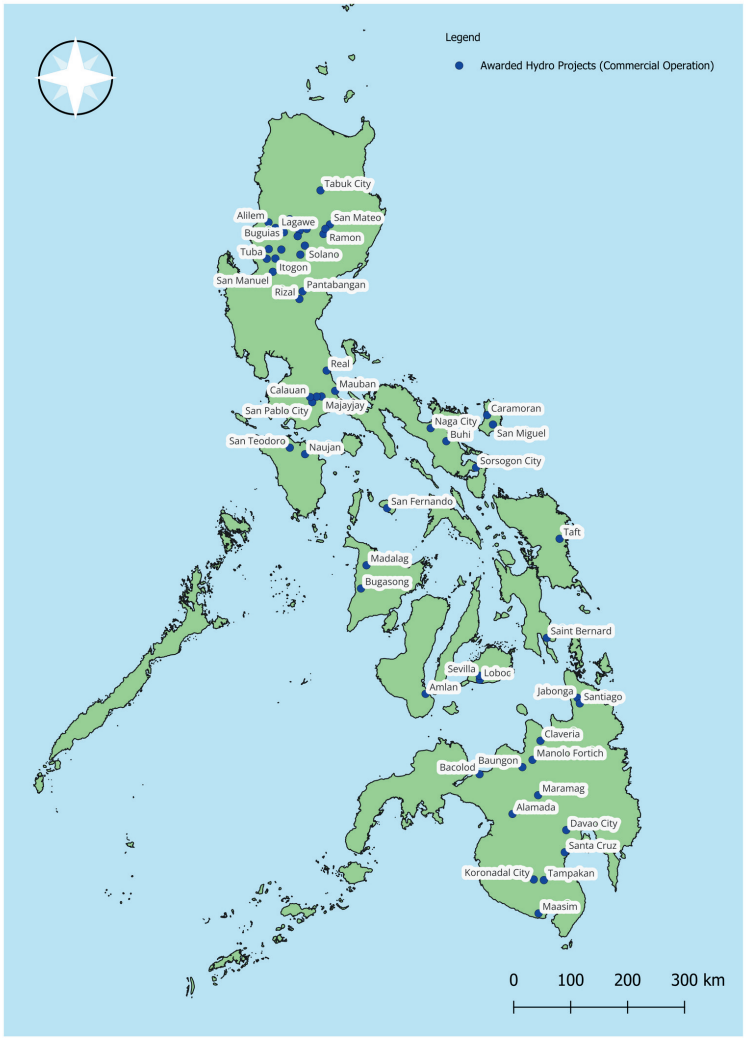



**Figure 18. Location of Hydro Power Plants**

# Results

Many large-scale hydro power projects that cogenerate with PV systems are already in operation in many countries (e.g. Thailand, Indonesia, China). This is an area that would naturally grow especially in combination with the push for both BESS and floating solar PV.

Micro-hydro power projects, albeit small and disperse, constitutes a unique market. Similar to the analysis on micro-grid sites in the context of solar PV and wind, much is to be desired when it comes to unserved or underserved areas such as the SPUGs. There are numerous remote mountainous with robust rivers and falls that can be harnessed for micro-hydro power. Even irrigation canals in more accessible farm areas can be harnessed for pico-solar application. Holistic / integrated micro-hydro packages can be offered in these locations.

**Ocean energy** in the country is clearly in its infancy stage, with registered projects all in the pre-development stage, with a total capacity of 34MW over 9 distinct projects. The project in more advanced stages of development is the Capul Island Tidal Power Project, touted to become the first of its kind in the Philippines and Southeast Asia. It is being developed by Energies PH and San Bernardino Ocean Power Corp. The project will be located in the San Bernardino Strait and will utilize Inyanga Marine Energy Group's HydroWing tidal stream turbines . The project is expected to launch by late 2025 and will include solar PV and BESS. Currently, the key players in ocean energy exploration and development are Bell Pirie, San Bernardino, Oceantera, Poseidon Renewable, Envirotek Asia, and Adnama Power.

Similar to offshore wind, ocean energy initiatives present opportunities in resource assessment, environmental impact assessment, auxiliary support (ports and shipping), EPC services, and financing.

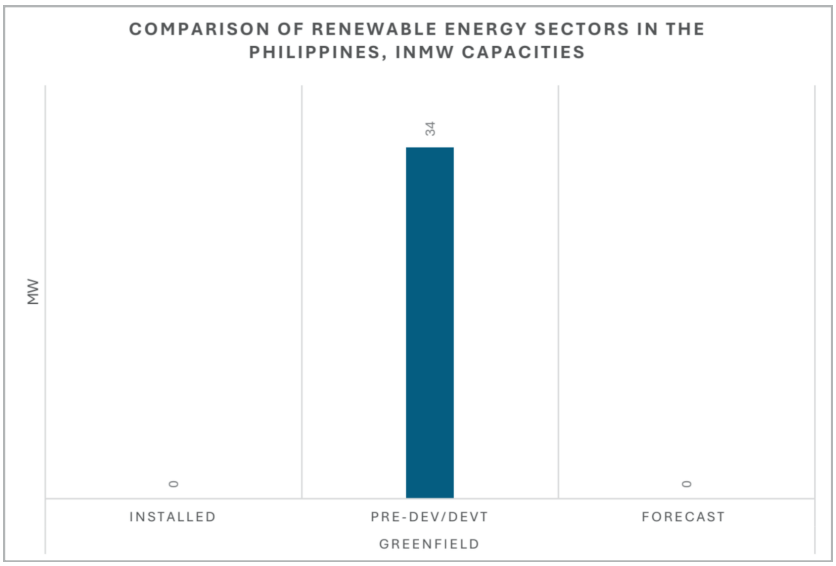



**Figure 19. Comparison of Ocean Subsectors**

# Results

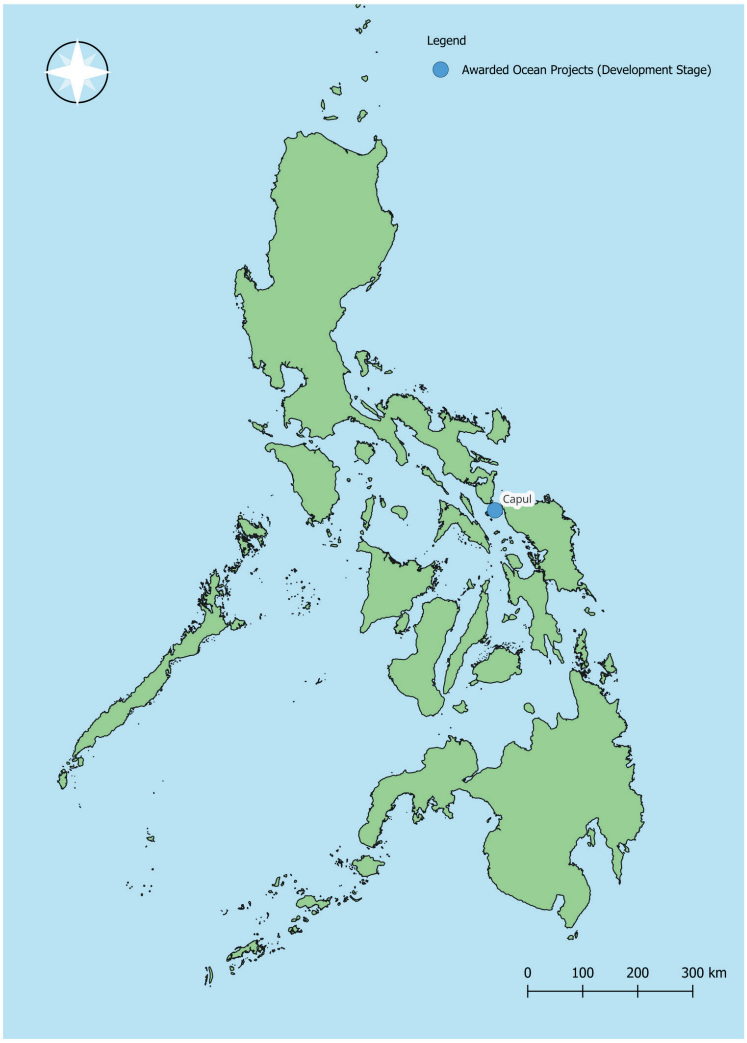



**Figure 20. General Location of Planned Capul Tidal Power Project**

This study also considers the two interrelated and crucial sectors of **electric vehicles** and **energy efficiency.** The importance of both EVs and EEs cannot be underestimated as they cut across various sectors of energy production and consumption - both drive renewable energy in multiple ways. The rapid demand for EV's is already driving more coal and natural gas power generation, and the development of more RE capacities can provide cleaner sources for electric transport. Energy efficiency initiatives enable new ways of using established technologies - from solar PV peak shaving and rooftop installations to passive heating and cooling. As such, it is vital to consider these two sectors in searching for opportunities and collaborations.

The Philippine government has been aggressively pushing for the adoption of electric vehicles. With the DOE at the helm and through the Electric Vehicle Industry

# Results

Development Act (EVIDA) as being rolled out through the Comprehensive Roadmap for the Electric Vehicle Industry, the EV industry in the country has grown rapidly. For instance, in the first 7 months of 2025 alone, the Land Transportation Office (LTO) data shows 29,715 new EV registrations, surpassing all the EV registrations in 2024. The EV registration has increased 300% from the last 2 years.

In recent years, a robustly diversified set of EVs have grown, offering various products at different price-points, becoming available to the mainstream market. This range includes hybrids to full electric options. Various brands have set up shop in the Philippines namely: China – BYD, Geely, Hongqi, Omoda and Jaycoo, Changan, BAIC, Ceres; Japan – Toyota, Nissan; South Korea – Kia, Hyundai; US – Tesla; European – Jaguar. It is important to note that Chinese brand BYD has become the apparent market leader (see Table below). This would point to possible Chinese EV + RE collaborations on many prospects from charging stations to priority dispatch (for EV) RE power plants, potentially through programs such as the REC and the GEOP.

**Table 2. Growth of Electric Vehicles Sales in the Philippines (2019 to 2024)**

| Year/ Period | Total Vehicle Sales (units) | EV Sales (units) | EV Market Share (%) | Leading EV Brands and Market Share |
|---|---|---|---|---|
| **2019** | 416,627 | 214 | 0.05 | Toyota (dominant HEV player) |
| **2020** | 244,274 | 378 | 0.15 | Toyota |
| **2021** | 268,488 | 843 | 0.13 | Toyota |
| **2022** | 372,083 | 3,091 | 0.83 | Toyota, Nissan, BYD |
| **2023** | 429,807 | 10,602 | 2.47 | BYD (~35% BEV share), Toyota (HEV leader) |
| **2024*** | 450,000 | 18,000 | 4 | BYD (~70% BEV share), Toyota (HEV leader) |

*First Quarter / Source: Manila Observatory/Render-Klima

# Results

**Table 3. EV and EVCS Targets (Philippine Energy Plan, 2023 to 2050)**

| EV / EVCS Targets | | Short Term 2023-2024 | Medium Term 2025-2028 | Long Term 2029-2050 | Total |
|---|---|---|---|---|---|
| **Vehicle Type** | EV Type | | | | |
| **Cars(Sedan, SUV, UV)** | HEV | 48,348 | 161,622 | 238,929 | 448,899 |
| | PHEV | 8,061 | 26,940 | 169,594 | 204,595 |
| | BEV | 8,061 | 26,940 | 948,194 | 983,195 |
| **Tricycle** | BEV | 22,258 | 74,414 | 399,444 | 496,116 |
| **Motorcycle** | BEV | 97,818 | 327,029 | 2,243,094 | 2,667,941 |
| **Bus** | BEV | 379 | 1,263 | 6,942 | 8,584 |
| **Total EVs** | | 184,925 | 618,208 | 4,006,197 | 4,809,330 |
| **EV Charging Stations** | | 5,188 | 17,338 | 150,916 | 173,442 |

The implementation of the **Energy Efficiency and Conservation Act (RA 11285)** has been underway since its signing in 2019. This provides an even broader scope for integrated EE and RE development that would include EVs and RE. The law further mandates the development of efficiency and conservation measures among all high energy consuming companies, referred to as Designated Establishments (DE). Designated Establishments are private entities in the industrial, commercial, transport, agriculture, power, and other sectors identified by the DOE as energy-intensive, based on their annual consumption from the previous year. Designated Establishments are classified as follows:

**Table 4. Types of Designated Establishments for Energy Efficiency and Conservation**

| Typology | Annual fuel and electricity consumption (previous year) | Report Submission |
|---|---|---|
| **Other DEs** | 50,000 kWh equivalent and below | Optional / Encouraged |
| **Type 1** | 50,001 kWh equivalent to 500,000 kWh equivalent (Commercial & Transport) 50,001 kWh equivalent to 1,000,000 kWh equivalent (Industrial) | Mandatory |
| **Type 2** | 500,001 kWh equivalent to 4,000,000 kWh equivalent (Commercial & Transport) 500,001 kWh equivalent to 8,000,000 kWh equivalent (Industrial) | Mandatory |
| **Type 3** | 4,000,001 kWh equivalent or more (Commercial & Transport)8,000,001 kWh equivalent or more (Industrial) | Mandatory |

Source: Department of Energy / Energy Utilization Management Bureau

# Results

DOE reported that based on the Annual Energy Efficiency and Conservation and Annual Energy Consumption Reports submitted by Designated Establishments from 2021-2022 alone, the sector has mobilized around USD123M worth of investments into energy efficiency.

**Table 5. Emissions Avoidance Targets (Philippine Energy Plan, 2023 to 2050)**

| Sector | Programs | Emissions Avoidance | | |
|---|---|---|---|---|
| | | Short-Term (2023 – 2024) | Medium-Term (2025 – 2028) | Long-Term (2029 – 2050) |
| **Government** | GEMP | 1.87 Mt CO2e 16.15% | 3.31 Mt CO2e 15.81% | 25.06 Mt CO2e 14.48% |
| **Commercial** | PELP /Minimum Energy Performance for Products (MEPP) | 7.51 Mt CO2e 16.15% | 13.28 Mt CO2e 15.81% | 100.50 Mt CO2e14.48% |
| **Residential** | PELP/MEPPs | 18.56 Mt CO2e 34.65% | 32.79 Mt CO2e 31.66% | 248.21 Mt CO2e 23.17% |
| **Industrial** | PELP/MEPPs | 17.43 Mt CO2e 19.38% | 30.81 Mt CO2e 19.17% | 233.18 Mt CO2e 18.35% |
| **Transport** | VFELP/FEPR | Pending data | Pending data | Pending data |
| | EVCS | Pending data | Pending data | Pending data |
| | 10% EV penetration by 2040 | N/A | N/A | 116.54 Mt CO2e 8.22% |
| **Utilities & End-use** | Power Sector Efficiency | 4.34 Mt CO2e 27.95% | 7.53 Mt CO2e 27.95% | 54.03 Mt CO2e 27.95% |

# KEY INFORMANT INTERVIEWS & FOCUS GROUP DISCUSSIONS



This section synthesizes insights gathered from industry stakeholders through key informant interviews, focus group discussions, and surveys conducted with Philippine and Chinese renewable energy stakeholders. These consultations provided practical perspectives on financing challenges, technology gaps, policy barriers, and market dynamics affecting renewable energy deployment. Stakeholders also shared recommendations for strengthening partnerships, improving technical support, and addressing financing constraints.

# Key Informant Interviews & Focus Group Discussions

The analysis of official plans and reports, service contract lists, and other related literature was concurrently complemented by key informant interviews (KIIs) and focus group discussions (FGDs). The guide questions indicated in the methodology section were used in the KIIs and FGDs. The KIIs and FGDs were further augmented by online surveys.

For the Philippine side, the sectors represented in the KIIs and FGDs were the solar PV industry, government, private financing, offshore wind, IT/App technical support, and non-profit industry associations. Majority of the participants came from the solar PV industry. For the China side, there were five private companies who responded to a rapid survey and one who accommodated an interview. The brief descriptions of all the participants can be found in Annex 38.

The interviews with the aforementioned organizations were done from August to October 2025. The various discussions yielded substantial insights and recommendations. The more detailed notes on these interviews are presented in Annexes 30 to 35 of this study. In the interest of focusing on key points that define and potentially drive opportunities for Philippine-China partnerships, the following **recurring challenges** were gleaned from the discussions:

1. **Financing Challenges** – Philippine companies face challenges in accessing funds due to stringent bank requirements, lack of collateral, limited partnerships with fintech companies, and low customer payment capabilities. These financial barriers hinder the scaling of renewable energy projects, particularly solar PV for rooftop, residential, and commercial applications. The following statements illustrate the typical responses to the question on financing:

> *"It is the (financial) capacity of the client, (their) options as to how to pay. What happens is that we are (providing) terms. For example, for the first year, we are limited to proof of concept. We really need financing. As the requirement of the banks are too much."* **(Woodrow Solar)**

> *"The business is hard to start if you do not have capital. And it is hard to maintain the capital if you do not have something? The challenge is how we can bring the products here (Philippines)."* ***(EcoSolutions)***

> *"(We need to) explore credit line options with Chinese suppliers"* ***(Sta Rosa FGD Solar PV distributors)***

> *"Indian solar panel manufacturers like Siwari offer financing options for end customers, which is not common in the Philippines. Chinese suppliers could consider partnering with local fintech companies or financiers to overcome customer fears and provide more accessible financing options. Market aggregation and supplier inventory finance can be an area for growth in the solar industry."* ***(Open Solar)***

# Key Informant Interviews & Focus Group Discussion

Across all the discussions and interviews, the respondents consistently mentioned limited access to financing and stringent bank requirements as significant barriers to renewable energy adoption in the Philippines. Additional recommendations include simplifying financing processes, increasing government subsidies, implementing supportive policies like GEOP, GEAP, and RPS, and accessing funding from organizations like multilateral development banks (MBPs).

2. **Technology and Technical Support Challenges** – Participants in the KIIs and FGDs consistently mentioned the lack of standardized installation practices, equipment compatibility issues, and poor after-sales support as key obstacles to renewable energy adoption and scaling up. Some of the key comments on this concern were:

> *"Chinese companies have shifted from direct sales to using local distributors in the Philippines. While this shift has increased the number of distributors, it has created complications with warranty management and after-sales service, as customers now have to deal with multiple layers between themselves and the manufacturer."* ***(OREEI)***

> *"How flexible are you (as a local distributor) when it comes to configurations as it is important to comply with required technicalities. What is your support when it comes to aftersales? On the perspective of distributors, these are the (important) things to always (consider). It (technology) should be compatible and less of a burden (to the consumer), that (problems) can be solved if there is something wrong, (it can be solved) within the country (Philippines) without calling out (to the suppliers)."* ***(EcoSolutions)***

> *"On the product level, there is no standard made for the Philippines. As well as installation workmanship. Even though there is a TESDA certification, there is no required installation standard to follow."* ***(PSSEA)***

In at least two FGDs, solar companies proposed various recommendations such as the following:

- Conduct proper due diligence when selecting distributors and partners to ensure quality technical support; gather feedback from installers before bringing in new products to ensure market fit; continue evaluating Chinese renewable energy products for compatibility with Philippine requirements.
- Establish consistent supply chains to avoid delays in product delivery.
- Strengthen after-sales support networks for renewable energy products, ensure superior quality products and timely technical support for installers.
- Improve forecasting for product orders to prevent supply shortages.

# Key Informant Interviews & Focus Group Discussion

More specific issues were discussed in the interviews such as inverter and battery compatibility, solar panel specifications, and the importance of spot-checking products upon arrival to ensure quality standards. In addition to this, some participants also confirmed the lack of buyback schemes among suppliers and the need for end-to-end recycling processes for solar farms.

As a possible response to the aforementioned issues on technical support, Chinese firm YC Solar indicated a positive response, stating that *"we can send our engineers to the product site to help them and to teach them, to train them how to install a solar (PV)system and also help them to do the market research with different scenarios or different industries.* ***(YC Solar).***

3. **Lack of End-User Education and Awareness** – Directly relating to end-user financing issues and technical support needs as discussed above is the need to educate consumers about renewable energy benefits and technologies in order to overcoming behavioral and knowledge barriers. Awareness campaigns and training programs are recommended to increase adoption. Speaking about this concern, a respondent said:

> *"(The) challenge is the (in) the explanation or (in) educating the end-user. (It is) quite challenging as they are not yet aware of who to choose from. There is a behavioral change (needed) in RE. News is helpful. Some are interested but do not deep dive into the technology yet."* ***(Infinite Solar)***

4. **Limited Battery Supply Option** – In view of the rapidly tightening supply and intensifying demand for batteries due to increased RE adoption and accelerated EV roll-out, the respondents reiterated the need for more battery supply options, supply arrangements, and innovations in order to further scale RE in the Philippines. Participants consistently discussed that affordable batteries, advancements in technology (such as improved inverter-battery flexibility), and use of related remote IT platforms can improve adoption and efficiency. When asked on what innovation can drive RE scale-up, key participants responded in this manner:

> *"Batteries. China has a longer horizon as they have national targets. Again, education, where is the technology going? This will help us here in the country in terms of timing."* ***(Infinite Solar)***

> *"When batteries become affordable"* ***(PSSEA)***

On top of off-grid solar PV set ups that require batteries and the increased adoption of electric vehicles, more utility scale solar PV with battery energy storage systems (BESS) are getting into the mix of projects in pre-development and development. In pursuit of

# Key Informant Interviews & Focus Group Discussion

improved RE stability and even grid stability, BESS are also being deployed for hybridization with other RE technologies (such as hydro and wind) and are being integrated with transmission or distribution facilities as ancillary services. Back-up power systems for disaster preparedness are also increasingly becoming battery dependent.

5. **Partnerships and Collaboration** – Across the different discussions and interviews, respondents underscored the need to strengthen partnerships with Chinese suppliers. By pursuing such partnerships, Chinese renewable energy enterprises can bring technical expertise, funding, and market testing opportunities. According to the participants, attracting foreign investments and leveraging equity capital can help scale utility-scale projects and off-grid renewable energy solutions. Collaboration among distributors, suppliers, and local companies is seen as essential for improving product quality, technical support, and after-sales services.

   Participants in the KIIs and FGDs emphasized on building trust-based relationships and partnerships between local and foreign companies. In this context, some feedback regarding a few Chinese companies is worth noticing:

   > *"Chinese investors prefer larger infrastructure investments. Some are primarily focused on land banking rather than project development. There is also talk about some Chinese companies who change partnership terms and conditions in the middle of negotiations"* ***(participant requested anonymity)***

   > *"We were working on a joint venture agreement with a Chinese company for a 132-megawatt solar project. We signed an agreement in January 2024, but later on the Chinese partners later withdrew, without valid reasons, even citing concerns about the West Philippine Sea as an excuse."* ***(OREEi)***

6. **Chinese Companies Interest in the Philippine Market** – In the various KIIs and FGDs, participants were consistently stated that attracting foreign investments and leveraging expertise from Chinese renewable energy companies are seen as opportunities to address local challenges. The respondents further suggest that offering lower introductory prices and conducting market testing are strategies for foreign companies entering the Philippine market.

   In view of the feedback of the participants on the matter of partnerships and foreign investments, it is important to consider the view of Chinese companies on further investing in the Philippines.

   The survey conducted among the 5 Chinese companies provide some insights on the interest or level of engagement in the Philippine RE market. Some highlights of the responses were the following:

# Key Informant Interviews & Focus Group Discussion

- Three companies already have 4 different projects in the Philippines in partnership with local companies, implemented through Build Operate and Transfer, EPC, and/or equipment supply.
- In a scale of 1 to 10, with 10 being the highest, three companies rated the Philippines 9 in terms of attractiveness of the RE market in the ASEAN, the other two rated 8 and 7.
- The key reasons for interest in the Philippine RE market are abundant resources, policy support, and growth in demand.
- Key policy barriers identified in developing projects were unstable policy implementation, complex permitting and approval process, restrictions on foreign investment access, and unstable bilateral relations.
- Key technical challenges identified were: Chinese technology standards were incompatible with Philippine standards, poor equipment adaptability, and shortage of local technical talent.

To complement the survey among Chinese companies, an interview was done with YC Solar. The interview validates the continuing interest of Chinese companies in participating in the Philippine RE market. The key statements on this were as follows:

> *"We have already set an office in Malaysia, and we are planning to set an office in the Philippines in the future. And I think we have several aspects to cooperate. The first is that after many manufacturers went to the Philippines to set a factory, we also have a plan to cooperate with local customers together to set a factory there."*

> *"We have a plan to set up all the solutions we have in China to the Philippines to make a big showroom to show what we can do together for a more sustainable future."*

> *"After several times we have been to the Philippines, we have seen so many opportunities, especially for the residential, commercial, and industrial. But we did not see too much solar system covered on the rooftop. I do not know what the reason is. Maybe it is an investment or something else."*

Across all the KIIs and FGDs, the participants were asked about their views on the current issues between China and the Philippines regarding the South China Sea / West Philippine Sea, particularly on its impact on RE development. The respondents consistently acknowledged the geopolitical issue but clarified that it does not directly affect their day-to-day decisions or directions in terms of RE development or business development in general. The respondents consider the issues and concerns discussed above as more salient in terms of partnerships and business growth compared to the maritime issue mentioned.

# Key Informant Interviews & Focus Group Discussion

7. **Philippine Government Support and Policy Advocacy** – The participants' comments regarding Philippine government support further validate key concerns already articulated above. To reiterate, the participants stated that simplifying financing requirements, developing certification standards, and implementing supportive policies are critical for scaling renewable energy adoption. The need for government involvement through policies, subsidies, and programs like GEOP, GEAP, and RPS is a recurring recommendation among the respondents.

To cap the primary data gathering process, a final **Roundtable Discussion** workshop was conducted with solar PV stakeholders on December 5, 2025. The highlights of the workshop were the following:

### Key Findings

- The Philippine renewable energy market is dominated by utility-scale solar projects, while rooftop and microgrid solutions remain underdeveloped despite their potential. Emerging technologies like floating solar and ocean energy are largely untapped, presenting opportunities for investment.
- Major barriers include high financing costs, technical compatibility issues, weak data on installed systems, and complex permitting processes. Stakeholders highlighted the need for improved end-user awareness and a national program for battery and photovoltaic (PV) end-of-life management.
- Access to finance is a critical barrier, with suggestions for innovative financing solutions such as supplier financing and blended concessional products. Successful community-based models, like the Sitio Malicongcong solar system, demonstrate the viability of cooperative financing and local management.

### Opportunities for Cooperation

- Six pathways for cooperation include focusing on niche markets in large-scale renewable energy, enhancing urban solar applications, developing holistic off-grid project packages, mainstreaming innovative technologies, supporting circular economy initiatives, and targeting local government units (LGUs) and public facilities for pilot projects.
- Proposed pilot concepts include rooftop financing programs, island microgrid packages, battery and PV recycling trials, and demonstrations of floating solar technology.

### Risks and Mitigation Strategies

- Key risks involve permitting and legal challenges, trust issues with partners, product quality concerns, speculative project pipelines, high capital costs, and e-waste management. Suggested mitigations include policy briefs for streamlined processes, supplier accreditation, and establishing minimum technical specifications.

# Key Informant Interviews & Focus Group Discussion

### Next Steps

- Immediate actions include convening discussions with Chinese enterprises, identifying a credible institutional touchpoint for cooperation, and preparing policy briefs to address regulatory barriers. A working group is recommended to review pilot concepts and facilitate collaboration among stakeholders.

Immediately pursuing the aforementioned next steps, additional interviews with Chinese companies were done. These interviews further reinforced the following key points:

- The Philippines offers a relatively free and open market, with fewer restrictions compared to other Southeast Asian nations, facilitating easier entry for local and foreign investors.
- A strong presence of foreign investors, including Chinese companies, indicates a separation of business from geopolitical tensions.
- The Philippines generally has clear legal frameworks that protect private and foreign investments, particularly in renewable energy, where 100% foreign ownership is now permitted.
- The competitive power sector, with multiple utilities, provides various entry points for investors, supported by a developed financing environment and the presence of the Asian Development Bank.
- Early challenges for Chinese companies included trust issues and a preference for Western suppliers, but perceptions have improved significantly over the past decade.
- The shift towards private-sector partnerships has proven more efficient than government projects, which are often slower and more complex.
- While wind energy development is still nascent, the overall renewable energy market has matured, particularly in solar, with lower entry barriers and improved networks.
- The current phase reflects a transition towards structured growth, similar to the earlier solar development trajectory.
- Misconceptions about the Philippine market being unfriendly to Chinese businesses are largely unfounded; success depends on respecting local laws and practices.
- The greatest cooperation potential lies in project investment and EPC activities, rather than manufacturing.
- Technical adaptation has not been a major issue, as local engineers are well-versed in international standards.
- Recommendations include improving communication (i.e. Chinese language use) with local government officials and focusing on large-scale utility projects under the Green Energy Auction Program (GEAP).

*Annexes 42 and 43 provide more details regarding these follow-up meetings with the Chinese companies.*

# PROJECT OPPORTUNITY PATHWAYS



Building on the analysis and stakeholder consultations, this section identifies key pathways for strategic collaboration between Chinese and Philippine renewable energy stakeholders. These pathways represent areas where technology, financing, and project development partnerships can unlock significant growth. They highlight opportunities in large-scale renewable energy deployment, urban solar applications, rural electrification, emerging renewable technologies, circular economy initiatives, and local government partnerships.

# Project Opportunity Pathways

The preceding analyses were geared towards answering the top-level research question: ***"How can Bridging Opportunities help unlock, accelerate, or scale-up Chinese-Philippines cooperation in renewable energy in pursuit of Philippine national targets?"***

The following sections provide recommended pathways that can be pursued to further respond to this question and expand China-Philippines cooperation in renewable energy development. The description of both opportunities as well as corresponding threats in each path is intended to provide an initial stock-taking on the part of potential Chinese partners, in the interest of gauging appetite to engage in a particular renewable energy sector.

It is also important to clarify at this point that while the opportunities and threats are being presented (external drivers), data is still being reviewed for the description of strengths and weaknesses (internal drivers) i.e. capacities and interests of Chinese suppliers, investors, and partners. Once the analysis of this data set gets done, more granular descriptions of the pathways or specific ones will be done, geared towards the identification of actionable next steps.

## Pathway 1: Leveraging Specialized Capabilities in Large Scale RE

The dominance of solar and wind in large scale RE development is apparent on all fronts - in installed capacity, predevelopment/development, and forecast. This clearly indicates a crowded playing field, with a diverse and wide range of major players active in the industry. The major ones include Sta Cruz, PV Sinag, Helios, Jobin, Solarace1, Ph Renewables, Solar Philippines, Nuevo Solar, Petro Solar, Citicore, Phinma, MSpectrum, and Solar Pacific.

A crowded marketplace in the solar and wind large scale projects also continue to operate on a consistently challenging project development terrain as land acquisition becomes tighter, transmission grid access become more congested if not totally deficient, and environmental impacts begin to manifest more significantly, especially in the marine/aquatic environment. This further creates reason to pause on further engaging in this space.

Nevertheless, traditional opportunities will continue to be attractive, depending on the appetite of investors or suppliers for competition and risk. This would particularly apply to the supply of solar panels, inverters, batteries, and balance of system which will continue to increase in the coming years; and its natural companion, the provision of Engineering-Procurement-Construction (EPC) services. In this regard, it is important to reiterate that Chinese equipment and services continue to be well established and even dominant in the Philippine market.

# Project Opportunity Pathways

Pathway 1 explores opportunities on 2 categories. Category 1 interests itself in maintaining the strong presence of Chinese brands and services. Category 2 looks at a slightly more diverse and relatively novel set of activities.

For **Category 1**, it is vital to take note of industry feedback regarding the potential erosion of confidence in Chinese brands and companies. Key informant interviews reveal that the level and quality of technical support and customer care (especially after-sales service) around Chinese technology have decreased over the years, likely due to the influx of more technology suppliers and options, in addition to the already established market presence (Dipolog and Sta Rosa FGDs, OREEi). Another crucial feedback is the negative impression on some Chinese investors and EPCs who, after extensive pre-development discussions with Philippine RE developers, suddenly change terms or go incognito (OREEi). Promised big ticket investments also reportedly do not actualize (Clime Capital). On the construction stage, there are feedback that Chinese EPCs extensively subcontract works to local contractors at what is deemed as unreasonable rates and arrangements, leading to incomplete projects and pole vaulting (OREEi).

These reports provide an opportunity to shore up support for established supply chains and markets. This can be done through specific initiatives such as sponsoring technical trainings, enhancement of more responsive online/remote technical support, and provision of in-country service units or spares. On the matter of partnership building, there is a need to explore ways to check erring Chinese investors, suppliers, and EPC companies. For starters, a mechanism for reporting can be put in place in cooperation with appropriate bodies in China (e.g. equivalent of chambers of commerce).

**Category 2** looks into relatively newer inroads into the mainstream markets of solar and wind, and to a certain extent even into hydro, geothermal, and biomass. This would include (a) Hybrid Systems, (b) Specialized Equipment and Approaches, (c) Auxiliary Support Systems, (d) Technical Assessments, and (f) Allied Products.

a. **Hybrid Systems** are the natural next stage for RE especially in large utility scale projects. The inclusion of BESS for starters is a straightforward prospect in almost all RE facilities, particularly and most of the time conveniently with solar PV. BESS not only provides more stability and addresses variability, but also offers additional functionalities such as ancillary service, embedded power source, and back up / emergency power. BESS aside, the more conventional hybrid systems will continue to be an opportunity considering that most RE installations are on single technology mode. Prospects on adding floating PV in existing hydro reservoirs is now gaining momentum. Solar pumped impounding hydro is also gaining interest among developers and investors.

# Project Opportunity Pathways

Biomass power plants can be supplemented with agro-solar facilities and feedstock production can be improved through solar powered irrigation. Instead of simply offering products and engaging in quality and price points, a competitive edge could be gained by positioning towards hybrid configurations. Somewhat related to hybrid systems but with some distinct characteristics,

**b. Specialized Equipment and Approaches** would aim to seize specific needs of emerging RE technologies and configurations. For instance, the rapid rise of floating solar PV projects would need cost effective, robust, and environmentally benign floatation devices. Submarine cables and grid interconnections in marine/aquatic environments would also particular needs that would be in demand. Special approaches in this context would refer to the adaptation of typical models to changing needs and requirements. An example of this is agro-solar, which does not necessarily require drastic technological shifts but would entail re-design in terms of installation height and spacing. Agro-solar or agrivoltaics is a potential work-around on land scarcity as it preserves traditional agricultural use thereby sustaining its food production function and avoiding lengthy land conversion processes. Related to this, RE (solar PV, wind, hydro) for irrigation and potable water supply continue to be in demand especially with government push for increased agricultural productivity.

**c. Auxiliary Support Systems** would not be limited to RE but would consider other products, services, or capabilities that would be needed in the implementation of the dominant RE projects especially solar and wind. Aside from direct EPC, other crucial services would prove essential in the years to come, and this would include, but not limited to port construction and management, logistics, shipping, auxiliary power during construction, heavy equipment, and skilled personnel. In view of the exponential growth of wind and solar in the country, gaps in the provision of these support services are anticipated. The DOE is particularly advocating for the rapid development of ports and the upskilling of local labor, especially for onshore and offshore wind installations.

As large RE, again especially wind and solar, encroach more sensitive and traditionally untouched spaces (e.g. marine ecosystems, biodiversity areas), **(d) Technical Assessments** such as Environmental Impact Assessment and Marine Spatial Planning would prove crucial. This would require specialized expertise and capabilities. For example, offshore wind and floating PV would benefit from more precise measurements such as using LIDAR and SODAR. Remote sensing instruments for resource assessments (e.g. anemometers) would also need autonomous power and connectivity. Currently, the National Mapping and Resource Information Authority (NAMRIA) and the University of the Philippines (among others) are already utilizing LIDAR and INSAR/IFSAR remote sensing technologies, especially for hazard mapping and DRM. Nonetheless, more capability is needed in the renewable energy sector. Chinese technology providers and experts can consider serving this as a special market

# Project Opportunity Pathways

Finally, (**e) Allied Products** are RE applications that might not be directly needed by the RE facility itself but would be of value to its vicinity development. For instance, floating solar PV in hydro reservoirs would typically have to co-exist with other water uses such as fishing and recreation. With the increased pressure on the same ecosystem, technology enhancements would prove necessary in the interest of environmental protection and sustainability. In this example, solar or small wind powered perimeter lighting, road lighting, park lighting, buoy lighting, boats, and aerators would be potential product offerings. This can also apply in marine environments for offshore wind development. The Xiong'an China Communications Future Science and Technology City is an example of this, one that harness clean energy and green buildings to establish a benchmark for cities where technology and nature can work harmoniously.

## Pathway 2: Enhancing Support for Urban Solar Applications

Pathway 2 looks into three areas of opportunity. Category 1 is on solar rooftop applications, Category 2 is on solar charging stations for electric vehicles, and Category 3 is on support for energy efficiency initiatives.

On **Category 1 – Solar Rooftop Applications**, the Institute for Climate and Sustainable Cities (ICSC) in cooperation with the DOE estimated total solar rooftop installations nationwide at more than 1,800MW using its proprietary machine learning technology called SPECTRUM (2025). ICSC further estimates the total potential rooftop solar PV capacity in the entire Philippines at around 106,000MW, a massive potential even compared to total renewable energy targets. In addition to residential, commercial, and industrial buildings, thousands of public schools, covered basketball courts / sports centers, municipal halls, health centers, and other public facilities across the country present an immediate opportunity for solar rooftop applications.

Solar rooftop technology continues be popular and is typically the most accessible image of solar PV technology for the general public, however this interest is not necessarily translating to actual adoption. According to a study conducted by the Ateneo de Manila University (2024), rooftop solar technology's high upfront cost and lack of public awareness regarding its benefits remain the major blocks for its widespread use. The study surveyed 403 respondents to understand why households remain reluctant to invest in solar technology despite its economic and environmental benefits. Although most of the respondents were interested in adopting solar technology, only one in five had firm intentions to actually purchase and install solar PV systems. The survey also confirmed that aside from upfront cost, reliability of technology providers, warranties, and the quality of the installations were equally important considerations.

# Project Opportunity Pathways

There are at least 130 active companies providing rooftop solar PV and net metering services installation in the Philippines. Notable ones include Philergy, Solaric, Solar Philippines, Edward Marcs, MATEC, Greenergy, Solaready, Greendot, OREEi, Spectrum. Some are already offering in-house financing such as Go Solar (10 years to pay). Despite this seemingly robust presence of rooftop solar PV providers, the low adoption prevails, and this is where Chinese partners suppliers can come in.

In-house financing is apparently still insufficient and inaccessible, with the likes of Go Solar proving to be more an exception than the rule, and even for the likes of them the bandwidth for loans would be limited. Considering the interest and the demand, there is ample space to provide financing options for rooftop solar PV adopters, from grid tied commercial establishments to private homes. A vital complement to financing would be proactive customer care, with key attention to responsive technical support and aftersales services including attractive warranties and rapid troubleshooting. These can be done in partnership with the local providers described above, through various modes including supplier financing, inventory financing, and invoice financing. Technical support capability is also locally present and can become more effective with continuous training, provision of state of the art instruments, and service units / spares. Online apps for rooftop solar PV tracking accessible to both suppliers and customers will also drive general public awareness and appreciation as well as technical tracking and troubleshooting (where needed) (Open Solar).

**Category 2 – EV Solar Charging Stations** would directly leverage the leadership of Chinese EV brands, particularly BYD, in the Philippine market. There are prospects for Chinese solar PV suppliers to link with the said EV companies to develop end-to-end solutions on the replication of charging stations. The Philippines' Comprehensive Roadmap for the Electric Vehicle Industry (CREVI) outlines a short-term goal of deploying 7,300 EV charging stations by 2028 (DOE/EUMB, 2025). The DOE further reports that as of March 2025, there are only 912 publicly accessible operational charging stations nationwide, mostly located in the National Capital Region.

The aggressive push for more EV penetration in the transportation sector will directly drive the need for charging stations. Solar PV with BESS would be a natural fit for charging stations and the provision of such facilities along highways and key cities outside the National Capital Region stands as a low hanging opportunity. Pursuing this opportunity will reinforce the push for EVs as more potential buyers will find confidence in the wider coverage of charging stations and finally actualize purchase or adoption. This initiative will also facilitate the standardization of or the development of flexible charging protocols.

# Project Opportunity Pathways

**Category 3 - Energy Efficiency** initiatives and investments are required by law from Designated Establishments as described in Table. Energy efficiency investments include among many others: lighting retrofit; heating, ventilation and air-conditioning (HVAC) retrofits or upgrades; boiler replacement; motor replacement; and smart energy applications. Renewable energy related energy efficiency investments would include solar PV for power augmentation or peak shaving, cogeneration, and EV charging. Other systems that can be coupled with appropriate RE include district cooling, irrigation, water supply, and smart manufacturing.

## Pathway 3: Developing Holistic Project Packages for Underserved and Unserved Areas

As Figure 4 and 5 shows, there are numerous off-grid sites in the country open for micro-grid or RE solutions, on single technology mode or hybrid. Small Power Utilities Group (SPUG) areas alone have 490 distinct sites nationwide with a total requirement of at least 600MW or an average requirement of 1.2MW per site. Most of these sites are partly energized by expensive and unreliable diesel generators.

Most technology providers shy away from these off-grid sites due to the difficult geographic inaccessibility (typically remote islands or upland communities), prohibitive cost of logistics and investments, and low priority for financing (elevated risk, small scale, and low yielding in terms of carbon offsets). Despite these constraints, opportunities for RE applications abound in these areas including lighting, water supply, telecommunications, cooling, ice making, desalination, irrigation, milling, drying, and many others. More pioneering technology providers such as OREEi, HSSI, and Go Gridless have developed business models for several types of RE enterprises in remote locations.

Investing in off-grid sites will directly support the country's bid for full electrification in last mile villages by 2035. This will be an opportunity to develop viable partnerships with the DOE and will harness policies in place such as QTP provisions and the Micro-grid Law.

While minor compared to utility scale RE, the aggregate 600MW of SPUG requirements still amounts to a ballpark market value worth at least USD480 million. All challenges considered, this still stands as a substantial opportunity that can be pursued by Chinese firms in cooperation with Philippine RE system integrators.

Typically, RE systems that have been deployed effectively in off-grid areas in the country are solar PV micro grids, micro-hydro power plants, small wind, and small gasifiers. These could further be enhanced into hybrid systems of two or even three types of RE (e.g. solar, wind, gasifier). These RE system packages can be designed to be

# Project Opportunity Pathways

modular to adapt to the different off-grid sites, funded through a partnerships program with the government, and/or co-financed through supplier, inventory, or invoice financing (similar to Pathway 2 options). Pathway 3 promises to be the most potent in terms of diplomacy, visibility, and community relations.

## Pathway 4: Mainstreaming Greenfield/Brownfield RE Technologies

The nascent RE sectors in the Philippines specifically ocean and low enthalpy geothermal are slowly but steadily gaining ground. While practically still on research and development (R&D) stage, these two technologies could prove to be game-changing in the long term. Chinese firms could join the first movers in this area if it can support current initiatives to mainstream these technologies.

**Ocean energy** in the country is still in its infancy but holds tremendous potential in terms of power generation capacity. The Philippines has a total coastline of 36,289 kilometers, ranked 3rd in Asia and 5th in the world when it comes to longest coastlines. It is bound by the Pacific Ocean, the Philippine Sea, the South China Sea, West Philippine Sea, the Sulu Sea, and the Celebes Sea. Initial estimates indicate a theoretical energy generation potential for this vast resource at 170 Gigawatts.

Similar to Pathway 1, specifically on potential support for offshore wind development, ocean energy development can also benefit from Auxiliary Support Systems such as port construction and management, logistics, shipping, auxiliary power during construction, heavy equipment, and skilled personnel. Being directly located in sensitive marine environments, ocean energy development would require even more Technical Assessments such as Environmental Impact Assessment and Marine Spatial Planning. Ocean energy has a wider range of technical options (tidal, wave, current, ocean thermal) and this would require even more specialized expertise and capabilities that may not be sufficiently present in the Philippines at the moment.

**Low enthalpy geothermal** is even more at the research and development stage, with barely 10 R&D projects done or being conducted nationwide. These are located in the provinces of Cagayan, Batangas, Romblon, Camiguin, and Davao del Sur. The widespread location of these research initiatives from North Luzon to Southern Mindanao is testament to the rich geothermal resources of the country. Being located along the Ring of Fire of Pacific volcanic and tectonic activity , the Philippines is considered as one of the world's top producers of geothermal power.

Low-enthalpy geothermal has specific technical needs such as geological and hydrological studies, environmental impact assessments (focus on waste and land subsidence), and energy conversion and heat exchange technologies. Chinese companies with capabilities in this area can provide technical assistance support.

# Project Opportunity Pathways

**Waste to energy (WTE)** projects can also benefit from this kind of support. While WTE has been around for some time now, it has not been as successful in scaling up compared to other RE technologies like solar and wind. The complexity and higher risks associated with WTE projects necessitate further analysis on how it can be developed and implemented more effectively, and such analysis may even include the development and deployment of new WTE technologies or processes, including feedstock management.

## Pathway 5: Supporting Circular Economy Initiatives

The Philippines has more than enough laws pertaining to waste management, namely Republic Act (RA) 8749 (Clean Air Act of 1999), RA 9003 (Ecological Solid Waste Management Act of 2000), RA 9729 (Climate Change Act of 2009), and RA 11898 (Extended Producers Responsibility Act of 2022; however, much is to be desired when it comes to reduction, repurposing, reuse, and recycling particularly in renewable energy. While all renewable energy technologies have their fair share of waste and by-products, particular concern is given to solar PV due to its rapid turn-over, modularity, portability, and dispersion. The fact that it is one of the most active sectors in terms of growth along with wind power, due attention is needed for possible circular-economy efforts. Wind also has issues in terms of blade disposal, but its components are long gestating and fixed, location wise.

It is increasingly being recognized that the heavy dependency on solar energy is now generating crisis-levels of waste worldwide. Various discourses on this issue include waste assessment, policies enhancement and regulation, and life cycle management encompassing production, use, monitoring, collection, recycling, and reuse.

Solar PV modules are composed mainly of glass, nickel, copper, aluminum, silver, and critical substances like tellurium, manganese, and gallium. Sometimes, they also contain hazardous metals like lead, cadmium, and selenium. Solar PV module waste is mainly composed of glass (68.10%), aluminum (13.99%), steel (7.98%), ethylene vinyl acetate or EVA (5.94%), and the rest are nickel, copper, silicon, iron, and magnesium. The main substances have high recycling yields. The actual amounts of these substances in grams or kilograms would depend on the size of a solar PV module. As a basic reference, this paper will use a 500-watt solar PV module which weighs around 30 kilograms.

At the macro-level, the 1,650MW of installed solar capacity in the country is estimated to be using around 3.3 million solar PV modules with an approximate gross weight of 99,000 tons (again using a 500-watt module as typical reference). This roughly translates to around 67,000 tons of glass, 13,000 tons of aluminum, 7,000 tons of steel, and 5,000 tons of EVA, all which are expected to go out of commission in the next 10 to 15 years.

# Project Opportunity Pathways

On top of the prospective waste coming from utility scale solar PV, there are at least 1,000 registered rooftop net-metering solar PV systems amounting to around 101MW of capacity, and more seriously, there are tens of thousands of small solar PV systems in portable and off-grid mode that are not sufficiently accounted for. In several ways and locations, these smaller PV systems go out into the environment unfettered, likely generating substantial volumes of electronic waste from solar modules to batteries. With current growth projections, it is estimated that the Philippines will have almost 1 million metric tons of solar PV module waste by 2050.

Strategies for the various stages of the life cycle of PV modules would include design of more durable PV modules, use of recovered secondary materials, stronger promotion and enforcement of installation procedures, comprehensive PV waste assessment and monitoring, efficient collection and fast classification of PV module waste, and establishment of recycling and recovery methods and facilities. More near term solutions would include buy-back programs, testing and repurposing, and redeployment. These are the strategic initiatives that Chinese partners can prospectively invest into with regards to circular economy development.

## Pathway 6: Partnering with Local Government Units

Local Government Units (LGUs) in the Philippines are essential partners in RE development due to their extensive roles, institutional cover, and mandates in local development. For starters, LGUs are integral to the Energy Virtual One Stop Shop (EVOSS) process, overseeing crucial steps such as land use permits, land conversion, free-prior-informed consent (FPIC) consultations, right of way (ROW) acquisition, and environmental compliance.

Nationwide, there are 82 provinces, 149 cities, 1,493 municipalities, and 42,011 barangays (villages). The core offices of these LGUs alone would amount to substantial solar PV rooftop space, and while this would overlap with the niche opportunity on solar rooftops, there is merit in approaching LGUs as distinct sector. Aside from their core offices, they have jurisdiction over various public facilities including parks, public markets, streetlights, waiting sheds, and even schools. Mandate-wise, LGUs lead comprehensive land use planning, and with it the formulation and implementation of nationally mandated and renewable energy related plans such as the Local Energy Plan (LEP), Local Energy Efficiency and Conservation Plan (LEECP), and Local Climate Change Action Plan (LCCAP). Within these comprehensive plans, numerous opportunities on RE integration can be explored and developed.

LGUs, along with electric cooperatives, have also been mandated by the DOE to actively use missionary electrification funds from Universal Charges to support energy projects such as the Local Total Electrification Roadmap (LTER), renewable energy (RE) development promotion, and climate resilience strengthening. This expanded role of

# Project Opportunity Pathways

LGUs in RE development can further grow in view of the Mandanas Ruling. The Mandanas Ruling (or Mandanas-Garcia) is a landmark Philippine Supreme Court decision (2019) that mandates LGUs to receive a larger "just share" (40%) from all national taxes (not just BIR's internal revenue), including customs duties, VAT, and excise taxes. This will significantly increase LGU funds for devolved services like health and infrastructure (increases started in 2022).

Finally, LGUs also have national organizations such as the League of Provinces, League of Cities, and League of Municipalities. Partnering with these organizations can leverage resources and facilitate consultations and coordination.

# NICHE OPPORTUNITIES



While the opportunity pathways outline areas of cooperation, this section highlights specific market opportunities that could be pursued in the near term. These niche opportunities represent practical entry points where demand, policy support, and technological readiness already exist. Examples include rooftop solar expansion, microgrids and solar home systems for electrification, solar-powered EV charging infrastructure, distributed solar in rural areas, and solar panel recycling.

# Niche Opportunity

In the interest of sharpening opportunities towards actual implementation, specific niche opportunities were further explored, embodying a specific opportunity pathway or a blend of two or more pathways. These niche opportunities are presented in the following sections.



Photo: Asian Development Bank/Buskowitz Energy

## Niche Opportunity 1: Rooftop Solar PV

*In July 2025, the Institute for Climate and Sustainable Cities (ICSC) – a Philippine-based non-governmental organization that advances climate, energy, and low-carbon solutions - launched the Solar Power Estimation of Capacities and Tracking Using Machine Learning or SPECTRUM. SPECTRUM is a proprietary model and web platform designed to enable the visualization of rooftop solar installations and estimation of existing solar capacity across the Philippines. Through SPECTRUM, ICSC analyzed 174 cities and municipalities across the country and found 1,309 megawatts (MW) of solar capacity in Luzon, 472MW capacity in Visayas, and 61MW capacity in Mindanao – amounting to 1,846MW of installed rooftop solar PV capacity nationwide. Of the total 1,846MW of solar rooftop capacity, 1,398MW are utility scale, 202MW are commercial, and 245MW are residential installations. Using SPECTRUM, ICSC further estimated that the country has a total potential of around 106,000MW of rooftop solar PV capacity.*

*The gap between installed rooftop solar capacity and potential/hypothetical capacity is apparently massive. This indicates the size of the market where Chinese and Philippine companies can further develop partnerships. Even just doubling the current installed capacity of solar rooftop in the country, the market stands at around 1,800MW or an estimated value of USD1.6 Billion (estimated at around USD890 per kilowatt of installed rooftop solar PV).*

*To learn more about SPECTRUM, visit https://icsc.ngo/solar-mapper/, or contact ICSC: media@icsc.ngo, +63 968 886 3466, +63 917 149 5649. The government agency tasked on rooftop solar PV development is the Department of Energy particularly the Renewable Energy Management Bureau (REMB). The REMB contact number is (632) 8479-2900 (Trunkline) and the email address is infocenter@doe.gov.ph.*

# Niche Opportunity



Photo: FP Island's Quinalasag island microgrid in Camarines Sur taken after its completion in 2021

## Niche Opportunity 2: Microgrids and Solar Home Systems for Missionary Electrification

*In the Philippine's National Total Electrification Roadmap (2024-2028) the Department of Energy estimates that an additional 3.6 million households are projected to require electricity connection and services in the next three years. From 2025 to 2028, the majority of unserved households will be energized through regular connections, accounting for 2.02 million households or 63.7% of the total targets. Additionally, 27.1% or 858,000 households will be energized through the installation of solar home systems, while 8.3% or 263,000 households will be served via the extension of distribution lines with household connections. The remaining 0.9% or 27,000 households will be energized through the deployment of microgrid systems. In the same document, it was estimated that a standalone home system will cost around USD600, bringing the total market value for home systems needed for electrification at around USD 517 million. No estimated costs for microgrids were presented considering that these systems are anticipated to be customized according to the requirements of each microgrid service area.*

*The DOE is mandated to facilitate the selection of Microgrid System Provider (MGSP) for areas declared as unserved and underserved areas, this is consistent with the provisions of the Republic Act 11646, also known as the Microgrid System Act. The DOE has identified 285 unserved and 132 underserved areas, to provide basic electricity services for a total of around 40,000 households. The third microgrid auction for 167 unserved and underserved areas (to be packaged in 71 lots) is tentatively set to be conducted in early 2026. The DOE has also announced that it is accepting unsolicited proposals for the said micro-grid areas. The total electrification program of the DOE is being led by its Electric Power and Industry Management Bureau (EPIMB). The contact details are the following: email - mgsp@doe.gov.ph, contact person - Engr. Marc Louie L. Olap (Division Chief, Rural Electrification Administration and Management Division), Telephone: (02) 8479-2900 local 417.*

# Niche Opportunity



Solar PV charging station for EVs at the University of the Philippines

## Niche Opportunity 3: Electric Vehicles and Solar PV Charging Station Integration

*The deployment of solar PV systems for the charging of electric vehicles is well underway in the Philippines. The following are a few examples of this initiative:*

- *Department of Energy and Subic Bay Metropolitan Authority (SBMA): Deployment of solar assisted EV charging stations in the Subic Bay Freeport Zone.*
- *Department of Energy and Philippine National Oil Corporation – Renewables Corporation (PNOC-RC): development of solar-assisted EV charging stations in the Clark Freeport Zone.*
- *Department of Energy, Philippine Council for Industry, Energy and Emerging Technology Research and Development, and the University of the Philippines: Piloting fast-charging solar PV and battery storage for grid independence and disaster resilience.*
- *United Nations Development Program, Department of Transportation, and Pasig City Local Government Unit: Launching of solar-powered EV charging stations for e-trikes, e-bikes, and cars in Pasig City, supporting low-carbon urban transport.*
- *BYD and AC Mobility: Growing a network of solar PV charging stations for EVs in BYD distributorships and showrooms. A solar PV charging station has been installed in the BYD Showroom in Lipa City, Batangas.*

*To keep up with the rapid growth of EVs in the country, the Philippine government aims to help establish around 7,300 EV charging stations by 2028. Using this figure, at an average of about 20 kilowatts of solar PV system per charging station (roughly equivalent to the size of an average gasoline station roof, 100 to 150 square meters), the target number of charging stations can potentially translate to around 146MW of aggregated generation capacity requiring an investment of around USD130 million (at around USD15,000 to USD18,000 per 20kW solar PV system).*

*The key agency that can be approached to pursue this opportunity is the Philippine Department of Energy (DOE) Energy Utilization Management Bureau (EUMB) with contact details: email paquino@doe.gov.ph (Director Patrick T. Aquino) or lmanaligod@doe.gov.ph (Director Lana Rose Manaligod), call 8840-2289 or 8808-9212, or email the general EUMB contact doe.eumb@gmail.com for EV-related queries, with the main DOE trunkline at (02) 8479-2900.*

# Niche Opportunity


Kapatiran Solar Pump Irrigation System at AMRIS North Main Canal in Sampaloc, San Rafael, Bulacan (Photo: National Irrigation Administration)

## Niche Opportunity 4: Distributed Solar in Rural On-grid Areas

*Underserved areas in the Philippines i.e. those with only 5-16 hours of electricity daily and low power quality power, can benefit from distributed solar PV and energy storage. These areas can be found across the country, even in the franchise areas of major utilities that are technically connected to the main power grid. In this space, particular opportunities exist in the productive application of solar PV in irrigation, cold storage, and mobile energy systems.*

***Irrigation*** *– The National Irrigation Administration (NIA) aims to increase irrigated rice fields from 61,738 hectares in 2025 to 70,879 hectares in 2030 (NIA National Irrigation Master Plan – 2020 to 2030). One of NIA's strategies to achieve this goal is the implementation of Solar Power Irrigation System (SPIP) Project. NIA has so far completed 82 solar irrigation projects, serving over 1,000 farming families, covering 866 hectares. The agency aims to implement at least 150 more solar irrigation projects in the next two years. Beyond NIA, there are more solar powered irrigation projects being carried out by local government units, cooperatives, and the private sector.*

***Cold Storage*** *– The Cold Chain Industry Roadmap (2020 to 2025) by the Department of Trade and Industry cites electricity as the biggest cost item in cold storage, accounting for at least 35% of costs. Similar to irrigation, the deployment of solar PV for cold storage has been considered as an advantage that can be harnessed in the cold chain industry. So far, various solar powered cold storage facilities have been established across the country, such as the Nueva Vizcaya Agricultural Terminal 5kW system and the Delbros Solar Powered Container Van in Cagayan de Oro City.*

# Niche Opportunity



Fully integrated solar PV recycling line by Reliable Environmental Protection Technology Corporation, Ltd. Based in Gongyi, Henan, China (Source: https://www.hnrecycleplant.com/recycle-plant/solar-panel-recycling-line)

## Niche Opportunity 5: Solar Panel Recycling

*The 1,650MW of installed solar capacity in the country is estimated to be using around 3.3 million solar PV modules with an approximate gross weight of 99,000 tons (using a 500-watt module as typical reference). This roughly translates to around 67,000 tons of glass, 13,000 tons of aluminum, 7,000 tons of steel, and 5,000 tons of EVA, all which are expected to go out of commission in the next 10 to 15 years. On top of this, there are at least 1,000 registered rooftop net-metering solar PV systems amounting to around 167MW of capacity, and more seriously, there are tens of thousands of small solar PV systems in portable and off-grid mode that are not sufficiently accounted for. In many ways and locations, these smaller PV systems go out into the environment unfettered, likely generating substantial volumes of electronic waste from solar modules to batteries. With current growth projections, it is estimated that the Philippines will have almost 1 million metric tons of solar PV module waste by 2050.*

*Currently there are no substantial solar PV recycling projects or initiatives in the country. This is an area where Chinese recycling companies such as Gongyi Reliable can come in. The key laws in place that will support this include Republic Act (RA) 8749 (Clean Air Act of 1999), RA 9003 (Ecological Solid Waste Management Act of 2000), RA 9513 (Renewable Energy Act of 2008), RA 9729 (Climate Change Act of 2009), and RA 11898 (Extended Producers Responsibility Act of 2022).*

*The government agency tasked to lead solar PV recycling is the Department of Energy particularly the Renewable Energy Management Bureau. The contact number is (632) 8479-2900 (Trunkline) and the email address is infocenter@doe.gov.ph. The DOE works closely with the Department of Environment and Natural Resources particularly its Environmental Management Bureau with the following contact information: (02) 8539-4378 (Loc 121/159) and support@emb.gov.ph.*

# CONCLUSION & RECOMMENDATIONS



This section highlights the key insights from the study and outlines recommended actions to advance China–Philippines renewable energy collaboration. It emphasizes the importance of strategic partnerships, policy alignment, financing mechanisms, and technical cooperation to unlock the identified opportunities. The recommendations focus on facilitating industry dialogues, developing joint programs, and conducting deeper studies on priority technologies.

# CONCLUSION & RECOMMENDATIONS

The **Bridging Opportunities: A Roadmap for China – Philippines Renewable Energy Cooperation** report highlights the immense potential for renewable energy collaboration between China and the Philippines. With ambitious national targets of achieving 35% renewable energy by 2030 and 50% by 2040, the Philippines is poised for significant growth in solar, wind, geothermal, biomass, hydro, and ocean energy sectors. The report identifies key challenges, including financing barriers, technical support gaps, limited end-user education, and battery supply constraints, while emphasizing the need for partnerships with Chinese suppliers and investors.

The Philippine renewable energy sector presents diverse opportunities for cooperation between local stakeholders and international partners. When structured strategically, such partnerships can accelerate renewable energy deployment while strengthening domestic capability, supporting Filipino entrepreneurs, and improving access to clean energy technologies and financing.

Ensuring that collaboration supports local industry development, workforce skills, and entrepreneurial growth will be essential for creating long-term value within the Philippine renewable energy ecosystem. Partnerships that encourage technology transfer, joint innovation, and local supply chain development can help maximize these benefits.

Given this, six (6) opportunity pathways are proposed to unlock and accelerate renewable energy adoption, including leveraging specialized capabilities in large-scale RE, enhancing urban solar applications, developing holistic project packages for underserved areas, mainstreaming greenfield technologies, supporting circular economy initiatives, and partnering with local government units. Niche opportunities such as rooftop solar PV, microgrids, EV solar charging stations, distributed solar applications, and solar panel recycling offer practical entry points for collaboration.

To further pursue the opportunities identified, the following next steps are recommended:

1. **Organize bilateral and multilateral dialogues between selected Chinese and Philippine companies to expand the discussions on the niche opportunities**. PACS and NEXUS are naturally positioned to facilitate this undertaking. As indicated in the FGDs and KIIs in this study, Chinese companies continue to consider the Philippines as one of Southeast Asia's most attractive markets for renewable energy and infrastructure investment due to its open market environment, clear legal framework, and favorable policies allowing 100% foreign ownership in renewable energy projects. The recommended dialogues will enable right-sizing and competence-matching between and among Chinese and Filipino companies.

# CONCLUSION & RECOMMENDATIONS

2. **Develop a specific program that would design and operationalize a long-term solar PV supply and technical support partnership between Chinese and Philippine Companies.** One of the critical support that the Filipino companies consistently requested in this study is the development of long-term supply/inventory arrangements with Chinese companies. In this regard, exemplary technical support currently being done in-country can be researched and documented for possible replication. Further to this, a cost and benefit analysis can be done to determine risk-sharing under a long-term supply agreement. In this context, particular attention is also being raised on battery supply, considering its increasingly tight supply.

3. **Facilitate discussions between Chinese and Philippine companies and the Department of Energy to develop specific partnerships and programs.** The Philippines need urgent support in its last-mile electrification efforts, and towards this end, the Department of Energy has recently launched the micro-grid auction and also has announced the acceptance of unsolicited proposals for micro-grids. Such specific opportunities for bilateral program development also apply to other related initiatives such as the aim of the DOE to establish thousands of EV charging stations and to establish solar panel recycling facilities. These sectors are still in need for first-mover investors.

4. **Conduct more in-depth studies and stakeholder dialogues for other technologies that may be considered as priorities for Chinese companies in consideration of their preferences and specialized capabilities.** Solar and wind continue to dominate the discussion on renewable energy development. There is a need to further explore other expertise that Chinese companies may possess and offer. This include but is not limited to hydro power and biomass that China is also known for large-scale applications. More specific expertise such as solar panel recycling (as mentioned earlier) can also be an opportunity worth pursuing.

All told, current realities in the Philippine renewable energy space indicate a continuing robustness in Chinese interest and Filipino local capability. More partnerships can be developed by pursuing specific opportunities. Strategic partnerships, supportive policies, and investments in emerging technologies and approaches will be critical to achieving these opportunities.

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