MARKET REPORT ON

ROOFTOP SOLAR

IN THE PHILIPPINES

PHILIPPINE SOLAR AND STORAGE ENERGY ALLIANCE

FOREWORD

Maria Theresa “Tetchi” Cruz Capellan

This manuscript serves as our commitment to accelerate adoption of clean energy solutions at the household level. It is a document that provides developers, banks and installers a clear and holistic view on the economics of solar rooftop, the viability of the photovoltaics technology, and the ease of engineering and construction of rooftop solar.

Solar energy is undeniably the cheapest source of electricity today. Rooftop solar empowers homeowners and offers families a choice as well as a way forward to address the rising cost of electricity in a quick and affordable manner.

The threat of climate change is real and the series of severe storms, devastating floods and extreme heat that the country is experiencing compel us to act decisively and with urgency.

Rooftop solar opens avenues for millions of homes and small businesses to participate and contribute to the global decarbonisation effort. We hope that this manuscript further strengthens the partnership of PSSEA with the Department of Energy and Energy Regulatory Commission and deepens our collaboration with government towards accelerated implementation of reforms that will bring us closer to a net-zero emission regime.

We encourage everyone to use this manuscript as a resource. Enjoy reading it and congratulations to the team that made this happen.

FOREWORD

Jose Rafael Mendoza

As President of the Philippine Solar and Storage Energy Alliance, I'm thrilled to present our inaugural Rooftop Solar Report. This landmark publication marks a significant step towards a unified industry understanding of solar power adoption in the country.

The Philippines, with one of the lowest per capita electricity consumption in Asia, has vast growth potential. Expanding our power generation capacity will drive economic prosperity, support industries and businesses, enhance competitiveness, and improve living standards for every Filipino.

Rooftop solar provides many advantages, such as reduced energy costs, increased energy security, lower carbon emissions, and local economic benefits through job creation. Our country's abundant sunlight makes rooftop solar an exciting opportunity for families and businesses to generate their own energy, independent of traditional power utility constraints.

This report examines current trends, challenges, and opportunities for rooftop solar installations nationwide. Our mission is to promote nationwide awareness, foster stakeholder collaboration, and advocate for supportive policies.

I extend my gratitude to everyone who contributed to this report. Together, let's harness the power of solar energy for a brighter Philippine future!

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ABBREVIATIONS

AACGR	Average Annual Compounded Growth Rate
BESS	Battery and Energy Storage Systems
BOI	Board of Investments
CFEI	Certificate of Final Electrical Inspection
COC	Certificate of Compliance
CREATE	Corporate Recovery and Tax Incentives for Enterprises
DER	Distributed Energy Resources
DIS	Distribution Impact Study
DOE	Department of Energy
DU	Distribution Utility
EPIRA	Electric Power Industry Reform Act
ERC	Energy Regulatory Commission
GJA	Green Jobs Act
ITH	Income Tax Holiday
kWp	kilowatt peak
LGU	Local Government Units
MWp	Megawatt peak
NDC	Nationally Determined Contributions
NGCP	National Grid Corporation of the Philippines
NM	Net Metering
OBO	Office of the Building Official
PEC	Philippine Electrical Code
PEP	Philippine Energy Plan
PEZA	Philippine Economic Zone Authority
PSSEA	Philippine Solar and Storage Energy Alliance
QE	Qualified End-user
RA	Republic Act
RE	Renewable Energy

I. INTRODUCTION

Demand for Electricity

In 2023, the fuel source of electricity generation in the Philippines is primarily coal at 62.5% (Figure 1). Gas accounts for 14.1% while oil-based fuel reached 1.1% of total. In contrast, solar only contributes 2.2% to power electricity generation.[1]

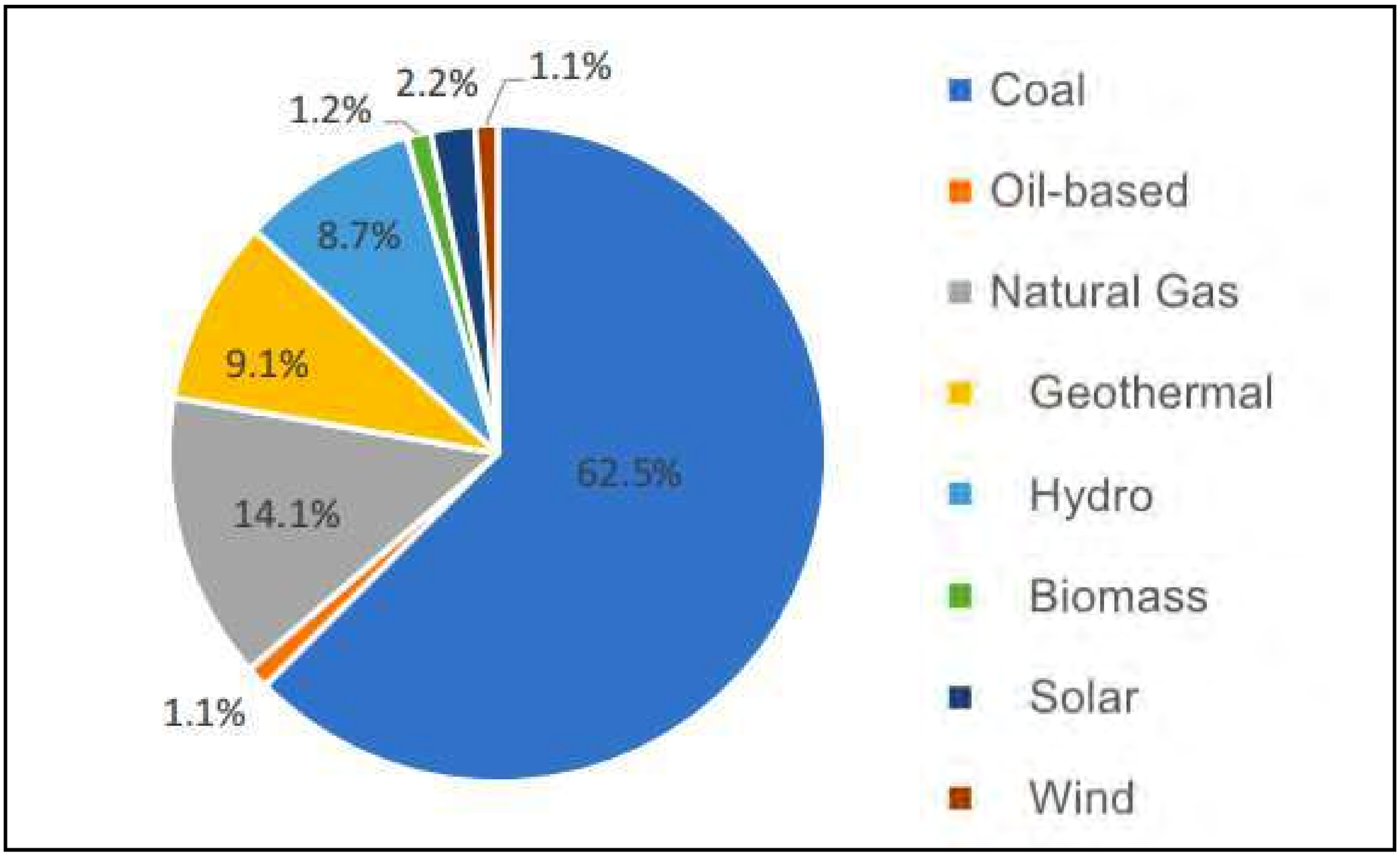
Meanwhile the demand for electricity is rising (Figure 2). After declining by 1.9% in 2020 due to the pandemic, total System Peak Demand (SPD) grew by 4.9% growth in 2021 followed by a 4.4% growth in 2023. The Average Annual Growth Rate (AAGR) is recorded at 3.8% for 2005 to 2023.[2]

By region, the Luzon grid posted an AAGR of 3.7% from 2006 to 2023 while the Visayas and Mindanao grid recorded 4.8% and 3.7%, respectively. The Luzon grid has steadily been growing since 2005. There was a decrease in demand in 2006 and 2011 due to the reduction in the power consumption of Meralco, the country's leading private utility company. These were caused by the global financial crisis in 2006 and the La Niña phenomenon in 2011.

[1] Department of Energy (DOE), "2023 Power Statistics," accessed July 20, 2024, https://doe.gov.ph/energy-statistics/philippine-power-statistics

[2] National Grid Corporation of the Philippines (NGCP), Transmission Development Plan 2023-2040 (Manila, Philippines: NGCP), https://ngcp.ph/Attachment-Uploads/TDP%202023-2040%20Consultation%20Report-2023-06-15-07-54-06.pdf

Figure 1. Gross Power Generation by Plant Type, Philippines 2023.

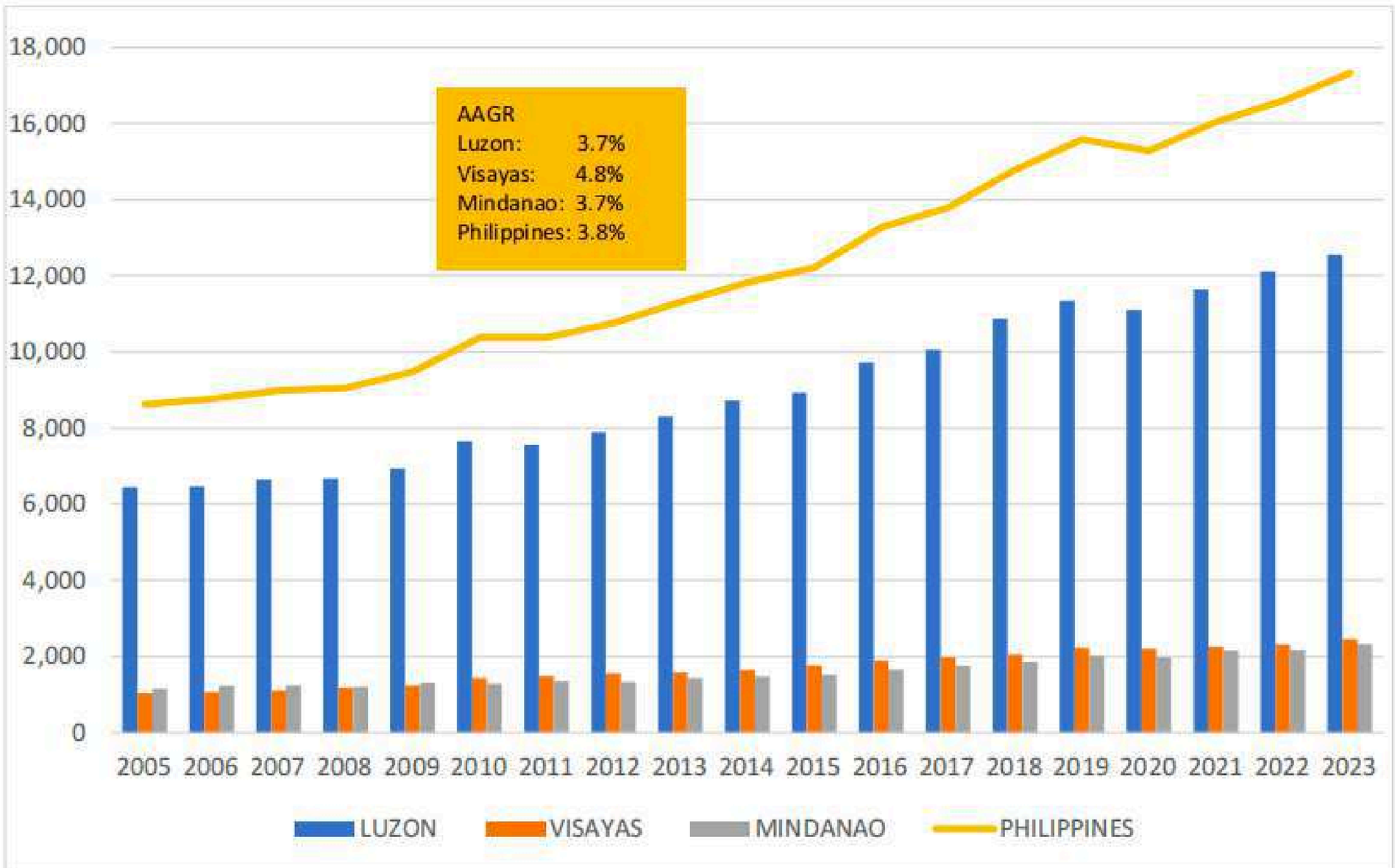


Source: DOE.

Demand in the Visayas grid rose in 2010 due to higher economic activities and rising reliance on the power supply from the grid of large customers with self-generation. The typhoon Yolanda which hit the region in 2013 slowed demand for power.

The Mindanao grid experienced sluggish demand from 2005 to 2010. The reduction in demand were caused by the effects of the global financial crisis which weakened exporting industries. Another reason is the El Niño phenomenon that affected hydropower generation, which constitute about half of the Grid's installed capacity.

Figure 2. Summary of historical demand for electricity per Grid (2005-2023), in MW.



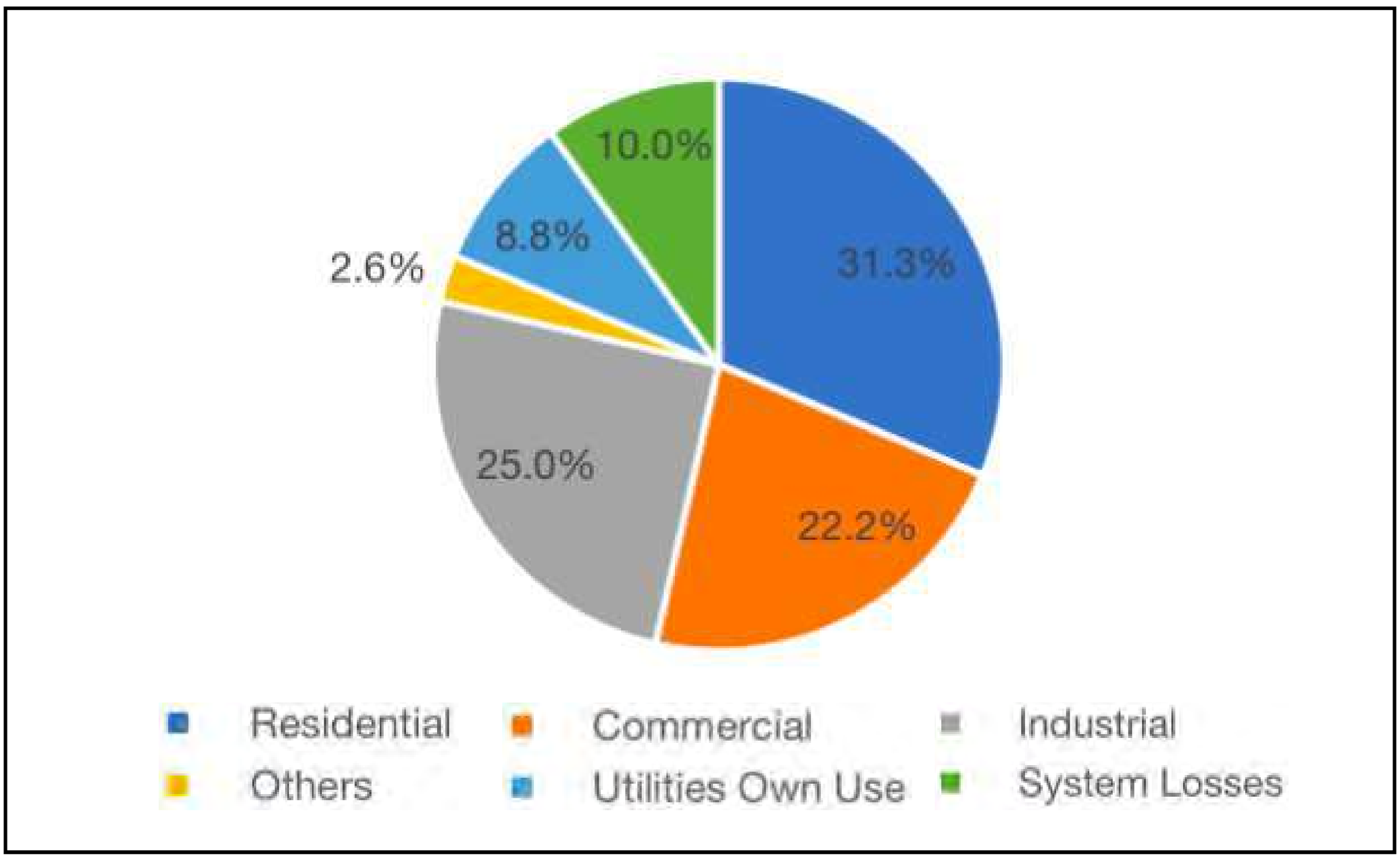
Source: NGCP.

By sector (Figure 3), electricity consumption in 2023 was dominated by the residential sector with a 31.3% share, followed by followed by industrial (25%) and commercial (21.2%).[3]

Electricity consumption is highest in Luzon which consumes 84,289,310 MWh or 71.4% of the total electricity consumption in the country (Table 1, Table 2). The Visayas and Mindanao regions accounted for 14.2% (16,701,458) and 14.4% (17,013,142) of total electricity consumption, respectively. In terms of sectoral sales, the residential sector in Luzon has the highest electricity sales at 22.7% or 26,782,632 MWh (Table 1, Table 2). Only around 4% of total residential, electricity sales were accounted for by the Visayas and Mindanao residential areas, respectively. The commercial sector in Luzon has the second highest electricity sales with 22,501,471 or 19.1% of the country total followed by the industrial sector with 19,471,728 MWh (16.5%).

[3] Department of Energy (DOE), "2023 Power Statistics," accessed July 20, 2022.

Figure 3. Electricity consumption by sector, 2023.



Source: DOE.

Table 1. Electricity sales and consumption by region, 2023 (in MWh).

	Luzon	Visayas	Mindanao
Electricity Sales	70,485,936	12,791,082	12,530,835
Residential	26,782,632	5,044,183	5,141,129
Commercial	22,501,471	1,950,267	1,783,894
Industrial	19,471,728	5,054,019	4,966,850
Others	1,730,105	742,613	638,961
Own-Use	7,132,726	1,848,518	1,421,959
System Loss	6,670,647	2,061,858	3,060,348
Electricity Consumption	84,289,310	16,701,458	17,013,142

Source: DOE.

Table 2. Share of electricity consumption to total electricity consumption by region, 2023 (in%)

	Luzon	Visayas	Mindanao
Electricity Sales	59.7	10.8	10.6
Residential	22.7	4.3	4.4
Commercial	19.1	1.7	1.5
Industrial	16.5	4.3	4.2
Others	1.5	0.6	0.5
Own-Use	6.0	1.6	1.2
System Loss	5.7	1.7	2.6
Electricity Consumption	71.4	14.2	14.4

Source: DOE.

On a per capita basis, electricity sales in Luzon is 1.1 MWh while total electricity consumption reached 1.4 MWh (Table 3). Per capita electricity sales in Visayas and Mindanao are 0.6 MWh and 0.5 MWh, respectively. Total per capita electricity consumption is slightly higher at 0.8 MWh for Visayas and 0.6 MWh for Mindanao.

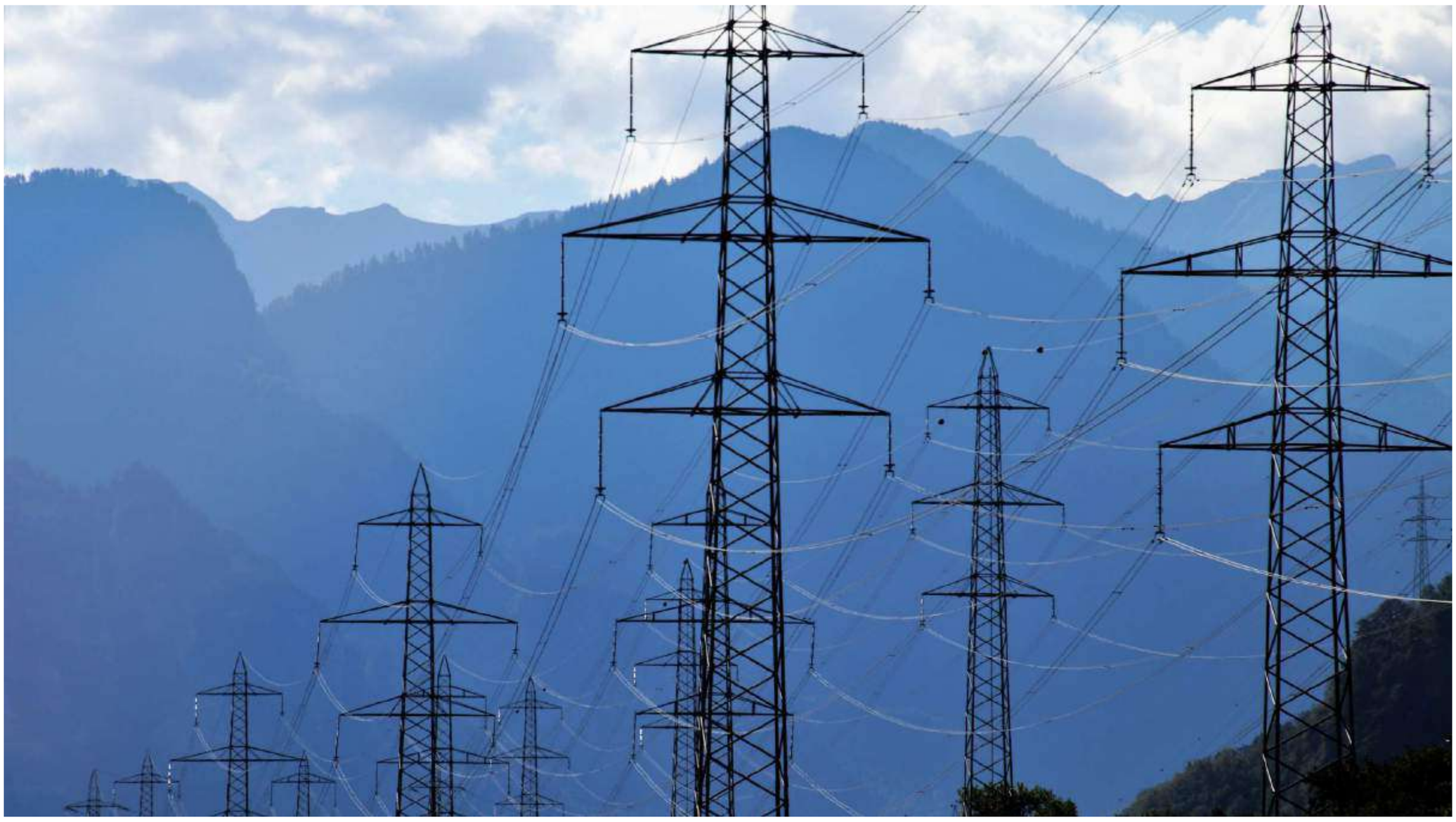
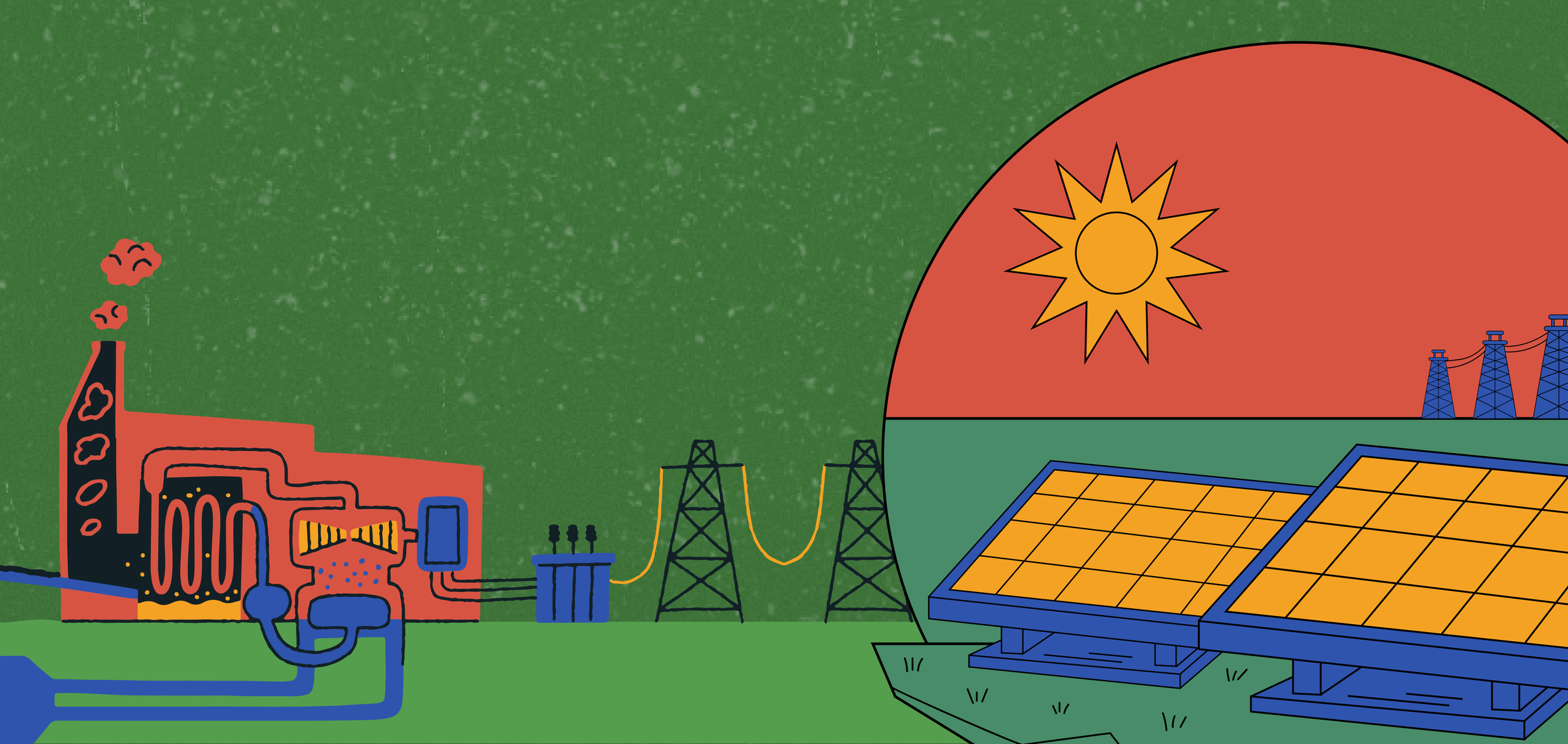


Table 3. Per Capita Electricity sales and cinsumption by region, 2023 (in MWh)

	Luzon	Visayas	Mindanao
Electricity Sales	1.1	0.6	0.5
Electricity Consumption	1.4	0.8	0.6

Source: DOE, Philippine Statistics Authority.

II. POLICY ENVIRONMENT OF ROOFTOP SOLAR



A. Renewable Energy Law

The Renewable Energy Act of 2008 or Republic Act (RA) 9513 aims to accelerate the development and advancement of renewable energy resources in the Philippines. It establishes the Renewable Energy Management Bureau which is tasked to implement policies, plans and programs towards the development, transformation utilization and commercialization on of renewable energy resources and technologies. The law also mandates the commercialization, marketing and distribution on of renewable energy resources particularly new and emerging technologies to end-users. Moreover, the law enables the creation on of a centralized, comprehensive, and unified data and information base on renewable energy (RE) resources; and allows the supervision and monitoring of government and private companies' activities on the development and utilization on of RE resources to ensure compliance to government regulation, guidelines and standards.[4]

Prior to the RE law, the Electric Power Industry Reform Act or EPIRA (RA 9136) was enacted in 2001. It led to the privatization and restructuring of the electric power industry. From a vertically integrated monopoly, the law allows competition in the generation and retail supply subsectors while still recognizing needed regulation in the transmission and distribution subsectors. The Department of Energy (DOE) is the agency mandated in section 37 of the EPIRA to promote investments in the electricity sector and develop indigenous and RE resources. [5]

[4] Republic Act No. 9513, "An Act Promoting the Development, Utilization and Commercialization of Renewable Energy Resources and for Other Purposes," Department of Energy, December 16, 2008.

[5] Republic Act No. 9136, "An Act Ordaining Reforms in the Electric Power Industry, Amending for the purpose certain laws and for other purposes," Department of Energy, June 8, 2001.

The RE law is intended to meet the power generation mix target in the Philippine Energy Plan (PEP) 2020-2040 consisting of 35% renewable energy by 2030 and 50% RE by 2040.[6]

As a decarbonization strategy, higher RE investments ensure the attainment of the Nationally Determined Contributions (NDCs) submitted by the Philippines in 2021 to the United Nations Framework Convention on Climate Change (UNFCCC) as signatory to the Paris agreement. It sets the reduction of the country's 2030 GHG emissions by 75.0%, constituting 72.29% conditional commitment and 2.71% unconditional commitment.[7] In the energy sector, GHG emissions cover the combustion of fossil fuels and other activities to produce energy. The energy sector targets a 2.8 % reduction from 2020-2030, which is equivalent to GHG emission reduction of about 45.9 MTCO2e or 1.37% of the NDC target of the country.[8]

[6] Department of Energy (DOE), Philippine Energy Plan (PEP) 2020-2040 (Taguig City, Philippines: DOE, 2020), h ps://www.doe.gov.ph/pep/philippine-energy-plan-2020-2040-1 7

[7] Republic of the Philippines, Na onally Determined Contribu on (Germany: UNFCCC, 2021), 4, h ps://unfccc.int/sites/default/files/NDC/2022-06/Philippines%20-%20NDC.pdf 8

[8] DOE, Philippine Energy Plan (PEP) 2020-2040, 2. 9

B. Net Metering Policy

Net-metering (NM) was enabled by the Renewable Energy Act of 2008 or RA 9513 as one of the policy mechanisms to spur RE investments. Having rooftop solar PV installations connected to the grid enables electricity consumers to generate part of their load demand while reducing their energy purchase from their Distribution Utility (DU). At the same time, they can also export excess energy to the DU and its value will be deducted from their monthly electric bill. Thus, under NM, the end-user transforms into a prosumer which can both be a consumer and producer of his own electricity.[9]

Both the DOE and the Energy Regulatory Commission (ERC) were mandated to implement Net-metering through the issuance of resolutions and circulars. The ERC began implementing NM in 2013 through the ERC Resolution 09 Series of 2013 or the Rules Enabling the Net-Metering Program for Renewable Energy.[10] In the resolution NM applies to on-grid systems and the participants are defined as Qualified End-users (QEs). The DU is required to install two uni-directional meters to measure the electricity imported and exported. Alternatively, a bi-directional meter can be installed. A third meter will measure the RE generated which the DU can use to earn Renewable Energy Certificates (RECs) on the energy generated under the program. Moreover, the resolution states that the QEs can sell their excess electricity based on the blended generation rate of their DUs.

[9] Department of Energy (DOE), Guidebook on Net-metering in the Philippines (Taguig City, Philippines: DOE, 2021), h ps://doe.gov.ph/sites/default/files/pdf/renewable_energy/Net-Metering-Guidebook-2022.pdf 10

[10] Resolution No. 09, Series of 2013, “A Resolu on Adop ng the Rules Enabling the Net-Metering Program for Renewable Energy,” Energy Regulatory Commission, July 1, 2013. 11

Resolution No. 06 Series of 2019 introduced several amendments to the NM Rules such as giving the DUs a maximum of 20 working day processing timeline to finish the interconnection process, assuming all permits and licenses are completed.[11] The ERC has made "Distribution Impact Study" (DIS) free to promote to end-users and ensure safety and reliability of the RE system. The price of exported energy remains the DUs' blended generation cost excluding other generation adjustments.

Resolution No. 05 Series of 2020 or the Amendments to the Rules Enabling Net-Metering Program clarified some of the implementing issues of Resolution No. 06 such as

1. End-users considered as good credit standing should have no unsettled or outstanding obligations with the DU at the time of the application. New customers can also be considered as QEs.

2. The DU shall bore the cost of all meters. Current customers who want to install RE systems must pay the cost of new meter minus the cost of the old meter.

3. The cost of the REC meter is the obligation of the DU while the wiring cost is shouldered by the QE.

4. The REC meter is located at the connection point or near the connection point.

5. The DU will replace uni-directional meters with bi-directional meters and will shoulder the cost of the new meter.[12]

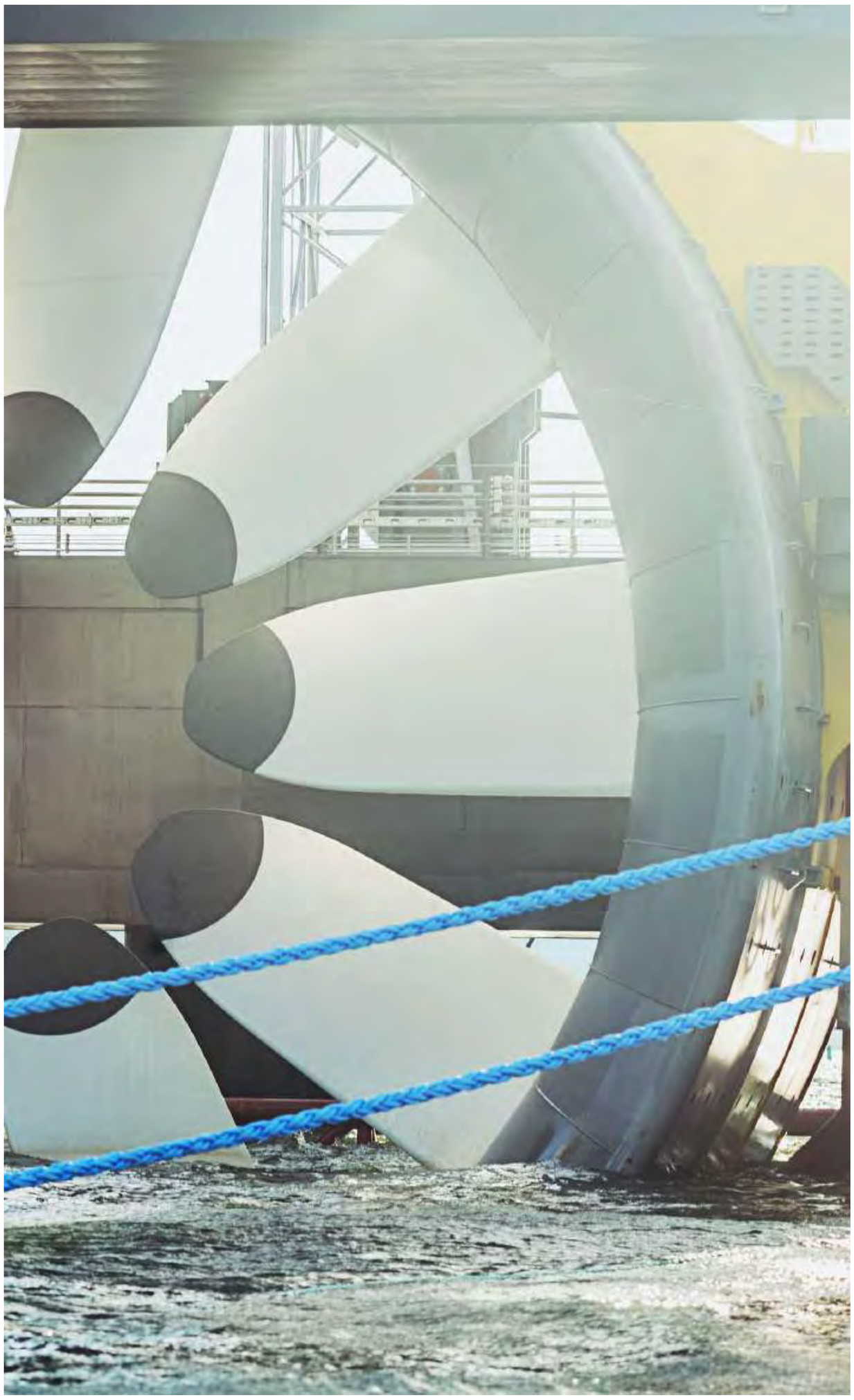
[11] Resolution No. 06, Series of 2019, "A Resolu on Adop ng the Amendments to the Rules Enabling the Net Metering Program for Renewable Energy," Energy Regulatory Commission, October 9, 2019.

[12] Resolution No. 05, Series of 2020, "A Resolution Adopting the Amendments to the Rules Enabling the Net-Metering Program for Renewable Energy," Energy Regulatory Commission, June 23, 2020.

Department Circular No. 2020-10-0022 Policies on Net-Metering Program from the DOE states that that at the end of each calendar year Net-metering credits will be forfeited. This is because QEs are not considered as net generator or producer of electric power. The circular also appoints NEA to assist all Electric Cooperatives (ECs) in promoting the NM program and provide capacity building program like technical assistance on Distribution Impact and Asset Studies.[13]

[13] Department Circular No. DC2020-10-0022, “Prescribing the Policies to Enhance the Net-Metering Program for Renewable Energy Systems,” Department of Energy, October 22, 2020.

C. Expanded Roof-Mounted Solar Program (ERSP)



On December 22, 2023, the DOE published Department Circular 2023-12-0035: Prescribing the Policy and General Framework on the Expanded Roof-Mounted Solar Program (ERSP) in the Philippines.[14] The ERSP is a different policy from the Net-Metering Program. It will apply to both on-grid and off-grid areas. It covers roof mounted solar facilities (RSFs) with a capacity of above 100 kWp, for own use or exported to the host DU or the grid. It lays out the policies and guidelines for three business models of RSFs: Supply Contingency Option, Lease to Generate Option, and restricted peer to peer energy trading (Figure 4).

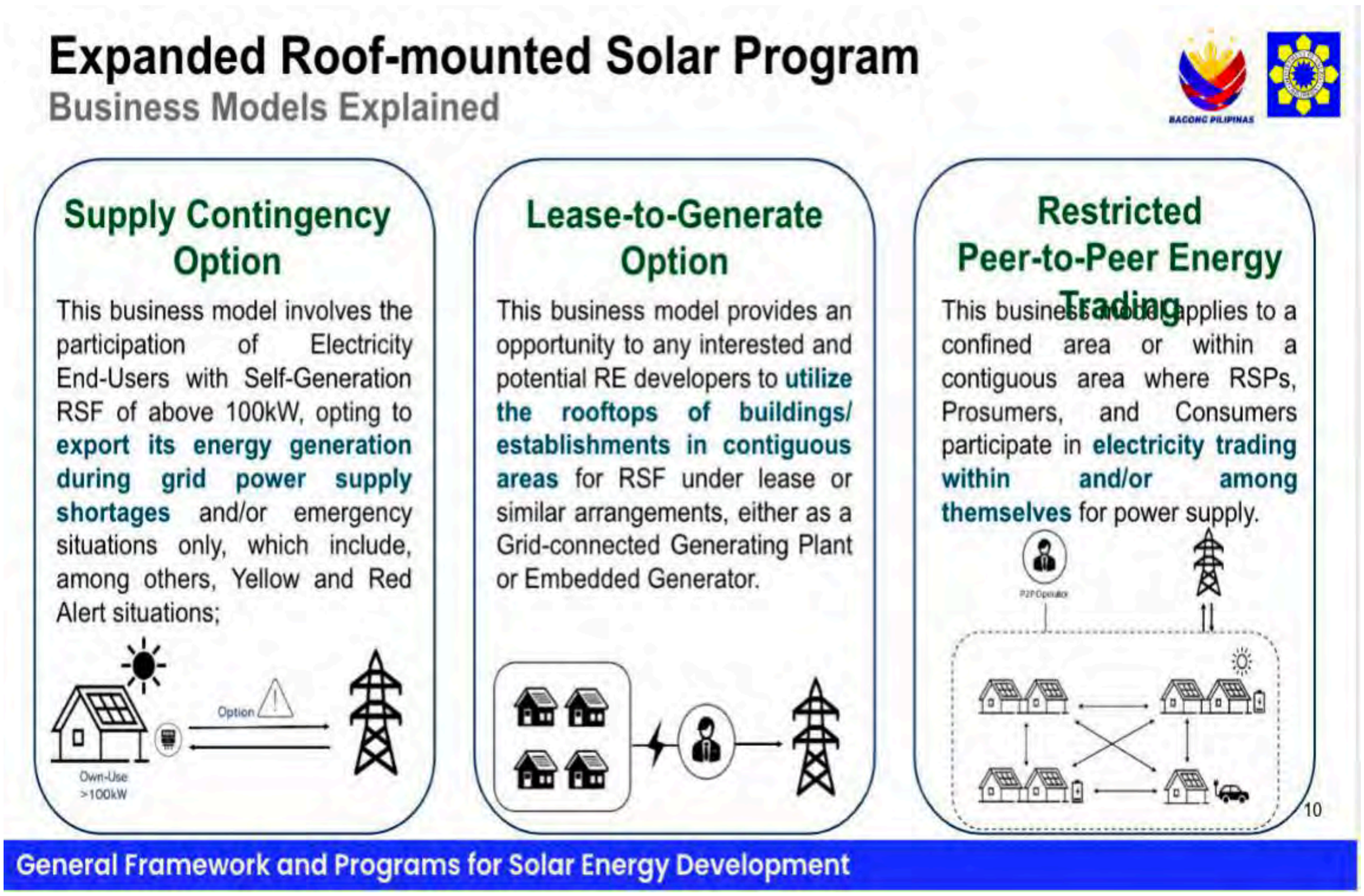
[14] Department Circular No. DC2023-12-0035, "Prescribing the Policy and General Framework on the Expanded Roof-Mounted Solar Program in the Philippines," Department of Energy, December 22, 2023.

The Supply Contingency Option is voluntary and refers to electricity end-users who have decided to export energy in cases of grid power supply shortages as well as emergency situations which include Yellow and Red Alert situations. To be able to do so, QEs must update their meter and connection according to their respective DUs. The cost for upgrading will be borne by the QE while the connection costs will be passed on to the Network Service Provider. As an agreement with the DU, QEs shall be compensated by the DUs on their exported energy with the price set by the ERC.

Lease to Generate Option offers an opportunity for RE developers to lease the rooftops of buildings and establishments in contiguous areas for RSF. It could be used as grid-connected generating plant or embedded generator. All the energy generated shall be exported either to the DU or to the grid and the sale of power shall be covered by a power supply agreement. The roof mounted solar provider (RSP) shall also obtain a Solar Energy Operating Contract with the DOE. The RSPs with lease to generate RSFs can supply power under Retail and Open Access and participate in the GEOP and GEAP.

Restricted Peer-To-Peer Energy Trading refers to a contiguous area wherein RSPS, prosumers and consumers trade electricity among themselves. The trading platform is provided by the RSPs and also act as the operator. Any excess electricity generated will be sold to then DU or grid according to an agreement between the DU and the RSP. The supply contracts between the parties shall be nonregulated.

Figure 4. Expanded Roof-mounted Solar Program.



Source: DOE.

D. Distributed Energy Resources (DER) Rules

Distributed Energy Resources (DER) are sources of energy connected to the distribution system or electrical system of the end-users which when aggregated are able to fulfill the demand for power. On December 14, 2022, ERC Resolution No. 11, Series of 2022: A Resolution Adopting the Rules Governing Distributed Energy Sources (DER), also known as the "DER Rules", took effect. [15]

The objectives of the DER Rules are to establish the guidelines, requirements, and standards for a safe, reliable, and technically sound interconnection of DER, enumerate the requirements to obtain a
Certificate of Compliance (COC) from the ERC, provide the pricing methodology for DER, and enable the efficient use of data for cost-effective energy planning and monitoring.

There are 3 type of installations covered by the DER Rules:

1. DERs utilizing renewable energy sources for end-user systems connected on-grid and are meant for consumption and export. These DERs have a capacity greater than 100kW up to 1MW and maximum capacity to export capped at 30%;

2. DERs utilizing renewable energy) sources for end-user systems connected off-grid and are meant for consumption and export. These DERs have a capacity not greater than 1MW, and maximum capacity to export also capped at 30%; and

3. DERs utilizing any energy generation and storage technology, whether on- or off- grid, and meant for end-user consumption only, with the DER owner and end-user as different entities.

[15]Resolution No. 11, Series of 2022, "A Resolution Adopng the Rules Governing Distributed Energy Sources (DER)," Energy Regulatory Commission, December 14, 2022.

The DER Rules do not include microgrids, electric vehicles (EVs), Net-metering, energy storage systems, self-generating facilities, solar home systems and DER used to export or sell power or service to the Grid or Distribution System. These are covered by other regulations.

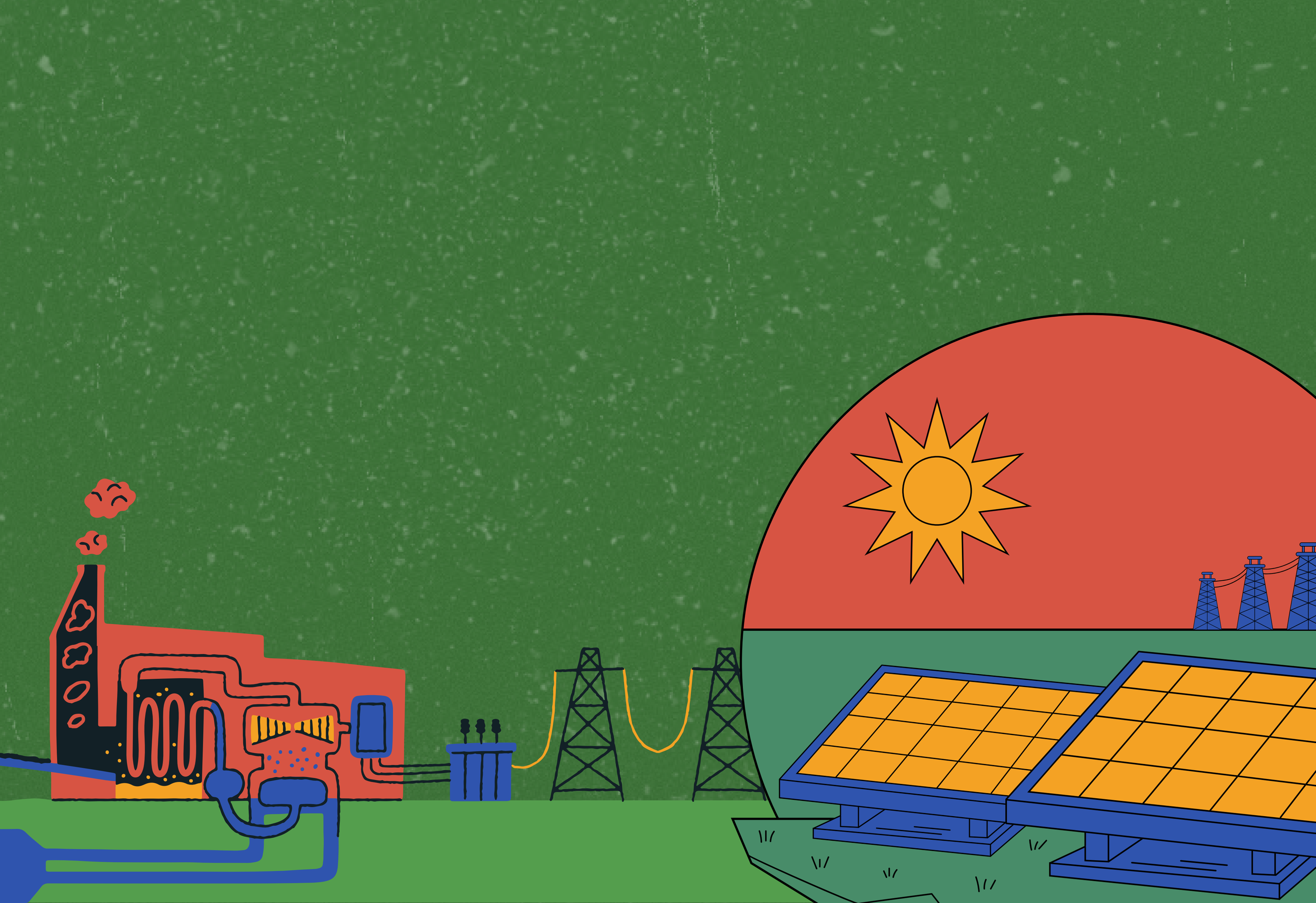
DER Rules apply to end-users, DUs, owners and/or operators of DER; and Metering Service Providers (MSP).

Compensation for on-grid Renewable DER's exported energy is based on the DU's monthly blended generation rate and the DER's rated capacity. Specifically, for 100kW to 500kW capacity the compensation price is 75% of the blended generation rate. DER with capacity above 500kW to 1MW can get 60% of the blended generation rate compensation rate.

A DIS is mandatory before the DU can install the DER to ensure the safety, power quality and reliability of the Distribution System. Moreover, The DU is also required to install a Renewable Energy Certificate meter close to all Renewable DER to measure the total RE generated in compliance with the Renewable Portfolio Standards Program under the Renewable Energy Act. It will also obtain data on the actual energy consumed for the payment of subsidies.

III. NET METERING

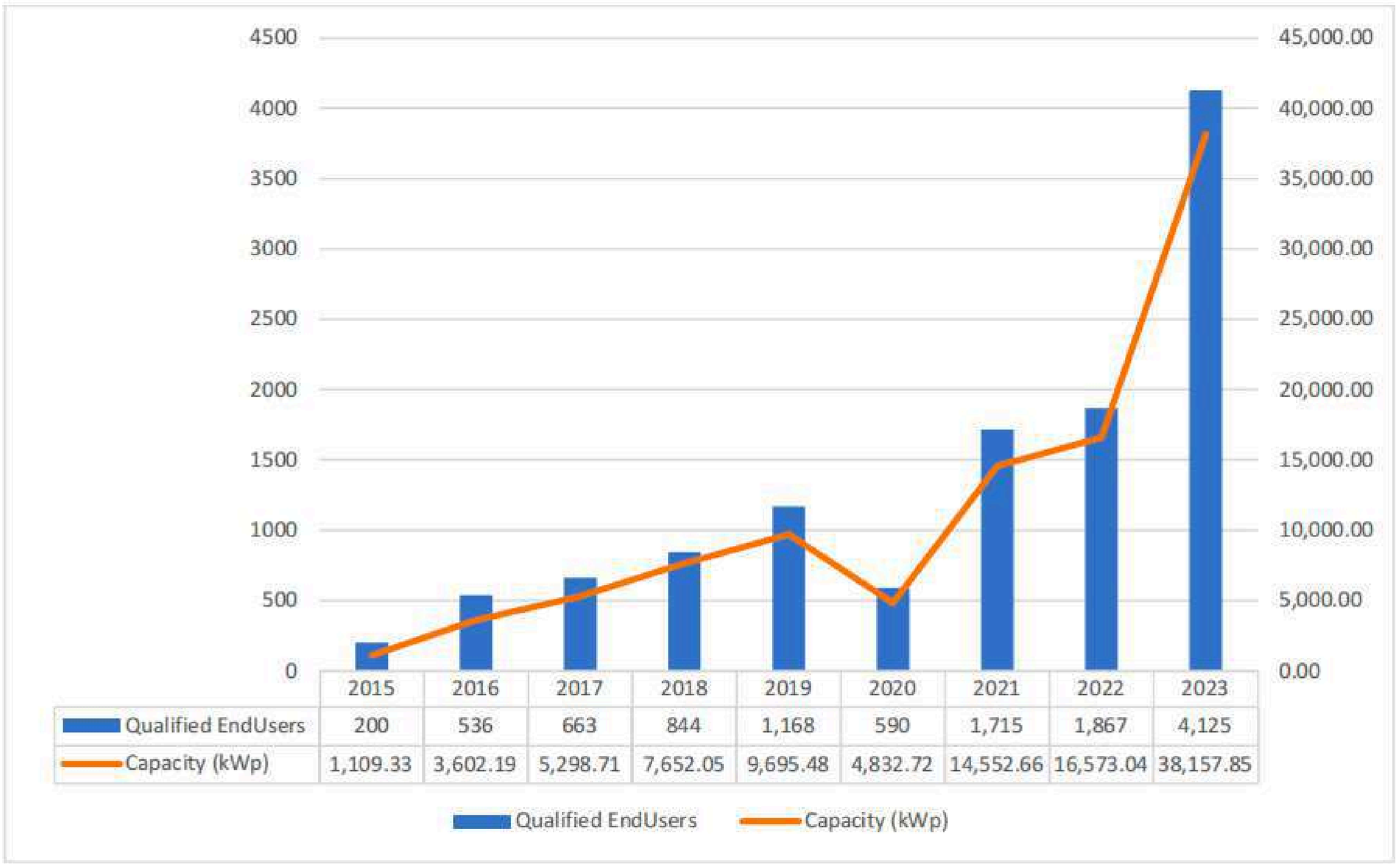
WHERE WE ARE



A. Net Metering Statistics

The steady increase of qualified end-users (QEs) from 2015 to 2023 was marked by a sharp decline in 2020 during the COVID-19 pandemic (Figure 5). At only 200 in 2015, QEs reached 11,708 by 2023 with a total capacity of 101,474.03 kWp as of April 2024. However, the number of QEs in 2020 dropped by 49% from 1,168 in 2019 to 590 in 2020. The average growth rate of QEs before 2020 was 64% while the average growth rate after 2020 was 107%. In 2023, there was a huge rise in QEs, growing by 121% over the previous year to 4,125. Similarly, the Net-Metering installed capacity was halved in 2020 from the previous level but recovered quickly to reach 38,157.85 in 2023, a 130% growth rate, year-on-year.

Figure 5. Qualified End-Users and Net-metering Capacity, 2015 to 2023 (as of April 2024)

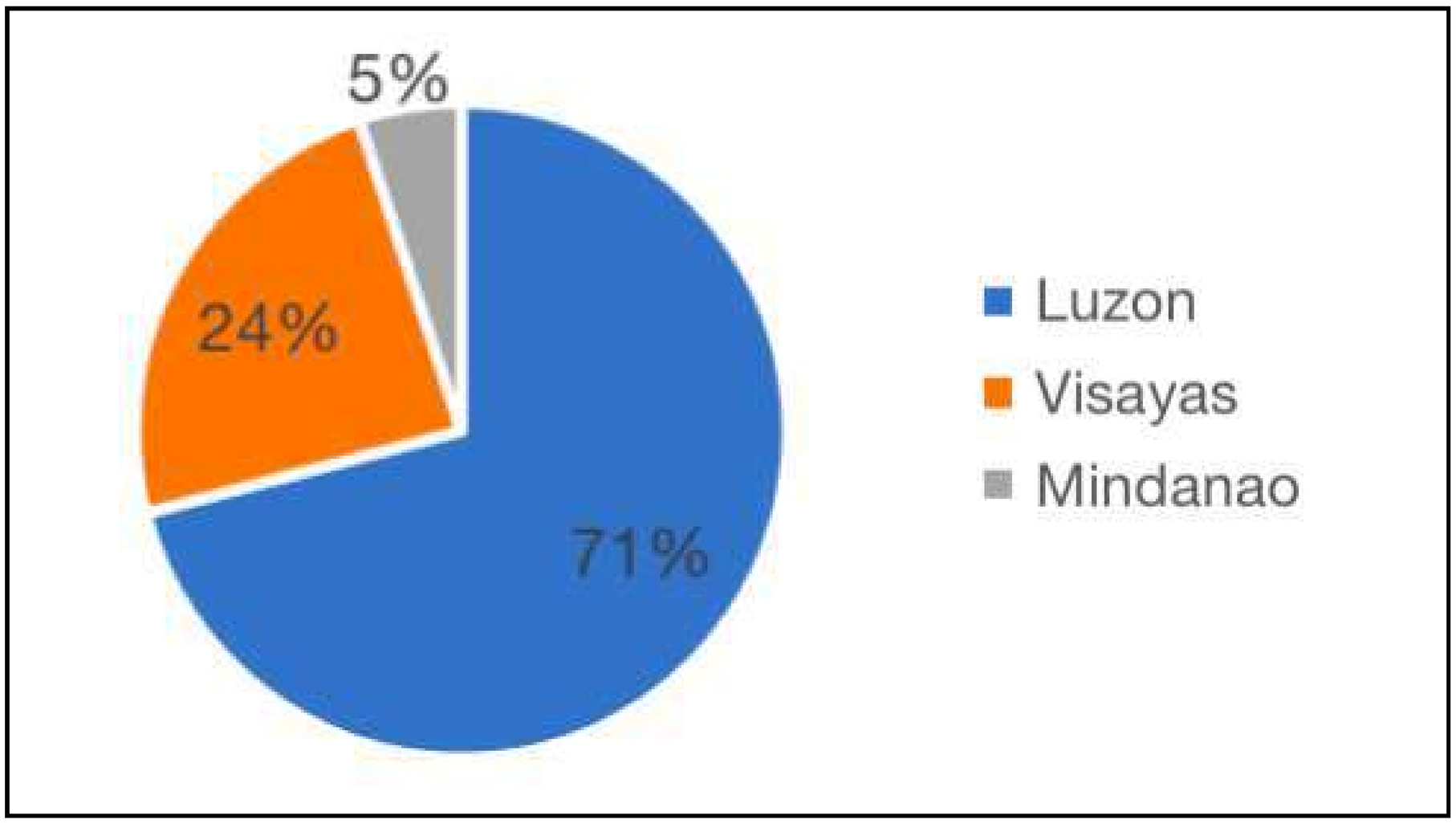


	2015	2016	2017	2018	2019	2020	2021	2022	2023
Qualified EndUsers	200	536	663	844	1,168	590	1,715	1,867	4,125
Capacity (kWp)	1,109.33	3,602.19	5,298.71	7,652.05	9,695.48	4,832.72	14,552.66	16,573.04	38,157.85

Source: ERC.

By grid type, the Luzon grid has the highest total rated capacity of 79,273.19 kWp or 71% of total installed capacity (Figure 6). This is followed by the Visayas grid with 26,797.68 kWp , comprising 24% of total installed capacity. The Mindanao grid lags the others accounting for only 5,670.24 kWp, or 5% of the total.

Figure 6. Percentage Share of Net-metering Capacity per Grid, April 2024.



Source: ERC.

The country has a total of 79 DUs with 12,730 QEs (Table 4). Out of the three islands, Luzon has the largest members with 41 DUs and 10,153 QEs. It comprises 52% of total DUs and 80% of total QEs. In contrast, the number of DUs in the Visayas and Mindanao are 23 (29%) and 15 (19%), respectively. For QEs, the Visayas has 2,044 (16%) while Mindanao has 533 (4%). Total Net Metering capacity for the country is 111,741 kWp., Luzon accounts for 71% of total capacity at 79,273 kWp. In contrast, NM capacity for Visayas and Mindanao reached 26,798 (24%) and 5,670.24 (5%), respectively.

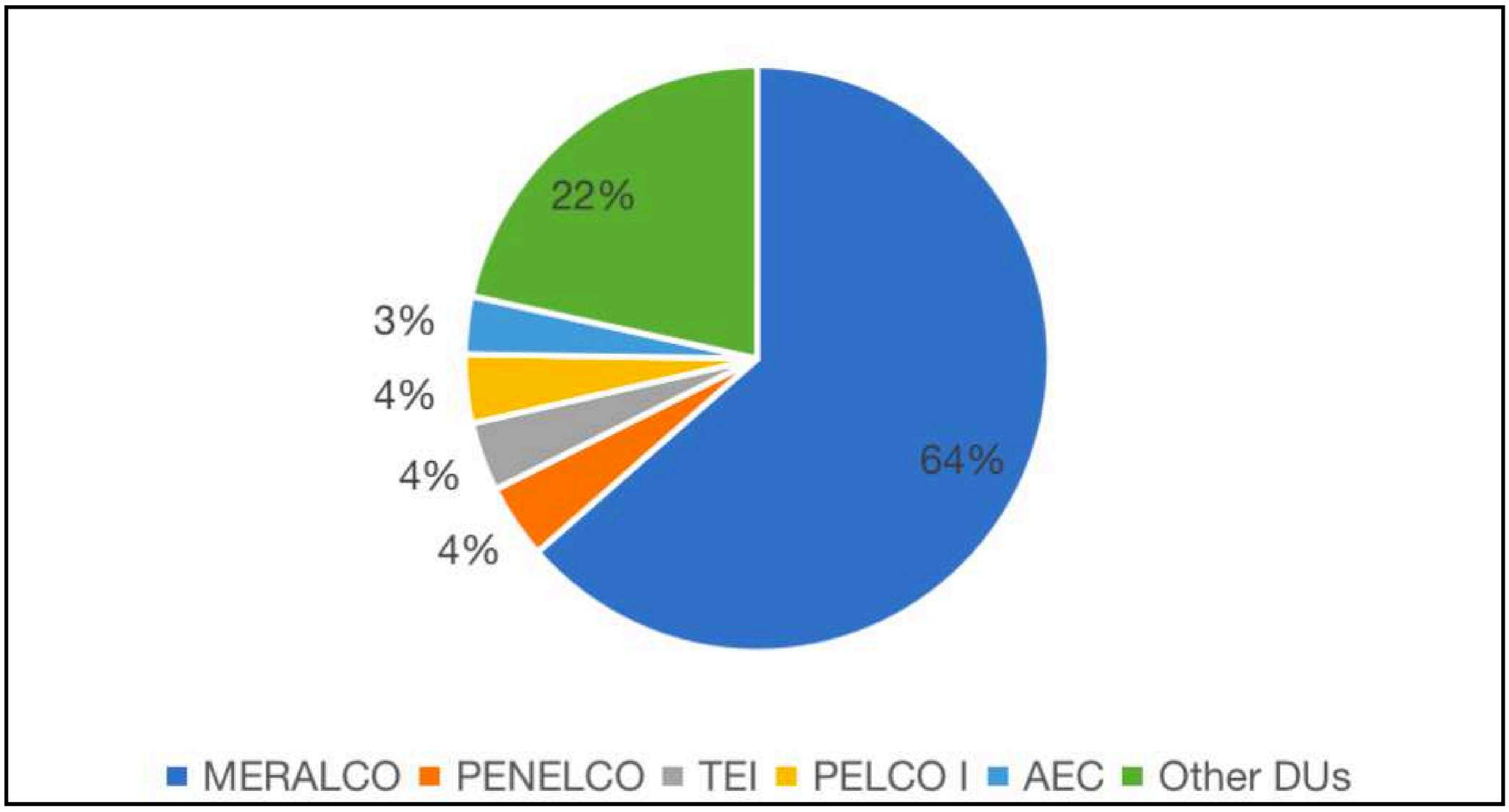
Table 4. Distribution Utility (DU) and Qualified End-Users by location, April 2024.

	Distribution Utility (DU)	Qualified End-Users	Capacity (kWp)
Luzon	41	10,153	79,273
Visayas	23	2,044	26,798
Mindanao	15	533	5670.24
Total	79	12,730	111,741

Source: DOE.

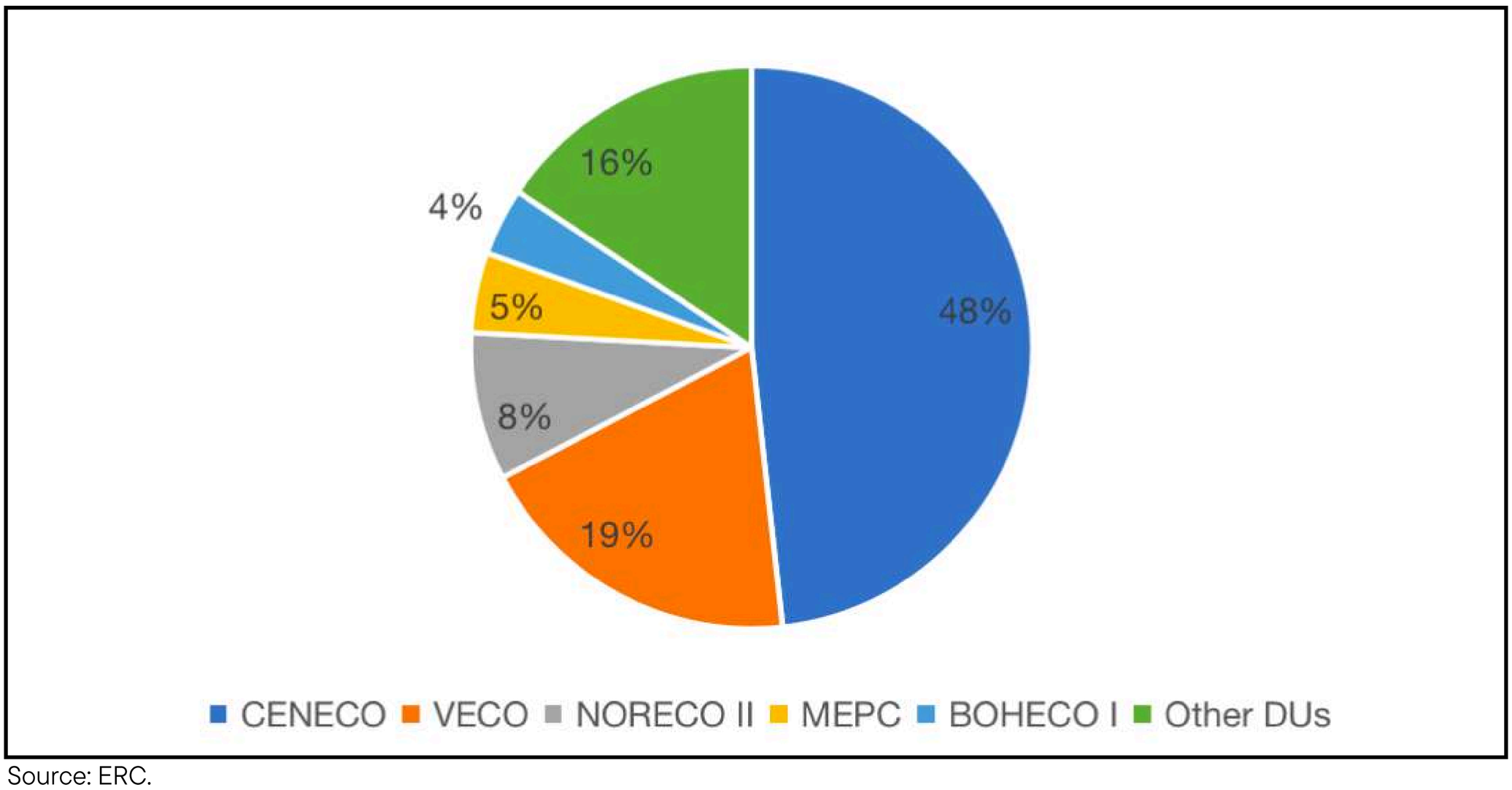
In Luzon, Meralco has the largest Net Metering capacity comprising 64% of the total (Figure 7). Other DUs with significant shares are AEC (3%), TEI (4%), PENELCO (4%) and PELCO I (4%). The other 34 DUs have 22% share of total net metering capacity of the island. Ceneco has the highest Net Metering capacity in the Visayas region at 48% of the total (Figure 8). Veco follows with 19% NM capacity. Meanwhile in Mindanao, DLPC dominates the net metering capacity at 69% of the total (Figure 9).

Figure 7. Share of DUs in Total Net-metering Capacity, Luzon.



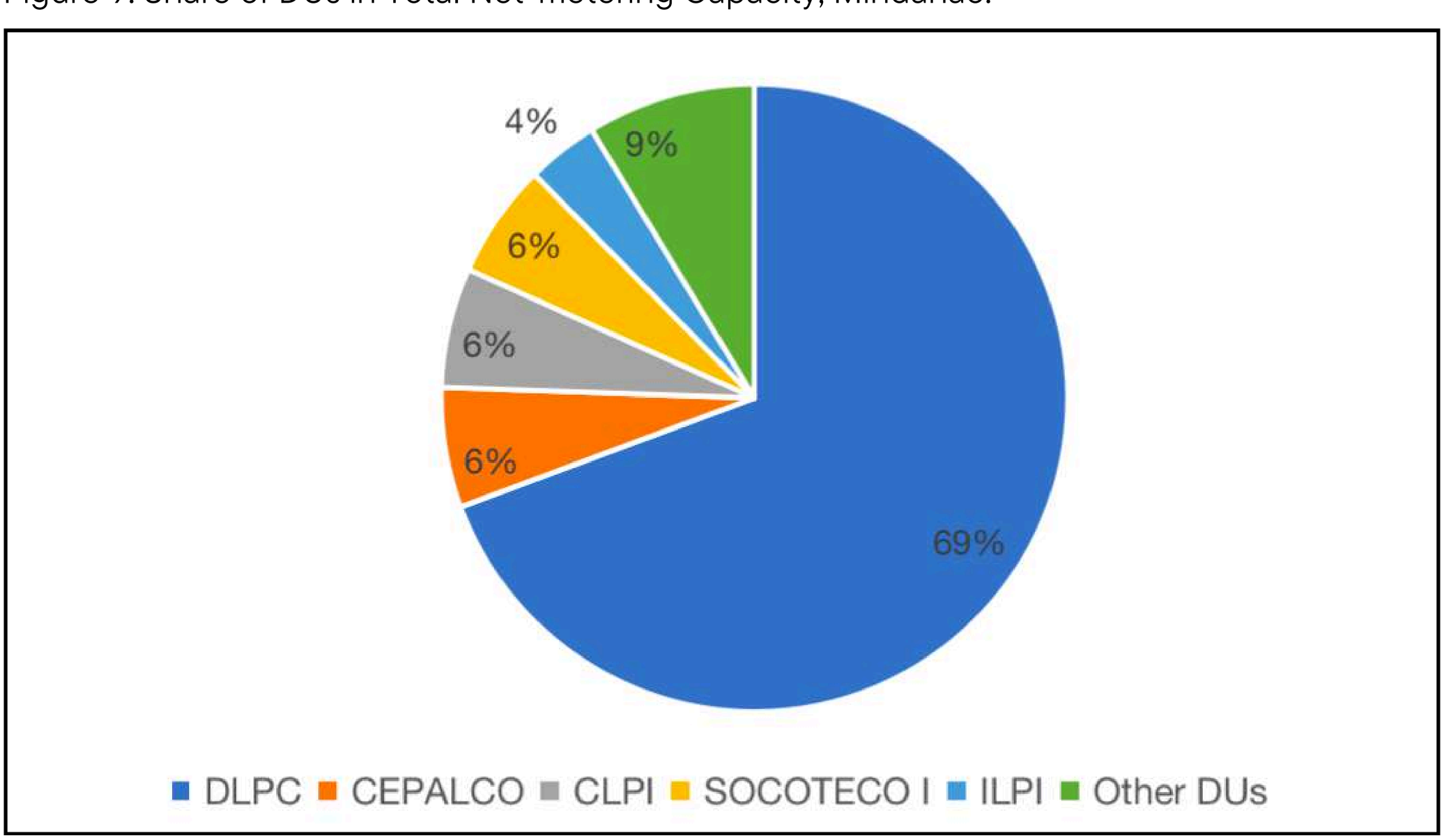
Source: ERC.

Figure 8. Share of DUs in Total Net-metering Capacity, Visayas.



Source: ERC.

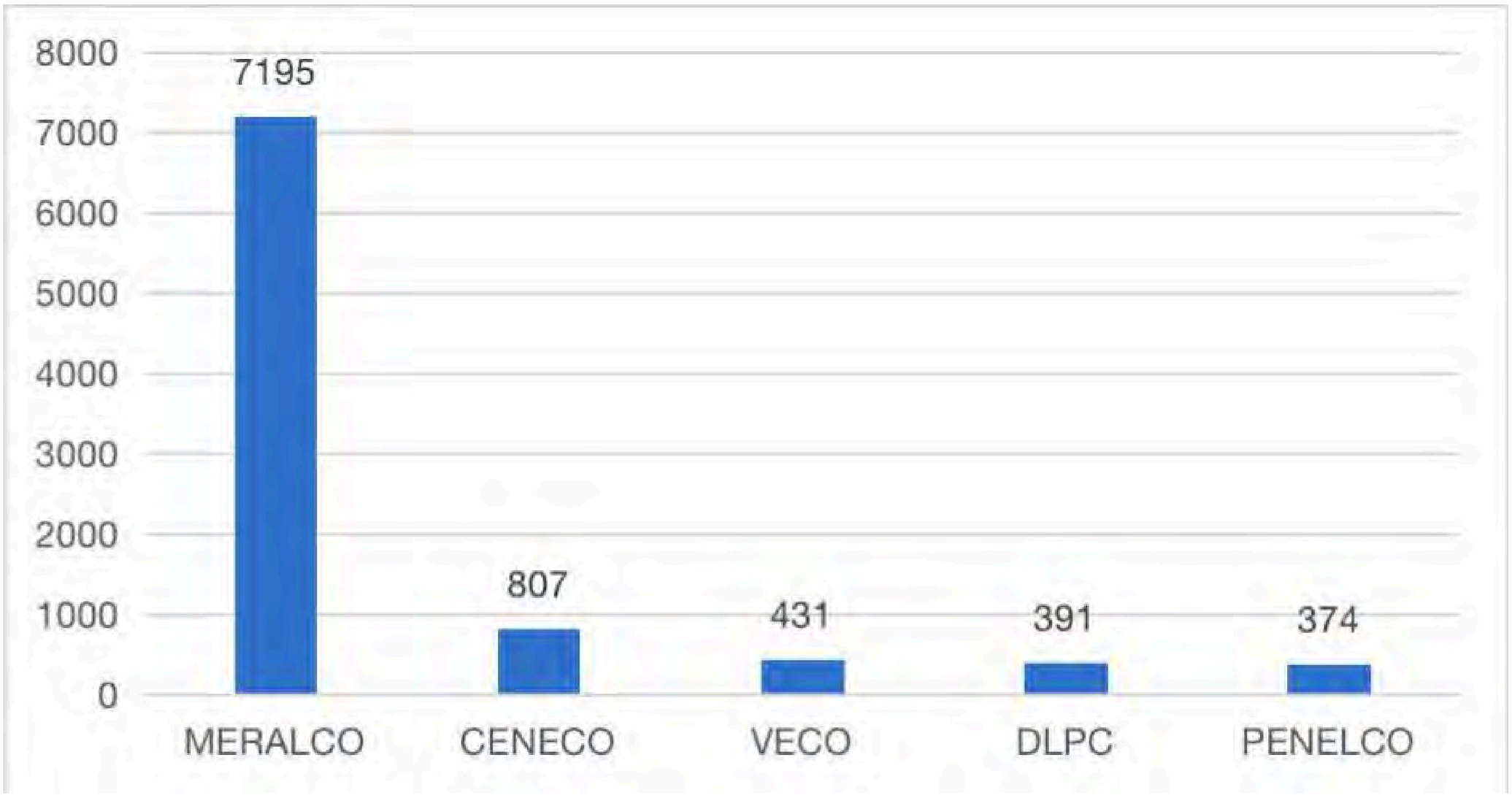
Figure 9. Share of DUs in Total Net-metering Capacity, Mindanao.



Source: ERC.

Meralco is the top DU with 7195 QEs (Figure 10). In contrast, the other top provincial DUs have much smaller QEs such as CENECO (807), VECO (431), DLPC (391) and PENELCO (374).

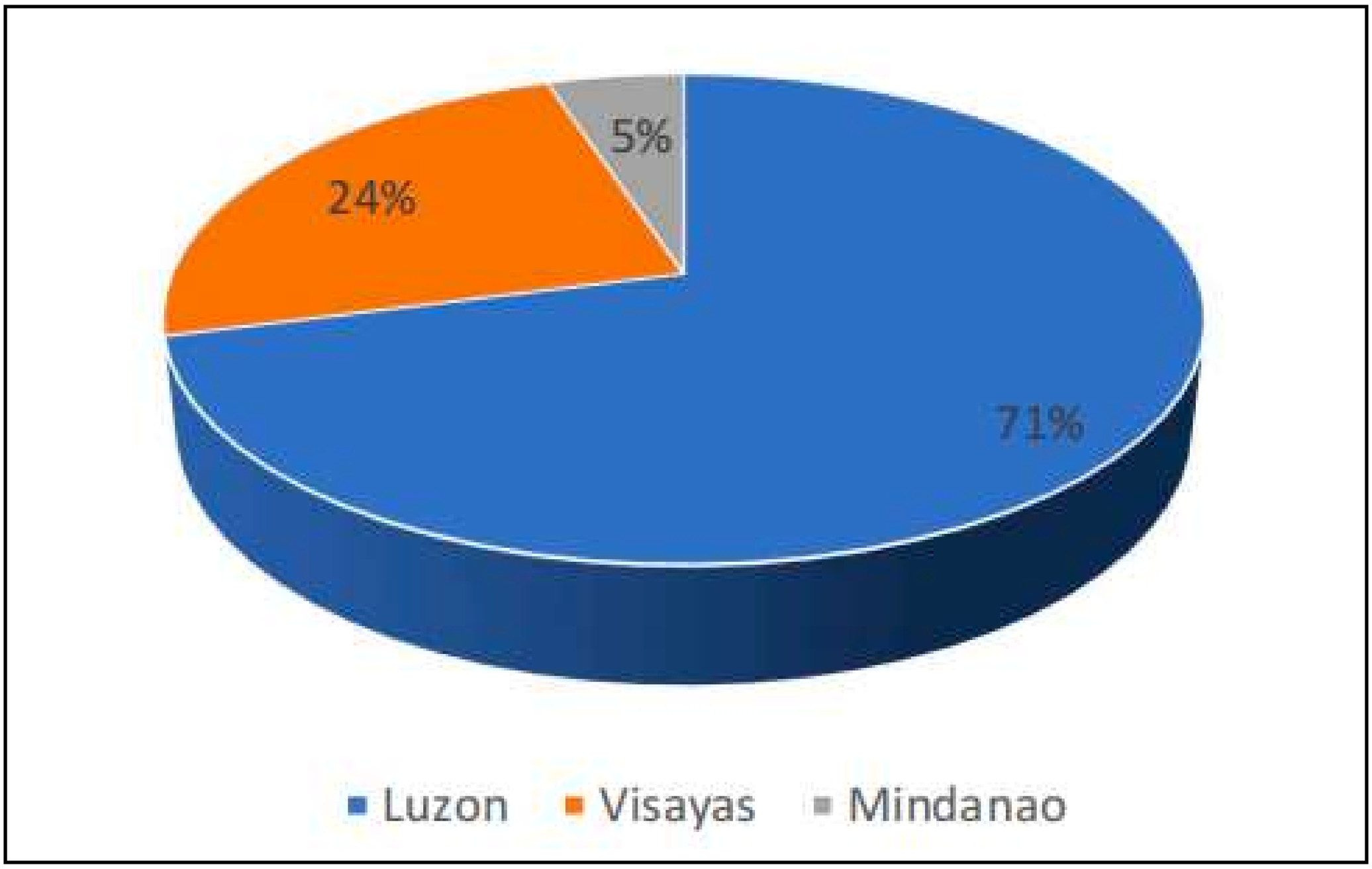
Figure 10. Number of QEs of Top Five DUs, April 2024.



Source: ERC.

The Luzon DUs cornered the highest share of the country's total grid at 71% (Figure 11). On the other hand, both Visayas and Mindanao lags behind significantly at 24% and 5%, respectively.

Figure 11. Percentage Share per Grid of DUs, by Region.



Source: ERC.

For electric cooperatives, the Visayas region has the largest capacity of 20,159.78 kWp followed by Luzon with 17,478.22 kWp. (Table 5). In terms of QEs, Luzon has the largest at 1,847 followed by Visayas which has 1,480. Mindanao lags both regions in Capacity and QEs with only 827.29 kWp and 87, respectively. Total capacity of electric cooperatives in the country is 38,465.29 and total QEs is 3,414.

Table 5. Electric Cooperatives' Capacity and QEs

Distribution Utility (DU)	Capacity (kWp)	Qualified End-Users
Luzon	17,478.22	1,847
Visayas	20,159.78	1,480
Mindanao	827.29	87
Total	38,465.29	3,414

Source: ERC.

The Philippine's total capacity for private utilities is 73,275.82 kWp while its total QEs stands at 9,316 (Table 6). Out of the three islands, Luzon has the largest capacity with 61,794.97 kWp (84%) as well as the highest end users of 8,306 (89%).

Table 6. Private Utilities' Capacity and QEs

Distribution Utility (DU)	Capacity (kWp)	Qualified End-users (QE)
Luzon	61,794.97	8,306
Visayas	6,637.90	564
Mindanao	4,842.95	446
Total	73,275.82	9,316

Source: ERC.

B. Permitting Process

There are four phases of the application process for NM: 1) filing of application, 2) Evaluation, 3) Inspection and 4) Energization (Figure 12). For the initial filing of application, the customer submits to the DU a written request called the Letter of Intent or Letter of Interest (LOI) to avail of the NM program. The DU will then provide the customer with a list of the required documents. When all the requirements are complete, the customer submits the NM application form to the DU which it will review for 10 business days. Once approved, the customer also submits the requirements of the particular LGU which are the building permits and the electrical permits. These are accepted by the Office of the Building Official (OBO) of the LGU.

The evaluation stage refers to the technical evaluation of the DUs. The DUs assessed if a Distribution Impact Study (DIS) is needed. The DIS ensures that the distribution system can safely and reliably accommodate another interconnection of a new generation source and whether upgrades may be necessary to do so. This is done for free by the DU. The DU will have 60 days to complete this study. Additionally, a Distribution Assets Study (DAS) may be required. The DAS is usually performed for big system sizes and covers all additional distribution assets and costs required making the solar PV installation compliant to NM requirements.

After installation of the RE System, the DU and the QE will inspect the facility. They will check to see if all the technical requirements of the Net-Metering Agreement and the Net-Metering interconnection standards were met. Both DU and QE will sign the Net-Metering agreement after the inspection. The LGU will also inspect the facility for the issuance of the certificate of final electrical inspection (CFEI).

The DU will assist the QE in its application for a certificate of compliance (COC) with ERC. All documents including the Net-Metering Agreement will be submitted to ERC within 5 days of the signing of the agreement. Finally, the QE and DU will execute the NM Agreement.

The last stage is energization. Several tests are conducted to confirm that the installed interconnection system is safe and complete. In addition, the DU shall inspect the RE facility onsite and check it's alignment with the technical requirements prescribed in the amended rules on Net-Metering. The QE will also provide protection parameters for his system. Once all permits and licenses have been obtained, the DU is expected to finalize all the inter connection process within 20 working days from the receipt of written request from the QE.[16]

1. Requirements from the Distribution Utilities (DU)

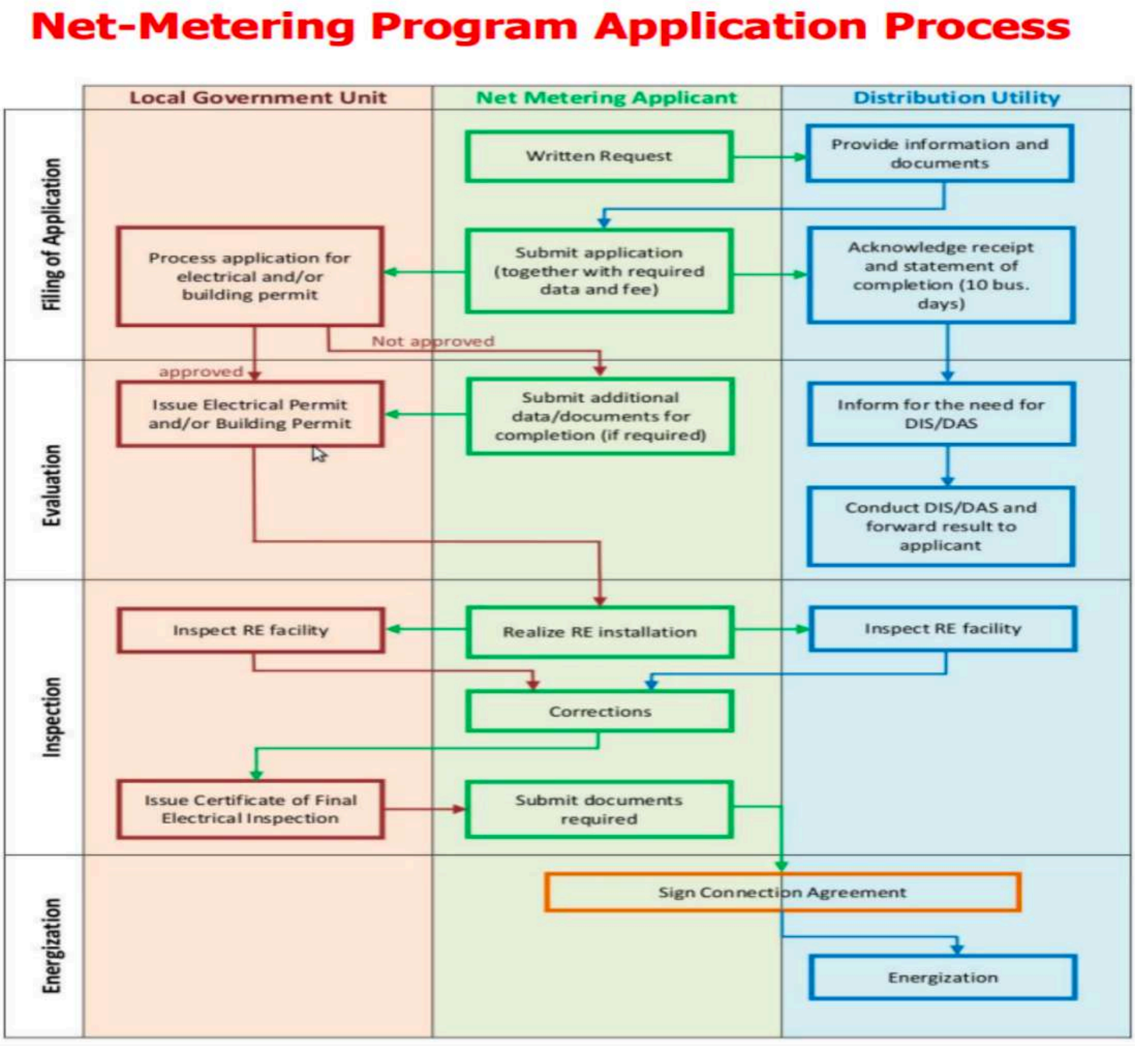
In the initial process, the DU receives a Letter of Intent/interest from a customer which is a request to participate in the NM program. The DU will then provide the customer with a list of required documents as mandated by the DOE. Here are the requirements as enumerated in the Meralco website.[17] Other DUs have similar requirements.

- Net-Metering Application Form
- Identification Document (Residential – ID & Proof of Valid Occupancy Business – Secretary's Certificate)
- Certificate of Compliance (COC)
- Certificate of Renewable Energy (RE) Facility Equipment
- Updated Electrical Plan, duly signed and sealed by Professional Electrical Engineer (PEE)
- Plant Parameters Form
- Distribution Impact Study (DIS) - DU has sixty (60) days to complete the study
- Amended Net Metering Agreement (NMA)
- Fixed Asset Boundary Document (FABD)
- COC Application Fee of PhP 1,500.00

[16] DOE, Guidebook on Net-metering in the Philippines, 48-56.

[17] Meralco, "Application Process," accessed April 18, 2024, https://www.meralco.com.ph/residential/electric service/solar-net-metering/application-process.

Figure 12. Net-metering Program Application Process.



Source: DOE.

2. Requirements from the Local Government Units (LGUs)

At the LGU level, the requirements are the building permit, the electrical permit and the Certificate of Final Electrical Inspection. These are all submitted to the Office of the Building Official (OBO) of the LGU.[18]

The building permit allows the construction, installation, addition, alteration, renovation, conversion, repair, demolition or other work activity of a specific project/building/structure. The building permit requires several documents that the applicant needs to complete (see Appendices A, B & C). The LGU-OBO ensures that the accompanying principal plans and specifications is aligned with the Implementing Rules and Regulations of the National Building Code.

The application for the building permit includes the application for electrical permits. Table 7 shows the documentary requirements to obtain the electrical permit. The Electrical Division of the OBO ensures that the applicant complies with the standards and requirements on electrical safety in the Philippine Electrical Code (PEC), the Electrical Engineering Law, and the particular LGU. The electrical permit is issued after an indicative period and after payment of the required fees (Table 8).

Once all of the electrical systems have been installed, the Electrical Division conducts an inspection. At the installation site, the Electrical Division ensures its compliance with the National Building Code and the Philippine Electrical Code. If the results are satisfactory, the Electrical Division issues a Certificate of Final Electrical Inspection.

[18] DOE, *Guidebook on Net-metering in the Philippines*, 50-52.

In actual practice, solar installation companies faced huge challenges in securing permits. A German company identified two reasons in their difficulty to obtain permits from the LGUs: [19]

a) There is no standard list on additional permits and requirements. Aside from the standard electrical permit, other permits may or may not be required by the particular LGU: barangay permit, electronics permit, fire safety inspection, structural permit etc.

b) There is no standard fees for solar project permits. The company experienced a couple of distinctly different permit fees: i) For a 520 kWp project in Rizal, they were asked to pay Php 153,000.00; ii) For 580 kWp project in Laguna, the company paid only Php16,000.00. According to the LGU in Rizal, without any nationwide policy on the fees schedule for solar projects, the LGU used their own Sangguniang Barangay resolution to determine the fees for various permits. The company's response to exorbitant charges by an LGU is to take the amount out of their profit margin. This is clearly a disincentive to the expansion of solar projects.

[19] PSSEA, Cebu Solar Community Meetup 2024, Cebu Parklane Hotel, April 23, 2024.

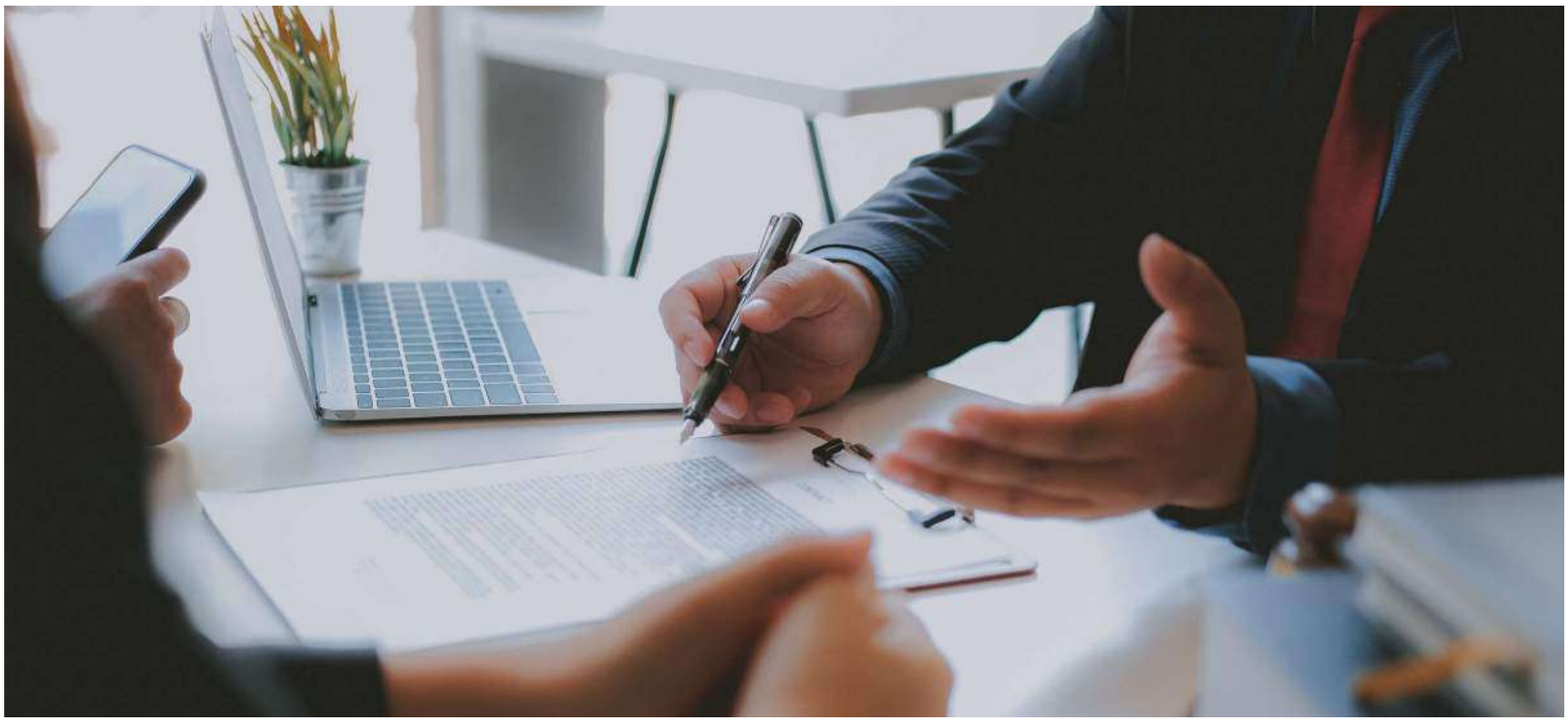
Obtaining the CFEI can also take months or years. This is because completing the occupancy permit required to get the CFEI entails resubmitting the electrical, plumbing, and layout plans of the house. This can be a problem for homes that have been built decades ago with no occupancy permit as it was not required before or had been lost already. Moreover, current residents of a home may not secure the occupancy permit because the original home owners are deceased or could no longer be located.[20]

c) Some companies complain that the LGUs see the permitting process as an opportunity to extract substantial fees. They even tried to separately charge solar installation permits and the usual building permit on new constructions to collect more fees. The inconveniences, delays, and high fees in obtaining the CFEI have discouraged consumers from availing of net metering.

Instead, unregulated (guerilla) installations have increased, ignoring the potential benefits of net metering for the community.[21]

Tonichi Agoncillo and Danny Aquillo of Meralco said that as a DU one of their major concerns is the non-standardized LGU and PEZA requirements for the CFEI. The LGUs have different requirements and costs. Moreover, some LGUs have admitted that they do not know how to check the solar installations of their customers.[22]

[20] PSSEA, Position Paper, 2024.
[21] PSSEA, Position Paper, 2024.
[22] PSSEA, Deep Dive Session, January 12, 2024.



In the consultations with stakeholders other related issues were also mentioned:[23]

- DOE Assistant Secretary Mylene Capongcol pointed out that another challenge is that the some DUs especially electric cooperatives are hesitant to participate in net-metering, despite consumers' willingness to enroll in NM, because of their lack of knowledge on how to conduct a DIS.

- Raul Lucero of VECO enumerated the problems they encountered with their customers with rooftop solar installations: (1) some residential and non-residential customers with grid-type rooftop solar installations are not on their records. They did not secure a COC from the ERC and electrical permit from OBO; (2) Small scale installers with non-competent electricians do not complete the requirements and standards. The customers had to spend additional costs for the rework; (3) Customers were shown unrealistic savings for the solar installations by solar installers making them feel scammed.

- Meralco attests to the presence of guerilla installations among their customers. These are households which do not register with the DU and the LGU their on-grid solar PV installations. The danger in guerilla installations is that these pose electrocution risks to service crews working on the lines. There are also homes which do not obtain their COC anymore once their NM service has been activated. The ERC has given them 6 months of grace period to register to avoid paying a penalty. In addition, there are customers who add solar capacity without informing the LGU, DU, ERC. They endanger the system as the evaluation was done after DIS. What hinders the customer from reporting the installed additional capacity to their DU is the inconvenience of securing another CFEI.

[23] PSSEA, Deep Dive Session.

Obtaining permits proved to be a major bottleneck to the acceleration of the rooftop solar industry. The permits for small and simple solar projects should be simple, standardized, cost-efficient and fast. Some recommendations to implement this are:

1. Issue a decree enumerating the basic permits and inspection requirements applicable to all the LGUs. Meralco in consultation with the DOE have recommended that the DUs can work with DILG and DTI for standard requirements and fees for the CFEI for solar PV installations, regardless of size.[24] These should be inscribe in a guidebook to be disseminated in all LGUs.
2. For permits that are area-specific, it should be justified in writing by the said LGU.
3. GoSolar recommended installing a permitting desk in each LGU which will entertain all enquiries about rooftop solar permits and requirements.[25] They should be able to coordinate with the DOE or a national authority for the solar industry.
4. Create a database of all projects per LGU.
5. To encourage LGUs to take-up rooftop solar projects in their communities, an award mechanism can be set-up based on a quota of finished projects annually.

[24] PSSEA, Deep Dive Session.
[25] Aibar Rabi Rashad F. Bibi, Interview, June 6, 2024.

Table 7. Requirements in securing electrical permit: Pasig City, Davao City and Cebu City.

PASIG CITY

Basic Requirements

1. 1 set duly accomplished application forms - completely and properly filled-out
2. 4 sets of complete plans with key plan and location map duly signed and sealed by respective Professional Engineers and signed by the owner / applicant.
3. 1 copy of Detailed Bill of materials signed and sealed by respective Professional Engineers
4. 1 set Material Specification signed and sealed by respective Professional Engineers
5. 1 copy of scope of works originally signed and sealed by respective Professional Engineers
6. 1 copy of latest PTR and Valid PRC ID of respective Licensed Professional Engineers originally signed and sealed
7. 1 copy of electrical design analysis, short circuit and voltage drop calculation, originally signed and sealed by Professional Electrical Engineer.
8. 1 copy of approved building permit or occupancy permit

Additional Requirement

1. 1 set of Load Design Computation – for elevator / escalator signed and sealed by PME. (Or to be indicated on mechanical plan)

2. 1 copy of Certificate of Structural Stability supported by structural evaluation and assessment and material testing originally signed and Sealed by a Structural Engineer and copy of latest PTR and PRD ID of Structural Engineer – for Elevator and Escalator (for rehabilitation, modernization, replacement and upgrading)

3. 1 set of Electronic Design Analysis (voltage Drop and Battery Sizing) – applicable for 5 - Storey building and above, originally signed and sealed by a Professional Electronics Engineer.

DAVAO CITY

Revocable Electrical Permit

1. Application Form
2. Notarized Affidavit of Undertaking
3. Clear Picture of the Residential House (Perspective View)
4. Detailed Location Plan
5. Building/ Electrical Inspector Report that the Structure is Made of Indigenous Materials
6. Barangay Certification (for Government and Private Properties)
7. Certification from City Housing (CPDO) that Structure is Indigenous Family Dwelling (for Government Housing and Relocation Projects)
8. Notarized Authorization Letter from the Registered Lot Owner (for Private Properties)
9. Photocopy of Certificate of Land Title (for Private Properties)
10. Photocopy of one (1) Valid ID of the Lot Owner and One (1) Valid ID of the Applicant, Present All Original IDs (for Private Properties)
11. Certification from Bureau of Fire including Statement of Account from the Davao Light Power Corp. (for Fire Victims)

CEBU CITY

1. 2 original Certificate of Final Electrical Inspection/Completion
2. 2 Electrical Permit Forms
3. 1 original & 1 photocopy Barangay Clearance
4. 1 Certified true copy & 1 photocopy Lot Tax Declaration
5. 1 Certified true copy & 1 photocopy Building Tax Declaration
6. 2 photocopies Sketch of the Location
7. 2 photocopies Certificate of Occupancy/Use
8. 1 original & 1 photocopy Electrical Plans

Source: Office of the Building Official of Pasig City, Davao City and Cebu City.

Table 8. Schedule in Computing Fees for Electrical Permit.

The following schedule shall be used for computing electrical fees in residential, institutional, commercial and industrial structures:

a. Total Connected Load (kVA)

					Fee	
i.	5 kVA or less	P	200.00			
ii.	Over 5 kVA to 50 kVA	P	200.00	+	P	20.00/kVA
iii.	Over 50 kVA to 300 kVA		1,100.00	+		10.00/kVA
iv.	Over 300 kVa to 1,500 kVA		3,600.00	+		5.00/kVA
v.	Over 1,500 kVA to 6,000 kVA		9,600.00	+		2.50/kVA
vi.	Over 6,000 kVA		20,850.00	+		1.25/kVA

NOTE: Total Connected Load as shown in the load schedule.

b. Total Transformer/Uninterrupted Power Supply (UPS)/Generator Capacity (kVA)

					Fee	
i.	5 kVA or less	P	40.00			
ii.	Over 5 kVA to 50 kVA	P	40.00	+	P	4.00/kVA
iii.	Over 50 kVA to 300 kVA		220.00	+		2.00/kVA
iv.	Over 300 kVa to 1,500 kVA		720.00	+		1.00/kVA
v.	Over 1,500 kVA to 6,000 kVA		1,920.00	+		0.50/kVA
vi.	Over 6,000 kVA		4,170.00	+		0.25/kVA

NOTE: Total Transformer/UPS/Generator Capacity shall include all transformer, UPS and generators which are owned/installed by the owner/applicant as shown in the electrical plans and specifications.

c. Pole/Attachment Location Plan Permit

i.	Power Supply Pole Location	P	30.00/pole
ii.	Guying Attachment	P	30.00/attachment

This applies to designs/installations within the premises.

d. Miscellaneous Fees: Electric Meter for union separation, alteration, reconnection or relocation and issuance of Wiring Permit:

Use or Character of Occupancy	Electric Meter	Wiring Permit Issuance
Residential	P 15.00	P 15.00
Commercial/Industrial	60.00	36.00
Institutional	30.00	12.00

e. Formula for Computation of Fees

The Total Electrical Fees shall be the sum of Sections 4.a. to 4.d. of this Rule.

f. Forfeiture of Fees

If the electrical work or installation is found not in conformity with the minimum safety requirements of the Philippine Electrical Codes and the Electrical Engineering Law (RA 7920), and the Owner fails to perform corrective actions within the reasonable time provided by the Building Official, the latter and/or their duly authorized representative shall forthwith cancel the permit and the fees thereon shall be forfeited.

Source: DOE.

C. Valuation of Exported Energy

Under Resolution No. 09 Series of 2013: Rules Enabling the Net-Metering Program, the ERC is mandated to establish a pricing methodology applicable to net-metering. The preliminary reference price[26] was set at the DU's monthly generation charge, which is based on blended generation costs. Resolution No. 06 Series of 2019: Amended Net-Metering Rules states that the DU's blended generation cost excluding other generation adjustments remains[27] the pricing methodology instead of the proposed retail rate.

The generation charge refers to the cost of producing electricity which is purchased from various suppliers. These suppliers are primarily:

1. WESM (Wholesale Electricity Spot Market) is a market for trading electricity with prices determined by supply and demand. Prices rise when there is tight supply.

2. Power producers and utilities with PSA (Power Supply Agreement) or contracts with DUs to provide a certain amount of electricity at agreed prices.

3. IPP (Independent Power Producers) are private companies which produce and sell electricity to utilities and other consumers.

[26] Resolution No. 09, Series of 2013, A Resolution Adopting the Rules Enabling the Net-Metering Program for Renewable Energy, July 1, 2013.

[27] Resolution No. 06, Series of 2019, A Resolution Adopting the Amendments to the Rules Enabling the Net-Metering Program for Renewable Energy, October 9, 2019.

The generation charge accounts for more than 50 percent of consumer's electricity bills and can be impacted by the cost of fuel, the foreign exchange rate, and other market conditions.[28]

The charges incurred by the DU can be broken down into the following:[29]

1. Generation Charge refers to the cost of power purchased by the DU from its suppliers which are mainly Independent Power Producers (IPPs), power producers with Power Supply Agreements (PSAs) with DUs, power producers using Renewable Energy and the Wholesale Electricity Spot Market.

2. Transmission Charge is the cost of transporting electricity from the power suppliers to the DU's distribution system.

3. System Loss Charge recovers the cost of power which was lost because of technical and non-technical system losses. Private DUs can recover a maximum of 8.5% losses under ERC Resolution No.17, Series of 2008.

4. Distribution Charge is the cost of developing, constructing, operating and maintaining the distribution system which provides power through the transmission grids to the C&I and residential end-users.

5. Subsidies – Lifeline and Senior Citizen Discounts is available for low-income customers and senior citizens who consume not more than 100 kwh in a month.
6. Metering Charge refers to the cost of reading, operating and maintaining power metering facilities and services.

7. Supply Charge is the cost for billing, collection, customer assistance and related services.

[28] Cristina Eloisa Baclig, "Understanding power rates: Impact of WACC, generation costs," Inquirer.net, June 04, 2024, https://newsinfo.inquirer.net/1947910/understanding-power-rates-impact-of-wacc-generation-costs#ixzz8guaE2GqO

[29] Meralco, "Breakdown of Charges," accessed April 15, 2024, https://www.meralco.com.ph/residential/billing payment/understanding-your-bill/breakdown-charges

Table 9 shows Meralco's generation cost from several sources which includes independent power producers, Power Supply Agreements (PSAs), WESM, and Export Energy from Net-metering Customers. In the example Meralco's energy purchase from Independent Power Producers (IPPs) reached 1.279 B kWh or 46.3% of the total and 1.239 B kWh or 44.8% from Power Supply Agreements (PSAs). From WESM, the DU obtained 245 M kWh (8.9%) power while energy from its Net-metering Customers only yields 1,729,310 kWh (0.06%). Total Generation Cost for the January 2023 amounted to PHP19.7 B and the average generation cost (PHP/kWh) was PHP 7.1228. The latter is the price of exported energy from QEs.

Table 9. Meralco's Sources of Generation Charge, January 2023.

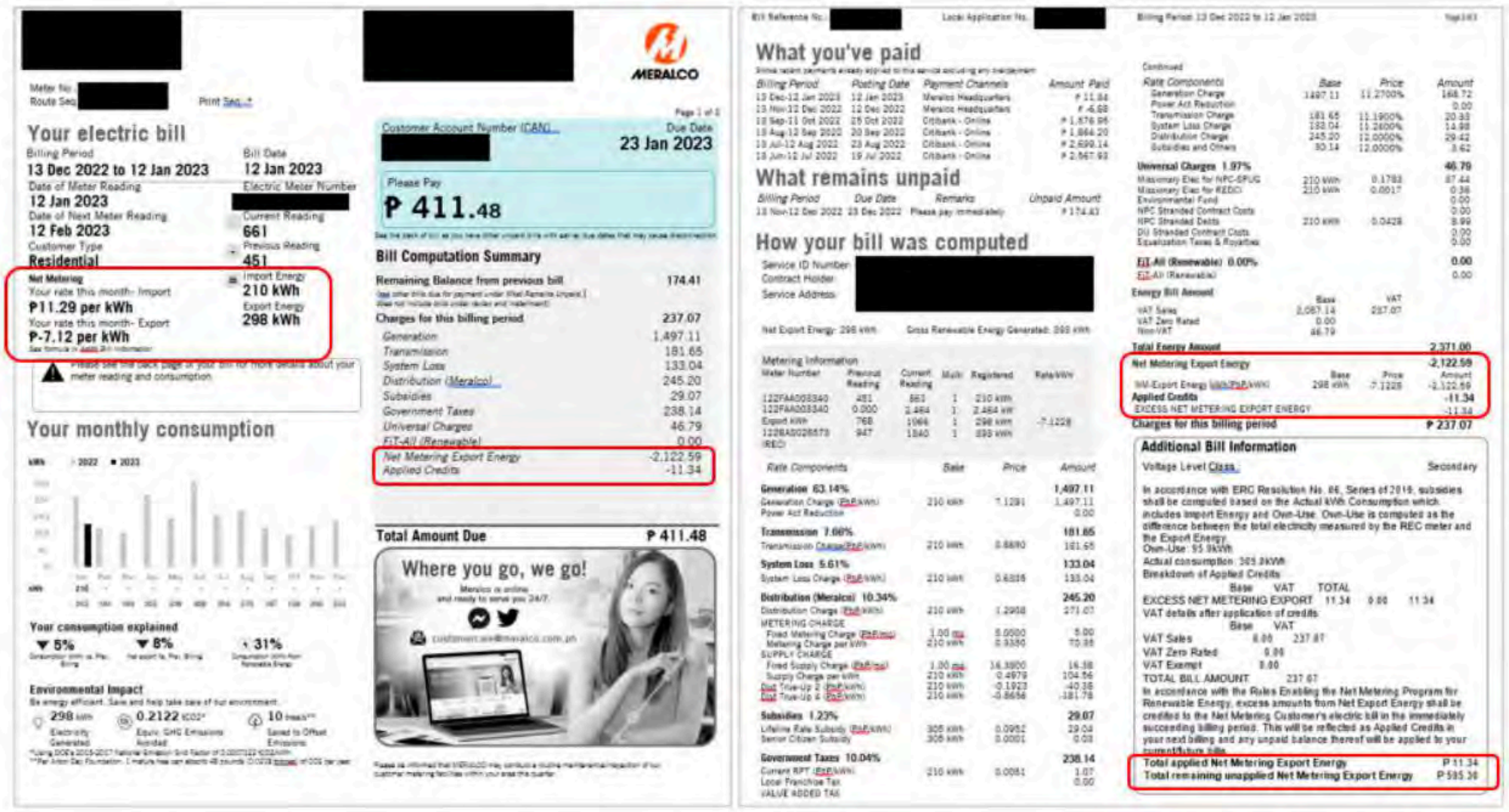
BREAKDOWN OF GENERATION CHARGE

Source	% of Total kWh Purchased	(A) kWh Purchased	(B) Basic Generation Cost (PhP)	(C) Other Cost Adjustments (NSS and Other Billing Adjustments) (PhP)	(D = B+ C) Total Generation Cost for the Month (PhP)	[D/A] Average Generation Cost (PhP/kWh)
BILATERAL CONTRACTS WITH POWER SUPPLIERS						
1. Quezon Power Phils Ltd. Co. (QPPL)	10.3%	284,369,959	3,395,782,390	(36,475,263)	3,359,307,127	11.8132
2. First Gas Power Corporation (FGPC) – Santa Rita	22.6%	623,571,864	4,674,838,519	(70,828,334)	4,604,010,186	7.3833
3. FGP Corp. (FGP) – San Lorenzo	13.4%	371,195,417	2,403,976,710	(41,864,863)	2,362,111,847	6.3635
Subtotal - Independent Power Producers (IPPs)	*46.3%*	*1,279,137,240*	*10,474,597,620*	*(149,168,460)*	*10,325,429,160*	*8.0722*
4. First NatGas Power Corp. (FNPC) - San Gabriel	9.6%	265,098,764	1,548,992,879	(25,133,746)	1,523,859,133	5.7483
5. San Buenaventura Power Ltd. Co. (SBPL)	6.7%	186,347,493	1,773,775,127	(45,053,231)	1,728,721,896	9.2769
6. AC Energy (baseload)	5.2%	144,000,000	636,549,572	-	636,549,572	4.4205
7. San Miguel Energy Corp. (SMEC)	6.7%	183,793,000	792,839,972	(59,414,879)	733,425,092	3.9905
8. South Premiere Power Corp. (SPPC) (baseload)	5.4%	147,960,000	633,592,822	(35,928,881)	597,663,941	4.0394
9. AC Energy (midmerit)	1.7%	47,520,000	213,354,156	-	213,354,156	4.4898
10. South Premiere Power Corp. (SPPC) (midmerit)	4.1%	114,530,000	575,600,480	(7,017,088)	568,583,392	4.9645
11. Energy Development Corporation (EDC) (midmerit)	1.4%	39,470,000	213,636,460	-	213,636,460	5.4126
12. Panay Energy Development Corp. (PEDC)	0.5%	14,398,000	35,243,586	-	35,243,586	2.4478
13. GNPower Dinginin Ltd. Co (GNPD)	2.8%	78,021,821	465,010,054	-	465,010,054	5.9600
14. Other PSAs*	0.6%	17,588,631	69,923,886	(1,594,743)	68,329,143	3.8848
Subtotal - Power Supply Agreements (PSAs)	*44.8%*	*1,238,727,709*	*6,958,518,994*	*(174,142,568)*	*6,784,376,426*	*5.4769*
Wholesale Electricity Spot Market (WESM)	8.9%	245,339,008	2,076,394,727	496,086,164	2,572,480,891	10.4854
Export Energy from Net Metering Customers	0.06%	1,729,310	11,743,451	-	11,743,451	6.7908
Others	0.00%	9,533	-	-	-	
TOTAL	**100.0%**	**2,764,942,800**	**19,521,254,792**	**172,775,136**	**19,694,029,928**	**7.1228**
Other Generation Adjustments (OGA)						
1. Pilferage Recovery						(0.0115)
2. ILP Recovery						0.0000
3. High Load Factor Rider						0.0000
4. TOU Differential						0.0178
JANUARY 2023 GENERATION CHARGE						**7.1291**

**Solar Philippines Tarlac Corp. (SPTC) and Powersource First Bulacan Solar Inc. (PFBS)*

Source: Meralco.

Figure 13. Electric Bill with Net-metering Charges.



Source: Meralco.

Figure 13 shows the different charges in the billing period. The generation cost accounts for 63.14% of total cost or PHP1497.11. Other charges are for transmission (7.7%), distribution (10.34%), and taxes (10.04%). The total energy cost amounted to PHP2,371. The exported energy was 298 kWh and with PHP7.1228 price of exported energy, the net-metering export energy amounted to PHP2,122.59. This including the applied credits were subtracted from the total energy charge. The final energy charge for the billing period amounted to only PHP237.07 or 10% of the total energy bill.

As Figure 13 shows the current pricing scheme for Net-metering is Net billing in which the kWh of exported energy is based on the blended generation rate of the host utility. This rate is below the retail rate of electricity. PSSEA contends that the lower than market valuation on of households' exported energy undermines their contribution to the energy supply which primarily falls during prime daytime hours when energy demand is highest. The blended generation charge has been applied for over a decade coinciding with low adoption of solar rooftop installations compared to potential. It should be examined thoroughly and adjusted appropriately to improve consumer adoption rates of solar rooftop technology.[30]

[30] PSSEA, *Position Paper*, 2024.

IV. ECONOMICS OF ROOFTOP SOLAR

A. Installation Costs [31]

A. Grid-tied solar panel installation in the Philippines can cost from ₱150,000 to higher than ₱1,000,000. The price may vary according to the type of house, roof and solar system size (Figure 14).

- Small Affordable Houses (₱400,000≤) will have a solar panel system costing from ₱150,000 – ₱210,000. This home consumes 224kWh of electricity per month. The recommended 2 kWp system needs 5 solar panel system on an area of around 12m2.
- Medium-cost Houses may need solar installations ranging from ₱300,000 – ₱420,000. This consists of 10 solar panels in an area of 17m2. It is a 4kWp system covering an average monthly energy consumption of 448kWh.
- Large High-cost Houses requires 38 solar panels (15kWp) with an installation area of 86m2. The cost of the system will range from₱900,000 – ₱1,260,000. Larger houses may need 75 solar panels (30kWp) which will cost around ₱1,800,000.

[31] GetSolar, “Solar Panel Philippines – Price of Installation and Maintenance,” November 17, 2022, https://getsolar.ai/blog/solar-panel-installation-maintenance-price-philippines/

Figure 14. Rooftop Solar Installation Costs by House Size.

Source: GetSolar.

Factors that Affect the Solar Panel Installation Price

There are several factors which can affect the installation cost.[32]

1. Size of the System. The installable area determines the size of the solar panel system. It will also determine the amount of electricity generated. The greatest cost savings is incurred when the system size is optimized to meet the energy requirements of the household.

2. Roof Pitch, Type, and Material. The cost of solar installation will depend on the type of roofing material which determines the type of mounting gear needed for the solar installation. The most common types of roofing in the Philippines are metal, tiled, and wood roofs.

- Trapezoidal metal roofs are the most common roof types for solar installations. The solar modules are clamped onto the trapezoidal roof through small mounting brackets. Rainwater does not collect under the panels because the trapeizodal peaks allow it to flow. This simple installation process ensures that prices are low.
- Corrugated metal roofs involve a more complicated installation process. Solar installers must build a mounting rack first to make the solar panels angled in the right direction for maximum performance, proper ventilation and security. This costs more because more labor is required to install the mounting racks.

[32] GetSolar, “Solar Panel Philippines – Price of Installation and Maintenance.”

- For Tiled roofing solar installation occurs in 2 steps. First, roof tiles are temporarily removed to install the mounting frame. Then, solar panels are attached to the mounting frame. The additional work adds to the cost of the installation.
- Solar installation on Wooden truss roofing is not advised. This can break under the weight of the solar setup. Moreover, the solar installation can be a fire hazard.
- Steep roofs require more manpower to secure the solar panels safely on the roof and hence, are more costly. This also takes a longer installation time.

3. Type of Solar panel. The price of solar modules is determined by its technology and brand. The three most common types of solar panel technologies are Monocrystalline, Polycrystalline, and Thin Film. Table 10 shows that Monocrystalline solar panels are the most preferred for residential solar installations due to its higher efficiency and it also has less installation area. The most popular solar panel brands in the Philippines are Trina, Hanhwa, JA Solar, and REC. These are Tier 1 solar panels as labeled by Bloomberg New Energy Finance (BNEF). They are high quality in terms of manufacturer's reliability and consistency.

4. Type of Solar panel system. The two types of solar panel system in the Philippines are grid-tied and hybrid. Grid-tied solar system does not use solar battery and instead connects to the grid in times when the solar panels are not producing energy such as at night or on cloudy days. Aside from receiving electricity, the system exports excess energy to the grid at a rate set by the DU. In contrast, hybrid solar systems add a solar battery which can store the excess electricity produced by the system. The cost of the solar battery makes the hybrid system more expensive than the grid-type system.

5. Cost of REC Meter Compliance. This is the most prohibitive cost in installing rooftop solar because of the following reasons: The consumer is required to spend additional expense in wiring the AC side from inverters to the service entrance of the DU or a location visible and accessible to the DU. A breaker is also required to be installed at the service entrance for the solar installation. From the service entrance, AC wiring will be routed back inside to the customer's main breaker. The DU requires Rigid Steel Conduit which is visible and exposed. The conflict here is that the REC meter is to quantify the Renewable Energy Credits that will be credited to the DU and will benefit the DU, but the customer is the one required to spend for it.[33]

[33] PSSEA, Position Paper, 2024.

In the consultation with Meralco, they pointed out the lack of Philippine Standards for Solar and Net Metering. Hence, substandard equipment can enter the country and be sold to cost-conscious consumers. These substandard equipment fail to pass the evaluation and interconnection standards. Overall, they negatively impact the rooftop solar industry and can slow down its adoption. Meralco suggested that the solar industry needs to collaborate with the DTI to establish national standards for equipment in order to protect the consumers and the industry. [34]

[34] PSSEA, Deep Dive Session.

Table 10. Types of Solar Panels.

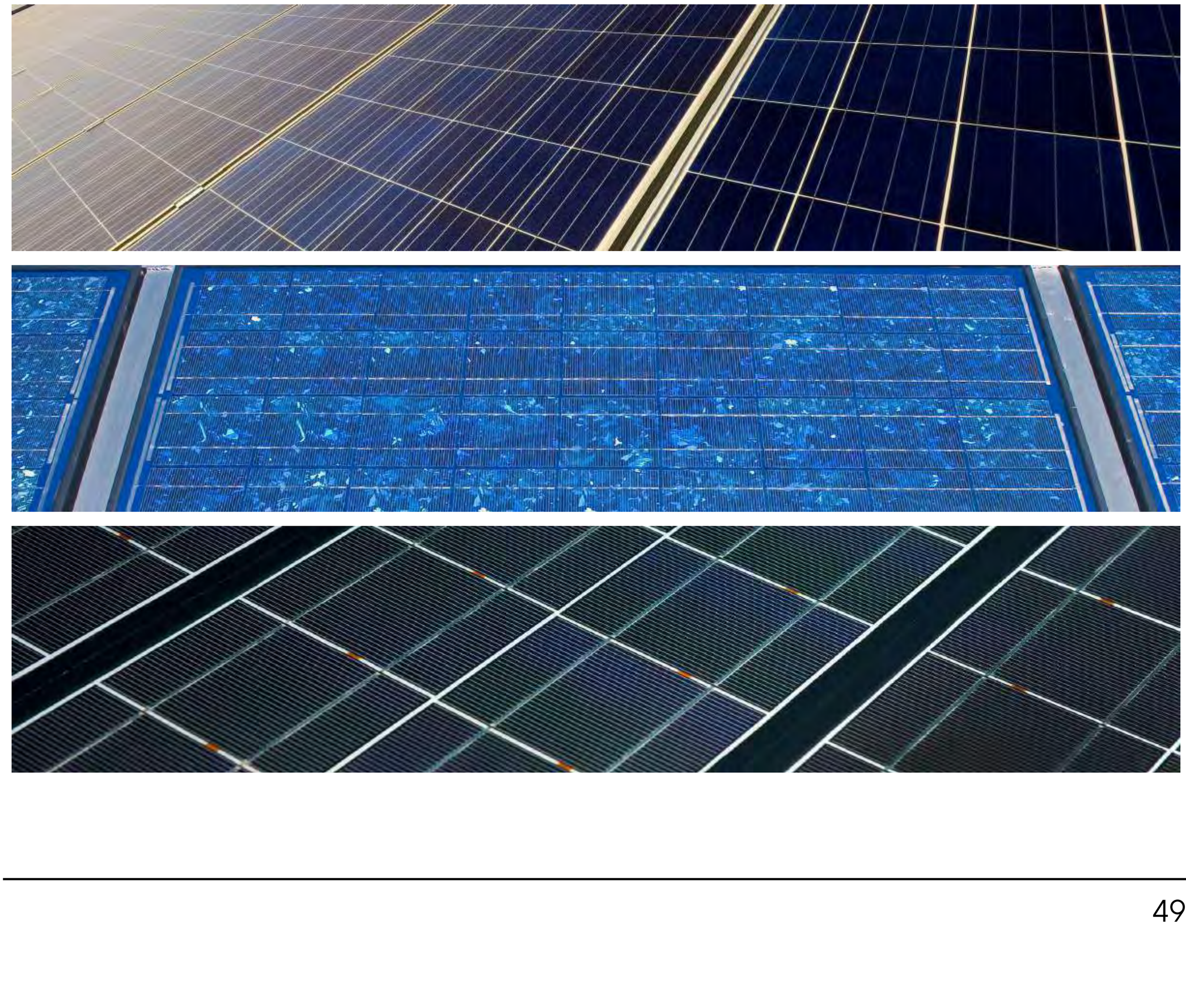
Types of Solar Panels

Panel Type	Pros	Cons	Common Use Cases
Monocrystalline	• High efficiency and performance (20%) • High durability • Aesthetically pleasing	• High cost (most expensive)	• Residential
Polycrystalline	• Mid-cost; affordable	• Medium efficiency and performance (15-17%) • Average durability	• Residential • Commercial • Industrial
Thin-Film	• Low cost (cheapest) • Easily produced • Lightweight • Portable & flexible	• Low efficiency and performance (10-13%) • Short lifespan	• Industrial • Areas with large installation space • Flat-Roofs

Source: Solar AI Technologies

SOLAR AI

Source: GetSolar.



B. Return On Investments (ROI)

Computation of ROI

Using the tool developed by the DOE, here are two examples of calculating the return of investment of a solar roof top under net-metering rules. [35] The ROI of solar panel installations of 1.6 kwp, and 5.6 kwp were estimated. A 1.6 kWp grid tied solar is recommended for households with an average electricity bill of PhP 12,000. The household have one to two refrigerators and an air conditioning system running in the daytime. A 5.6 kWp grid tied solar is recommended for households with an average electricity bill of PhP 20,000. This can power heavy usage of several appliances such as washing machines, vacuums, refrigerators, and air conditioning systems.

The general assumptions are the life time of the solar PV reaches 25 years while its degradation factor is 0.7%. The consumer consumes 70% of its solar power and exports 30% to the grid. The DU retail rate is 12.0575 while its generation charge is 6.5332. It is expected that the generation rate will grow by 3% annually. The solar panels have a module efficiency of 16% and is employed 8,760 hours per year. The cost of operation and maintenance is PhP900 per kWp yearly.

A 1.6 kWp has an installation cost of PhP70,000 per kWp hence, the total cost of the installed PV system amounted to 112,000 (Table 11). The total solar energy produced over its lifetime is 51,598 kwh. This consists of 36,119 kwh solar energy consumption and 15,479 kwh solar energy export. Total cost of operating and maintenance amounted to 140,800 and total savings reached PhP553,904. Total avoided cost amounted to PhP628,341 while total credit from export is PhP145,911. Break even happens at the 5th year when total energy produced is 2,180 kwh.

The installation for a 5.6 kWp solar system costs PhP280,000 which is expected to yield 180,593 kwh over its 25 year lifetime (Table 12). This is broken down into 126,415 kwh consumption and 54,178 kwh solar energy export. The total cost amounted to PhP380,800 while accumulated savings reached PhP1,938,663. The avoided cost reached PhP2,199,195 and credit for exports amounted to PhP510,688. Breakeven also occurs at the 4th year with 7,685 kwh total energy produced.

In a scenario where a 5.6 kWp solar system consumes 100% of the energy produced and none is exported, the breakeven year is still on the 4th year (Table 13). The difference is that total savings rise by 17% to PhP2,263,655 (previously PhP1,938,663). Moreover, the internal rate of return is 34%, a 4 percentage point increase from the previous scenario with net-metering.

[35] https://doe.gov.ph/netmetering-downloads

Table 11. The ROI of 1.6 kWp Grid Tied Rooftop Solar Installation.

No	Assumptions		
1	Life time of PV	Years	25
2	Rated Capacity of PV System (RC)	KWp	1.6
	Module Efficiency (ME)	%	16%
	Hours/Year	Hours	8,760
3	Yield (RC * ME * hours/year)	kwh/year	2,243
4	Degradation Factor	%	0.7%
5	% Own Consumption	%	70%
6	DU Total Customer Charge	PHP/kWh	12.0575
7	Annual Increase in DU/Generation Charge	%	3%
8	% Net Export	%	30%
9	DU Generation Charge	PHP/kWh	6.5332
10	Operations and Maintenance (O&M)/Year/KWp	PHP	900
	Cost of installed PV System	PHP/kWp	70,000
11	Cost of installed PV System total	PHP	112,000
	Key Performance Indicators		
	Total Solar Energy Produced	kwh	51,598
	Total Cost	PHP	140,800
	Total Savings	PHP	553,904
	Break Even	Year	5
	Internal Rate of Return	%	21%

Source: DOE, Author's computation.

Table 12. The ROI of 5.6 kWp Grid Tied Rooftop Solar Installation.

No	Assumptions		
1	Life time of PV	Years	25
2	Rated Capacity of PV System (RC)	KWp	5.6
	Module Efficiency (ME)	%	16%
	Hours/Year	Hours	8,760
3	Yield (RC * ME * hours/year)	kwh/year	7,849
4	Degradation Factor	%	0.7%
5	% Own Consumption	%	70%
6	DU Total Customer Charge	PHP/kWh	12.0575
7	Annual Increase in DU/Generation Charge	%	3%
8	% Net Export	%	30%
9	DU Generation Charge	PHP/kWh	6.5332
10	Operations and Maintenance (O&M)/Year/KWp	PHP	900
	Cost of installed PV System	PHP/kWp	50,000
11	Cost of installed PV System total	PHP	280,000
	Key Performance Indicators		
	Total Solar Energy Produced	kwh	180,593
	Total Cost	PHP	380,800
	Total Savings	PHP	1,938,663
	Break Even	Year	4
	Internal Rate of Return	%	30%

Source: DOE, Author's computation.

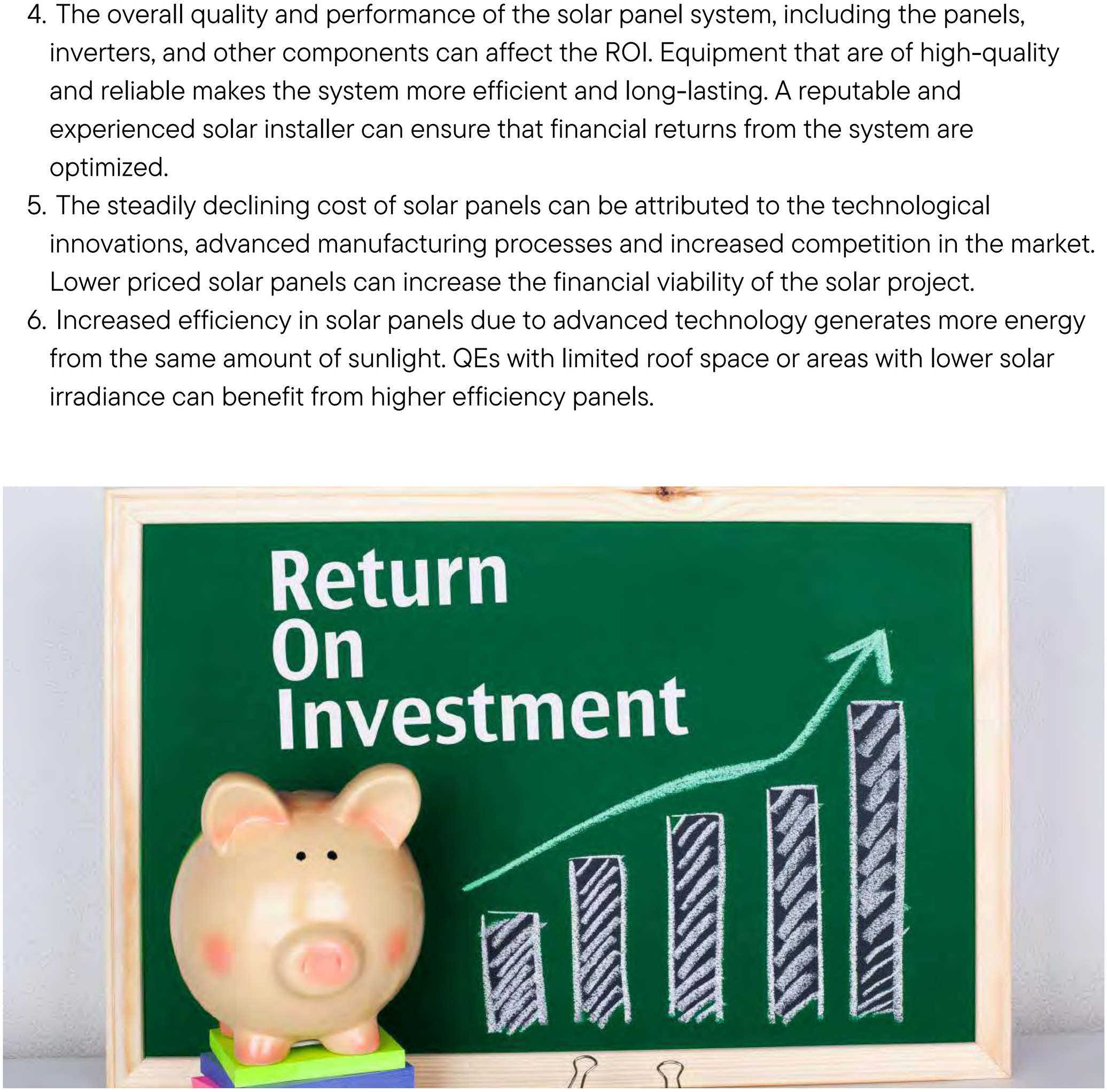
Table 13. The ROI of 5.6 kWp Grid Tied Rooftop Solar Installation, without Net-metering.

No	Assumptions		
1	Life time of PV	Years	25
2	Rated Capacity of PV System (RC)	kWp	5.6
	Module Efficiency (ME)	%	16%
	Hours/Year	Hours	8,760
3	Yield (RC * ME * hours/year)	kwh/year	7,849
4	Degradation Factor	%	0.7%
5	% Own Consumption	%	100%
6	DU Total Customer Charge	PHP/kWh	12.0575
7	Annual Increase in DU/Generation Charge	%	3%
8	% Net Export	%	0%
9	DU Generation Charge	PHP/kWh	6.5332
10	Operations and Maintenance (O&M)/Year/KWp	PHP	900
	Cost of installed PV System	PHP/kWp	50,000
11	Cost of installed PV System total	PHP	280,000
	Key Performance Indicators		
	Total Solar Energy Produced	kwh	180,593
	Total Cost	PHP	380,800
	Total Savings	PHP	2,263,655
	Break Even	Year	4
	Internal Rate of Return	%	34%

Source: DOE, Author's computation.

Factors Affecting ROI [36]

1. The location of the house affects the ROI on the solar panels. More energy can be produced in areas with high solar irradiance. Favorable local policies, incentives and electricity rates can also affect the system's ROI.
2. The size and orientation of the solar installation can impact ROI. Larger systems will produce more electricity and thus, increase savings. The angle and direction of the panel can maximize the production of energy.
3. Higher energy consumption allows more energy savings and shorter period to realize the ROI.
4. The overall quality and performance of the solar panel system, including the panels, inverters, and other components can affect the ROI. Equipment that are of high-quality and reliable makes the system more efficient and long-lasting. A reputable and experienced solar installer can ensure that financial returns from the system are optimized.
5. The steadily declining cost of solar panels can be attributed to the technological innovations, advanced manufacturing processes and increased competition in the market. Lower priced solar panels can increase the financial viability of the solar project.
6. Increased efficiency in solar panels due to advanced technology generates more energy from the same amount of sunlight. QEs with limited roof space or areas with lower solar irradiance can benefit from higher efficiency panels.



[36] Jack Jones, "What Is The Return On Investment (ROI) For Solar Panels?" November 5, 2023, https://solarpowerinc.org/faqs/what-is-the-return-on-investment-roi-for-solar-panels/

It is evident that the ROI is driven by technology. The technology of solar panels has come a long way since the first solar panel which was built in the 1950s. Solar panels before were expensive to produce and only convert 10% of sunlight into electricity.[37] As engineers improved its efficiency and PV chemistries, solar prices fell 500 times since 1975 and about 90% since 2010.[38] Today, solar panel technological innovation continues. Solar PV cells are being engineered to be thinner, lighter, flexible and transparent. Lightweight technologies can save on labor, transportation and land use costs. It can also allow the installation of solar PV in other places aside from rooftops, such as windows.[39]

In 2024, the DOE and the Department of Science and Technology (DOST) signed a Memorandum of Agreement (MOA) which signifies their collaboration to advance renewable energy research and development (R&D).[40] This will be funded by the Renewable Energy Trust Fund (RETF) mandated under Section 28 of Republic Act No. 9513 or the Renewable Energy Act 2008. The RETF is created to finance R&D, demonstration, and promotion of RE systems on power and non-power uses by R&D institutions or through public-private sector partnerships. The guidelines for managing the RETF is stated in Department Circular No. DC2022-06-0018 issued by the DOE.

[37] "Solar Energy," Climate Portal, accessed July 27, 2024, Solar Energy | MIT Climate Portal

[38] International Energy Agency, "Evolution of solar PV module cost by data source," 1970-2020, updated July 2, 2020, https://www.iea.org/data-and-statistics/charts/evolution-of-solar-pv-module-cost-by-data-source-1970-2020

[39] "Solar Energy"

[40] DOE and DOST collaborate for renewable energy research and development," April 3, 2024, https://doe.gov.ph/press-releases/doe-and-dost-collaborate-renewable-energy-research-and-development

The DOE and DOST, through the Philippine Council for Industry, Energy and Emerging Technology Research and Development (PCIEERD) will pursue research projects on improving the efficiency, affordability and scalability of solar technologies. It will also facilitate the application of the research towards the commercialization of these technologies and its contribution on fostering a robust local green economy. In addition, the outputs will aid policymakers to improve policy frameworks and market mechanisms for faster deployment of solar technologies in the country.

The initial topic proposals on solar energy are: Integrated Renewable Energy Information and Mapping Systems and Local Market Assessment of Solar Photovoltaic Systems. It is also suggested that future proposals should cover research and development on the use of indigenous materials in the evolving solar equipment technology. This will enable the country to enter the global supply chain of solar materials and increase business and employment.

C. Sources of Financing

1. Bank Loans

QEs can avail of loans from banks to finance their solar rooftop installations. The project cost is generally divided into 70% financing by the bank and 30% equity from the lender. The terms are usually flexible and accommodate the QEs circumstances. The term of the loan can be 3 to 7 years or longer as required by the project. Loan payments are made according to the project's cash flow and can be on a monthly or quarterly basis. The interest rate is the prevailing interest rate which can be on a fixed or variable basis. Collateral can be real estate mortgages on residential or commercial properties, chattel mortgage on equipment, and joint and/or several signatures of principal stockholders for corporate borrowers.[41]

Philippine banks loans however, are concentrated to solar projects worth 1MW to 50 MW. This implies that smaller projects like residential rooftop solar gets limited funding.[42] However, there is desire by local banks to increase lending to renewable energy particularly wind and solar projects. Security Bank intends to nearly double its lending in 2025 to P40 billion.[43]

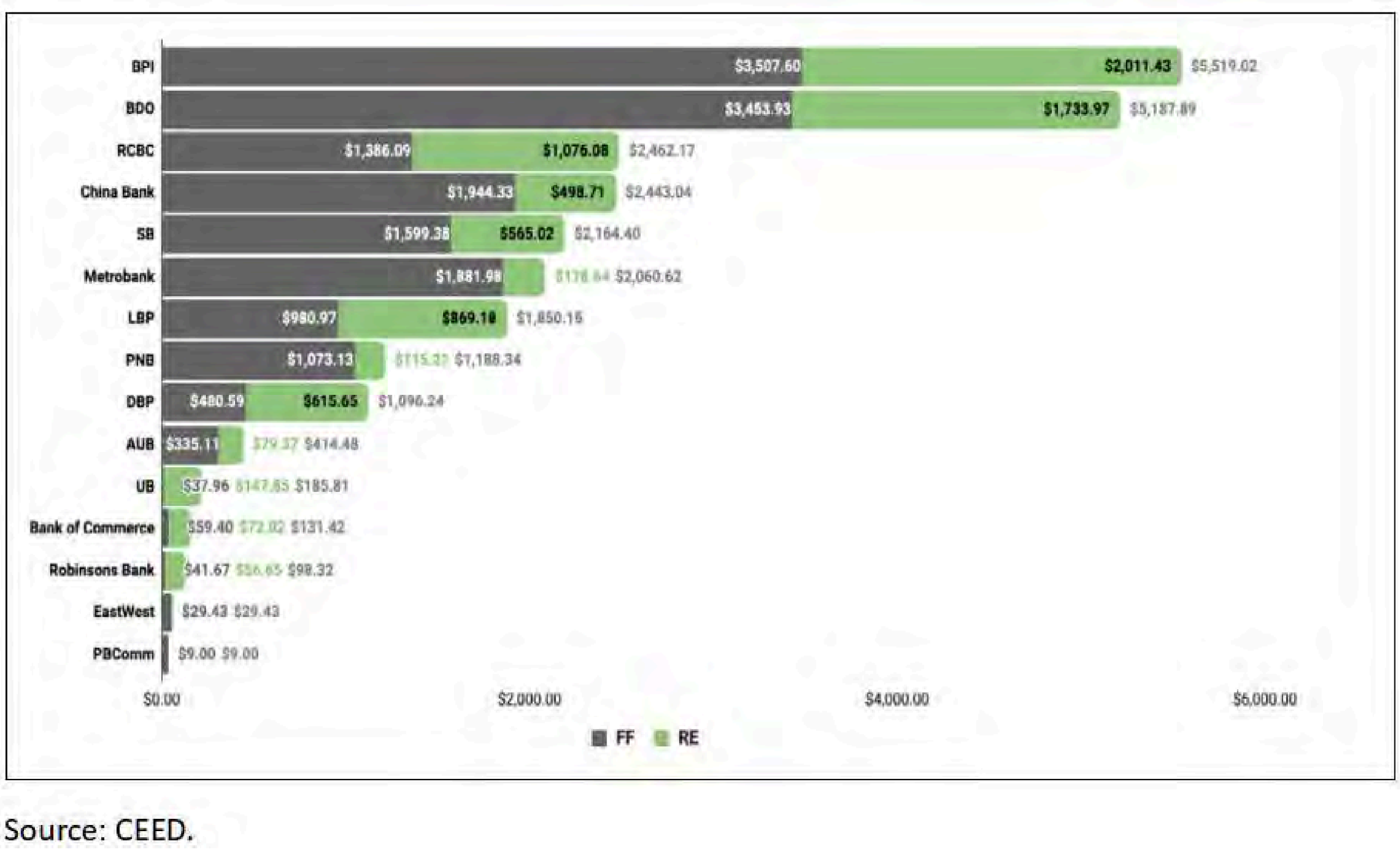
[41] Department of Energy (DOE), "How to fifinance Solar rooftops;" accessed May 10, 2024, https://doe.gov.ph/6-how-fifinance-solar-rooftops

[42] DOE, Guidebook on Net-metering in the Philippines, 42.

[43] Meg J. Adonis, "Security Bank bets on RE lending to fuel growth, eyes P40B in new loans,"Inquirer.net, June 20, 2024, https://business.inquirer.net/464559/security-bank-bets-on-re-lending-to-fuel-growth

According to the Center for Energy, Ecology and Development (CEED) 15 of the country's largest banks issued $8 billion worth of loans for renewable energy projects from 2009 to 2023 (Figure 15). At the same time, loans to the coal industry reached $15 billion, almost twice those of renewables. Moreover, the selected domestic banks spend less than 48 US cents on renewable energy per dollar of coal and gas (Table 14). Reclaim Finance states that in order to reach IEA's Net-Zero Emissions by 2050 scenario and keep global warming to 1.5°C., for every dollar going to fossil fuel, six dollars should be spent on renewable energy investments by 2030. These banks did not meet the IEA ratio of 6:1.[44]

Figure 15. Fossil Fuel VS RE Financing from 2009 to 2023 (amount per bank)



Source: CEED.

[44] Center for Energy, Ecology, and Development (CEED), 2024 Fossil Fuel Divestment Scorecard (Manila, Philippines: CEED, 2024),

2. The Development Bank of the Philippines enables net-metering through their loan facility called Energy Efficiency Savings (E2SAVE) Financing Program.[45] It is available to the public (national government agencies, government-owned and controlled corporation, state universities andcolleges, LGUs, etc.) and private sectors [private companies and Energy Service Companies (ESCO) accredited by the DOE.

Public institutions are entitled to a loanable amount of up to 100% of total project cost. Private companies can borrow a maximum of 80% of their project costs. Likewise, ESCOs can avail of loans up to 80% of Contract or Purchase Order amount, net of margin. Loans for own use net-metering has a tenor of up to 10 years inclusive of up to 1 year grace period on the principal. The interest rate will be based on the prevailing rates of DBP, fixed or variable depending on the source of fund.

[45] Development Bank of the Philippines, "Energy Efficiency Savings (E2SAVE) Financing Program," accessed May 10, 2024, https://www.dbp.ph/developmental-banking/environment-initiatives/energy-efficiency-savings-e2save-fifinancing-program/

Table 14. Investments on Renewable Energy for Every Dollar of Fossil Fuel.

Bank	For every $1 on fossil fuel, banks spend the following on RE (2009 - 2023)
BPI	$0.57
BDO	$0.50
RCBC	$0.78
China Bank	$0.26
SB	$0.35
Metrobank	$0.09
LBP	$0.89
PNB	$0.11
DBP	$1.28
AUB	$0.24
UB	$3.89
Bank of Commerce	$1.21
Robinsons Bank	$1.36
EastWest	$0.00
PBComm	$0.00

Source: CEED.

3. Pag-IBIG Fund has issued a memorandum in 2015 allowing its qualified members to borrow as housing loan the acquisition/installation of solar panels as part of home improvement or as a component of the housing unit to be purchased subject to the prevailing Pag-IBIG Fund retail housing loan programs. The collateral for the loan shall be the same residential property that the member is making the loan for. [46]

4. Solar companies have a standing agreement with major credit card companies to provide QEs with installment packages for their rooftop solar installations. Some credit have 0% interest rate for installment of up to 12 months [47]

5. Third party ownership refers to either a direct lease arrangement or a power purchase agreement. In a lease agreement, a lump sum amount is paid by the QE to the institution which owns the facility. The QE can consume the energy produced by the solar installation and use net-metering to sell its excess energy. In a power purchase agreement, the QE pays a pre-determined amount per KWh to the owner institution. Unlike in a lease arrangement, it is the institution which sells the excess energy to the grid. [48]

6. The Landbank's Renewable Energy Program offers loans to companies building renewable energy projects.[49] The program specially caters to projects which are in the preparation stage and can be tapped for a feasibility study, engineering design production and other research. Borrowers such as electric cooperatives, local governments, state-owned firms and national agencies can avail of up to 90% of the total project cost. Single proprietorships such as cooperatives, associations and private borrowers can borrow up to 80%.

Loans for working capital and project preparation should be paid in five years while capital expenditures can be paid within 15 years depending on the cash flow. The interest rate shall be based on the prevailing market rate, although not below five percent per annum.

[46] DOE, Guidebook on Net-metering in the Philippines, 43.
[47] DOE, Guidebook on Net-metering in the Philippines, 43.
[48] DOE, "How to finance Solar rooftops;" accessed May 10, 2024
[49] GMA News Online, "Landbank says loans for green energy projects reached P20B," GMA News Online, April 27, 2022, https://www.gmanetwork.com/news/money/companies/829919/landbank-says-loans-for-green-energy projects-reached-p20b/story/

D. 100 kWp Cap On Net-metering For Residential – Should This Be Increased?

In residential homes net-metering is set at 100 kWp. This capacity limit is set in the RE Act. This is because NM under Section 4 (gg) of the RE Law, refers only to a system appropriate for Distributed Generation (DG). As defined under Section 4 (j) of the RE Law, DG refers to small generation entities supplying directly to the distribution grid with capacity not exceeding 100 kW. Solar PV above 100kW is considered for the Zero-Export program in which excess energy not consumed by the customer is prohibited to be exported to the grid.[50]

This limitation hinders the full potential of utilizing NM. According to PSSEA, the ERC rule refers to the potential Direct Current (DC) production of the solar panels as the "generator." However, this is not an accurate assessment of the energy export capacity. In an air-conditioned laboratory, solar modules are rated and tested under fixed 1000w/sqm sunlight with solar panel temperature at 250C. However, in a tropical country such as the Philippines panel temperatures can reach 450C to 600C. The derate in production for each degree above 250C is 0.7%. To account for heat related losses more DC than AC is installed to match inverter output. This means that more solar panels are installed than inverter rating. It is proposed that the 100kW capacity be viewed not as solar panels but as maximum Alternating Current (AC) injection capacity of the connected AC inverters. This is more in line with the AC power that runs on the distributed grid.[51]

[50] DOE, "How Net-Metering works: understanding the basics of policy, regulation and standards," accessed May 15, 2024, hΣ ps://doe.gov.ph/1-how-net-metering-works-understanding-basics-policy-regulation-on-and-standards

[51] PSSEA, Position Paper, 2024.

The ERC addressed this issue of limitation in the NM rules with the approval of the Distributed Energy resources (DER) rules. The DER rules allow installations greater than 100kWp but not more than 1MW to inject power to the grid. However, export capacity of solar installation is limited to a maximum of 30%. The compensation on the DER exported energy is 75% of blended generation rate for above 100kW to 500kW and 60% of the blended generation rate for above 500kW to 1MW.[52]

A member of PSSEA states that the DER rate is a more economically disadvantageous rate structure than the existing NM program. The lower valuation of excess generation has discouraged national and local governments to put up solar facilities. A large commercial plant with a solar facility for self-consumption can export power only during weekends and holidays and only 30% of its plant size. It is also exported at a price almost half the retail price of energy with 65% further devaluation. As an example, a 45-million-peso investment of 1 MWp exporting energy during the weekend can only recoup about PhP 40,000.00 a month under the DER regime.[53]

Net-metering for rooftop solar below 100 kW in size did not translate into significant growth for the industry. For the industry to accelerate the cap needs to address the discrepancy between DC and AC production or be removed altogether. Meanwhile, DER rules can increase the currently low export capacity and compensation rate to make it more profitable.

[52] "Distributed Energy Resources," Meralco, accessed July 10, 2024, https://company.meralco.com.ph/products-services-and-programs/distributed-energy-resources

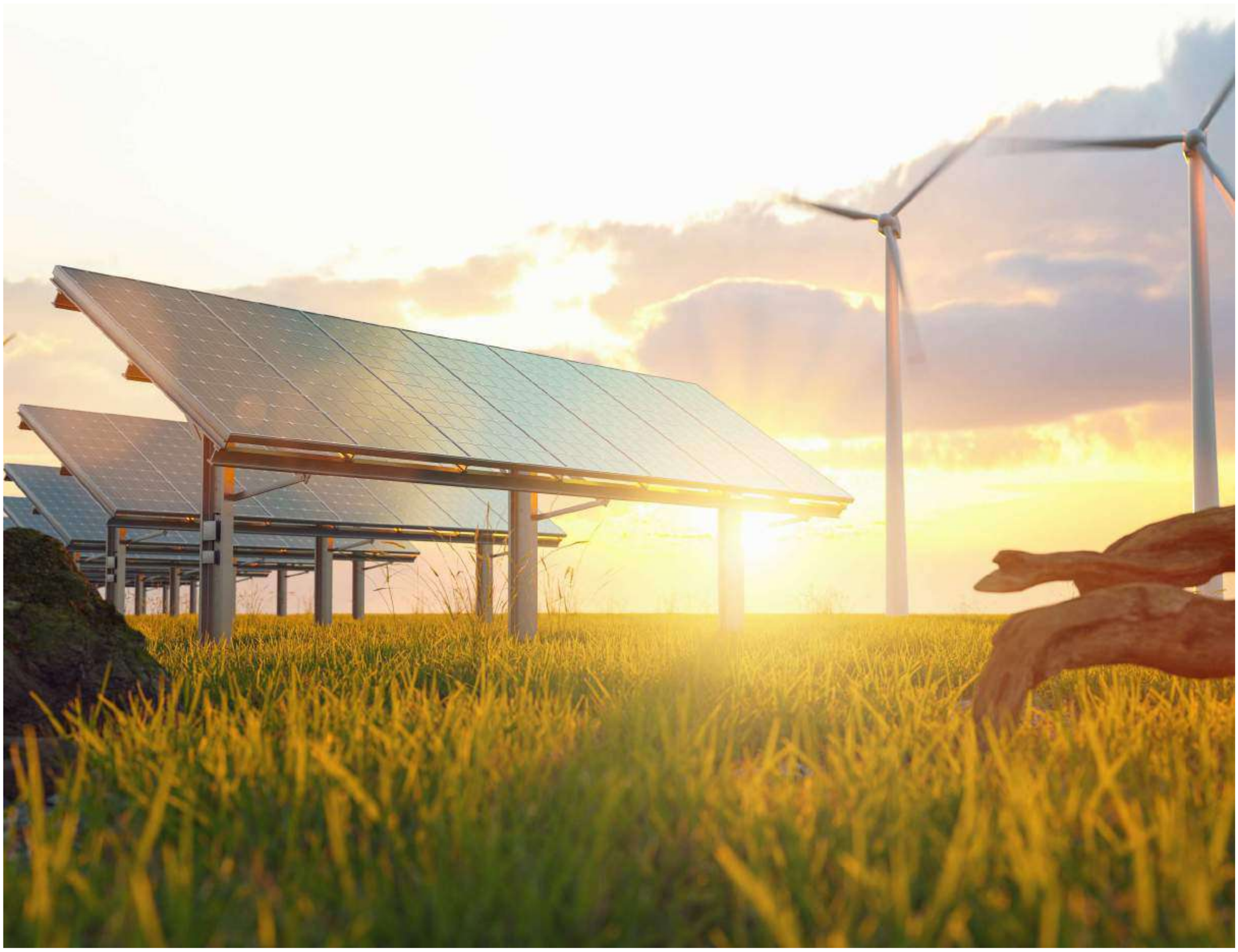
[53] PSSEA, Position Paper, 2024.

E. Board of Investment (BOI) Incentives for Companies

The Strategic Investment Priority Plan (SIPP) which came into effect in 2022 has expanded and extended the tax incentives given to selected industries which are crucial to the development of the country. It covers industries in high-tech sectors.

The SIPP classifies an economic activity into three tiers. These activities can avail of the investment incentives under the Corporate Recovery and Tax Incentives for Enterprises (CREATE) Act. The CREATE ACT came into force in 2021 with fiscal incentives to lift the country from the economic recession during the pandemic.

Incentives under the CREATE Act can be income tax holidays (ITH), enhanced deductions (EH), 5 percent special corporate income tax rate (SCIT), duty exemption on importation of Capital Equipment, raw materials, spare parts, or accessories and VAT exemption on importation and VAT Zero-rating on local purchases.



The length of the incentives is determined by several factors: by the tier that an activity belongs in, whether the business is for local consumption or to be exported and its location, whether in the National Capital Region, metropolitan areas, or areas contiguous and adjacent to the National Capital Region, or other regions.

Energy Efficiency and Conservation projects belong in Tier 2. Tier 2 refers to activities which promote a green ecosystem and fill gaps in the value chain. Energy efficiency projects (EEP) aim to lower energy consumption or cost through improving, repairing or adding fixtures on any building or facility. A salient feature of the BOI guideline is that the ITH shall be imposed only to the income generated from the registered project. It is also important to note that the ITH offered in the CREATE law is 4 to 7 years while the Renewable Energy law (RA 9513) offers an ITH of seven years.

On self-financed energy efficiency projects, the incentives are:

1. The ITH can be availed for the ITH entitlement period under the CREATE Act or when 50% of their capital investment has been recovered. The latter exclude cost of land and working capital of the registered EEP, whichever comes first.

2. Duty exemption on importation of capital equipment, raw materials, spare parts or accessories.

- The ITH is based only on the income of the project which implemented the EEP. In addition, the existing project should be listed in the SIPP during the registration of the EEP and the project do not receive an ITH incentive if it is registered with an Investment Promotion Agencie (IPA).
- For any project which can obtain an income based incentive aside from ITH such as 5% SCIT, these conditions will apply:

- If the EEP applies for the ITH incentive, the 5% SCIT shall be waived during the ITH incentive period;

- When the of 50% of its investment capital for the EEP is recovered, the IPA registered project can resume the 5% SCIT on its remaining period. There will be no extension of the income incentives period. It is not considered self-financed if the EEP is applied to a project of an affiliate or subsidiary, regardless of an IPA registration.

There are three scenarios for ITH utilization. In Scenario A (Figure 16) the firm availed ITH for its core activity for five years.

Figure 16. Firm Avail of ITH.

Scenario A: The Firm is enjoying ITH from it's core activity

ASSUMPTIONS:

Base Year Revenue:	**Php 7,367,321,398.00**
Sales Growth Rate:	**11% per annum based on historical data**
Estimated Net Income:	**4.5% of total revenue based on historical data**
Tax Rate:	**25%**
Capital Investments	**PhP 500 million**

EESI Project		EE Project Registration	SCO*		
	YEAR 1	**YEAR 2**	**YEAR 3**	**YEAR 4**	**YEAR 5**
Estimated Revenues	8,177,726,751.78	9,077,276,694.48	10,075,777,130.87	11,184,112,615.26	12,414,365,002.94
Estimated Net Income	367,997,703.83	408,477,451.25	453,409,970.89	503,285,067.69	558,646,425.13
ITH (100%) from the Core Activity	0	0	0	0	0
ITH (50%) from EESI Project			0	0	0

*SCO: Start of Commercial Operations

Source: BOI.

In Scenario B (Figure 17), the company enjoyed the ITH of 50% recovery of its capital investment on the EE project amounting to PHP250 million. The ITH is computed as the product of the estimated net income and the 25% tax rate. In Year 1 the estimated ITH reached PHP91.9 M (PHP367.9 M X 0.25). ITH in Year 2and Year 3 amounted to PHP102.1 million and PHP55.8 million, respectively. The company was able to recover 50% of its capital investment in 2 years and 5 months.

Figure 17. Firm Uses ITH of 50% recovery of its capital investment.

Scenario B: ITH (50% Recovery of Capital Investment of the EE Project) – Not enjoying any Fiscal Incentive

ASSUMPTIONS:

Base Year Revenue:	**PhP 7,367,321,398.00**
Sales Growth Rate:	**11% per annum based on historical data**
Estimated Net Income:	**4.5% of total revenue based on historical data**
Estimated ITH:	**Estimated Net Income X Tax Rate (25%)**
Investment Capital (EE Project)	**PhP 500 million**

	YEAR 1	YEAR 2	YEAR 3
Estimated Revenues	8,177,726,751.78	9,077,276,694.48	10,075,777,130.87
Estimated Net Income	367,997,703.83	408,477,451.25	453,409,970.89
Estimated ITH	**91,999,425.96**	**102,119,362.81**	**55,882,778.91***

Total Estimated ITH	PhP250,000,000
% Investment Capital Recovery	50%

***50% Capital Investment may be recovered within 29 months (2 year & 5 months)**

Source: BOI.

Scenario C (Figure 18) is an example of a firm enjoying 5% SCIT for 5 years The firm has registered its EE project and SCO is on Year 2. In Year 1 the SCIT amounted to PHP61.3 M (PHP1.2 M X 0.05). SCO begins in year 2 so 50% capital recovery ITH applies this year instead of the 5% SCIT. In year 3 the capital investment of PHP250 M is assumed to be recovered. Year 4 and Year 5 continues the 5% SCIT and the company was able to save PHP83.8 M and PHP93.1 M, respectively.

As an example, Solar Philippines Commercial Rooftop Project Inc,. a BOI-registered firm, has availed of the following incentives: 1. Duty -free importation of capital equipment, spare parts and accessories under the CREATE law; and 2. Income Tax Holiday Incentives.

The CREATE Act incentives are intended to encourage rooftop solar as an energy efficiency activity by firms. However, some companies are not aware of this government initiative. The BOI launched investment roadshows which aim to increase awareness about incentives for Energy Efficiency and Conservation (EE&C) projects and encourage firms to transition to renewable energy use. Specifically, the goal is to support businesses to source their electricity needs through self-established or self-financed RE facilities.

Figure 18. Firm Uses 5% SCIT for 5 Years.

Scenario C: Firm is enjoying 5% SCIT/GIE

ASSUMPTIONS:

Base Year Revenue:	**PhP 7,367,321,398.00**
Base Gross Proffit	**PhP 1,134,557,905.00**
Sales Growth Rate:	**11% per annum based on historical data**
New Investment Capital	**Php 500 million**

EE Project	SCO				
	YEAR 1	**YEAR 2**	**YEAR 3**	**YEAR 4**	**YEAR 5**
Estimated Revenues	8,177,726,751.78	9,077,276,694.48	10,075,777,130.87	11,184,112,615.26	12,414,365,002.94
Gross Profit	1,226,659,012.77	1,361,591,504.17	1,511,366,569.63	1,677,616,892.29	1,862,154,750.44
GIE/SCIT (5%)	**61,332,950.64**	**0 - ITH**	**0 - ITH**	**83,880,844.61**	**93,107,737.52**

Notes: (1) Firm is enjoying 5 years SCIT/GIE (5%) for its existing activity

(2) Firm registered its EE project and SCO is on Year 2

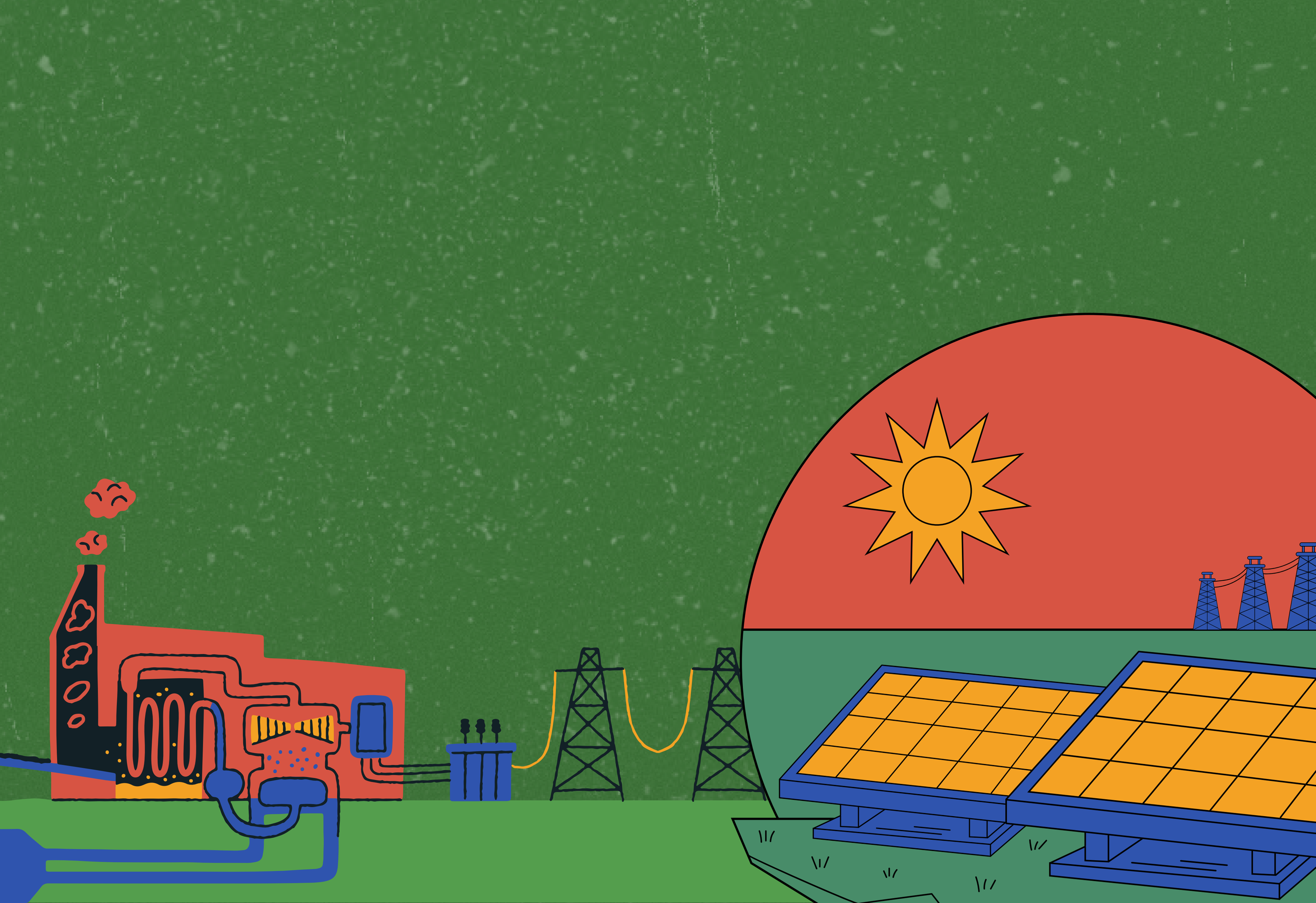
(3) Firm has an option to avail ITH (50% recovery of Capital Investment) or continue its GIE/SCIT

(4) Assume EE project's capital investment is recovered within 2 years

(3) Firm has 2 remaining years to enjoy SCIT/GIE

Source: BOI.

V. SOME THINGS TO THINK ABOUT



A. Using Artificial Intelligence to Determine Solar Potential

One challenge in the solar industry is the lack of information on registered solar panel installations in the country. This hinders strategic policies on energy mixes or solar targets. The affected agents are manufacturers and installers, distribution utilities and their respective networks, and policy-makers.

Geospatial analytics provides a solution to this problem. By using computer vision technology, solar panels can be detected from satellite images. Aside from filling the data gaps, the technology also provides specific details relevant in making decisions. It provides information on building locations and roof sizes which can be used to forecast potential demand and determine the market size. This technology will improve solar energy planning by solar installers, LGUs, and distribution utilities.

Using geospatial analytics, Thinking Machines conducted a study on solar rooftop penetration in Clark, Pampanga, one of the leading special economic zones in the Philippines. The results show that only 1.3% of commercial and industrial (C&I) rooftops in Clark have solar panels. This is equivalent to 5.1 GWh and can meet only 1.5% of electricity demand. The study shows that Clark has ample room for growth of the rooftop solar industry. Moreover, the data reveals that covering C&I rooftops alone will enable Clark to produce power for its entire energy needs. The electricity generated by installing solar on the top 10% of the largest C&I rooftops can generate power equivalent to the electricity produced by the Clark Solar Power Plant (Figure 19).[54]

[54] Thinking Machines, “Spotlighting the Potential of Solar Energy In Clark, Pampanga,” September 15, 2023, https://stories.thinkingmachin.es/solar-panel-data-clark/

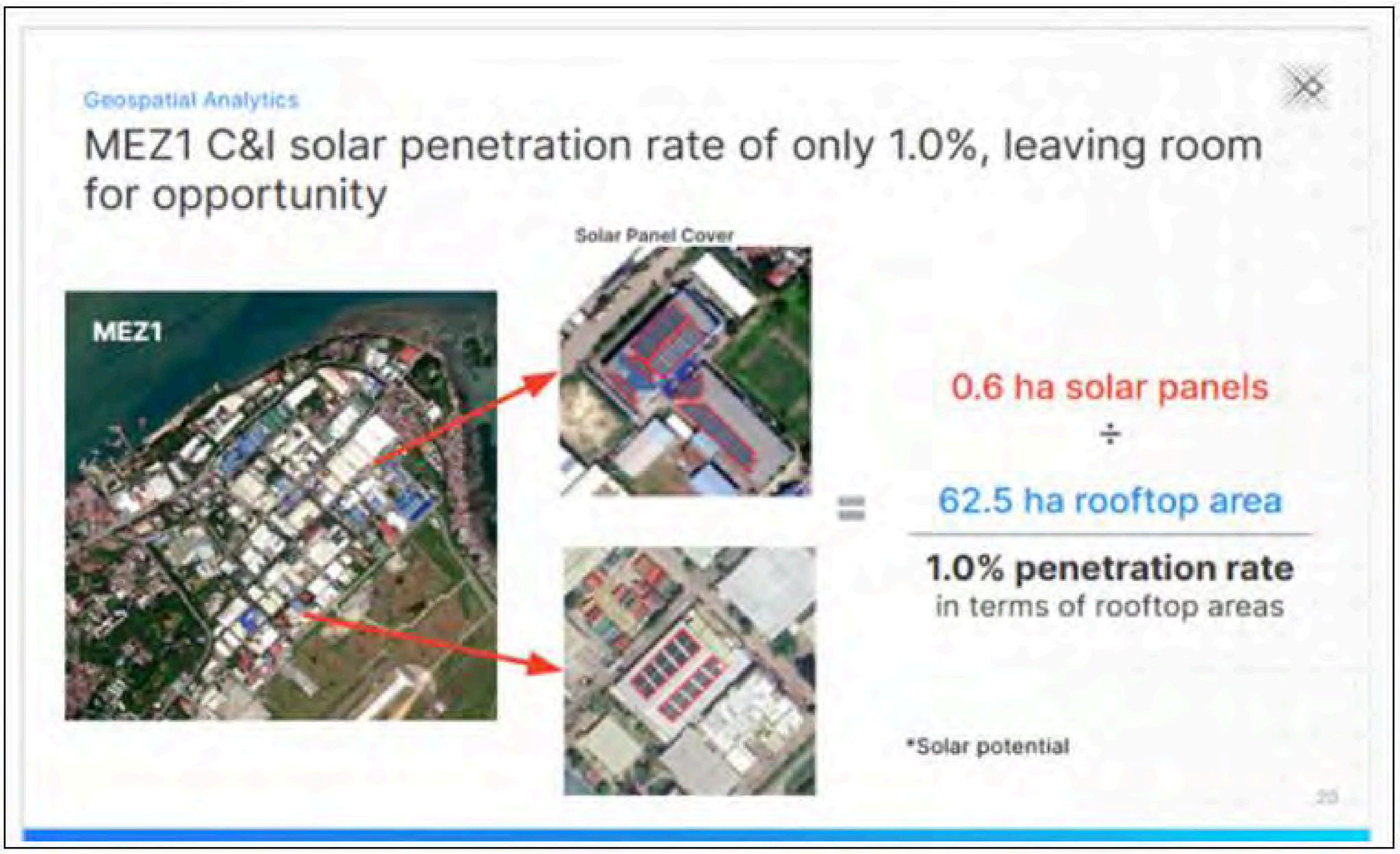
Figure 19. Installed Capacity of Top C&I Rooftop VS. Clark Solar Plant.

Source: Thinking Machines.

Another case study is the Mactan Economic Zone 1 (MEZ1) which has 61.9 ha of potential solar roof area and 61.9 MW estimated solar installation capacity. It only has a 1% penetration rate of solar rooftop areas (Figure 20). This covers 0.6 ha solar panels out of 62.5 ha of C&I rooftop area. Mactan's projected hourly peak demand of electricity is 126.3 MW. Almost half of this or 62.5 MW can be supplied by solar on all C&I rooftops. The currently installed capacity of 0.6 MW shows that there is a vast RE potential in this area (Figure 21).

In Figure 22, commercial solar rooftop potential nationwide is determined. Commercial buildings with a roof area greater than 200 sqm were observed. The results show that nationwide hourly capacities were estimated at 83.9 GW and provinces with PEZAs have the greatest solar potential. In particular, the region with the highest solar potential of 12.8 GW is Region VII, Central Visayas with Cebu city dominating solar capacity. Region 3, Central Luzon follows with 11.5 GW and Bulacan leading the region. CALABARZON shows 11.2 GW solar capacity with Batangas having a substantial share. The NCR's solar potential is peg at 8.8 GW. The region with the lowest solar potential is CAR, recording just 1 GW solar capacity.[56]

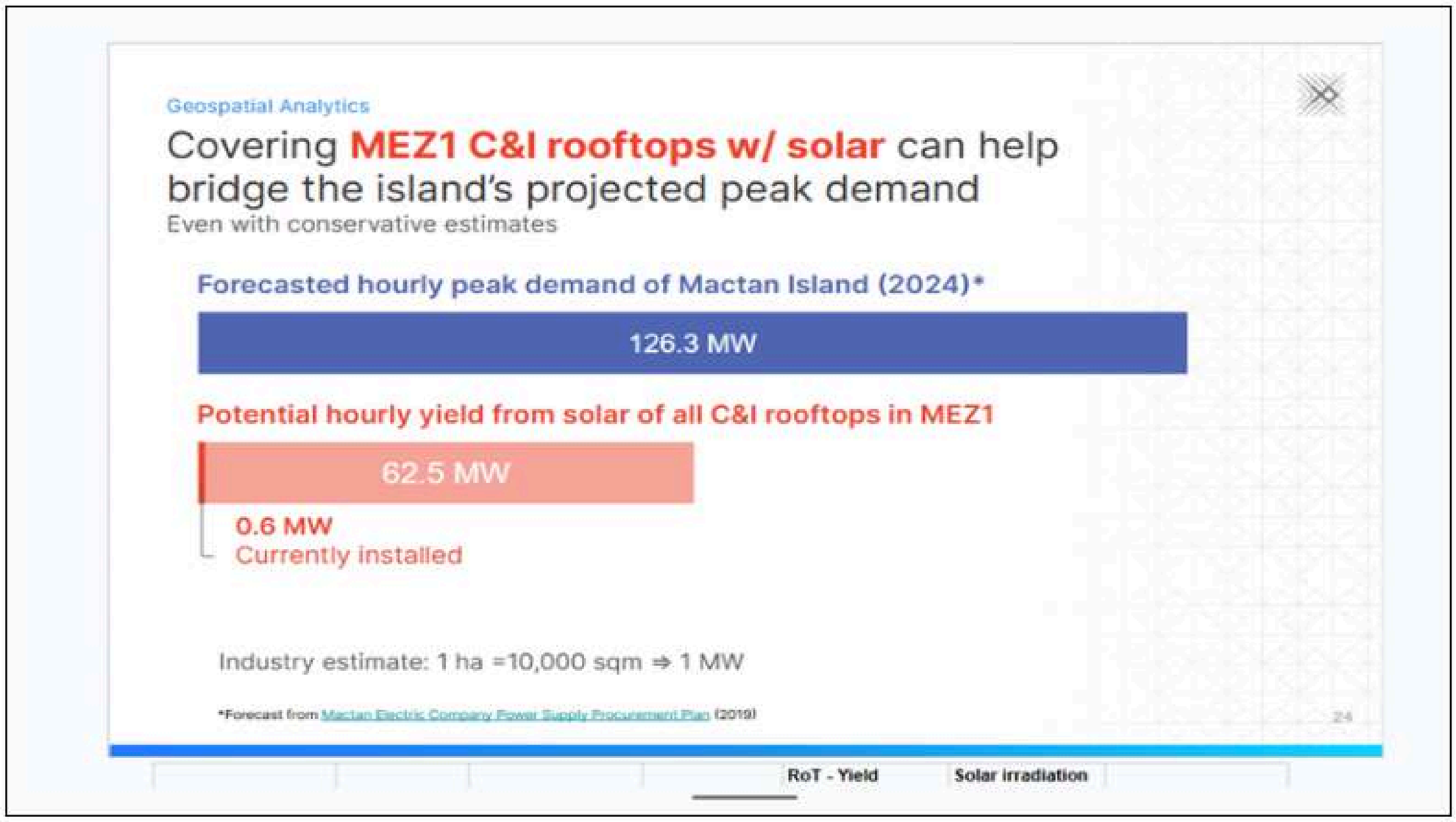
Figure 20. Mactan Economic Zone 1 (MEZ1) Solar Penetration Rate.



Source: Thinking Machines.

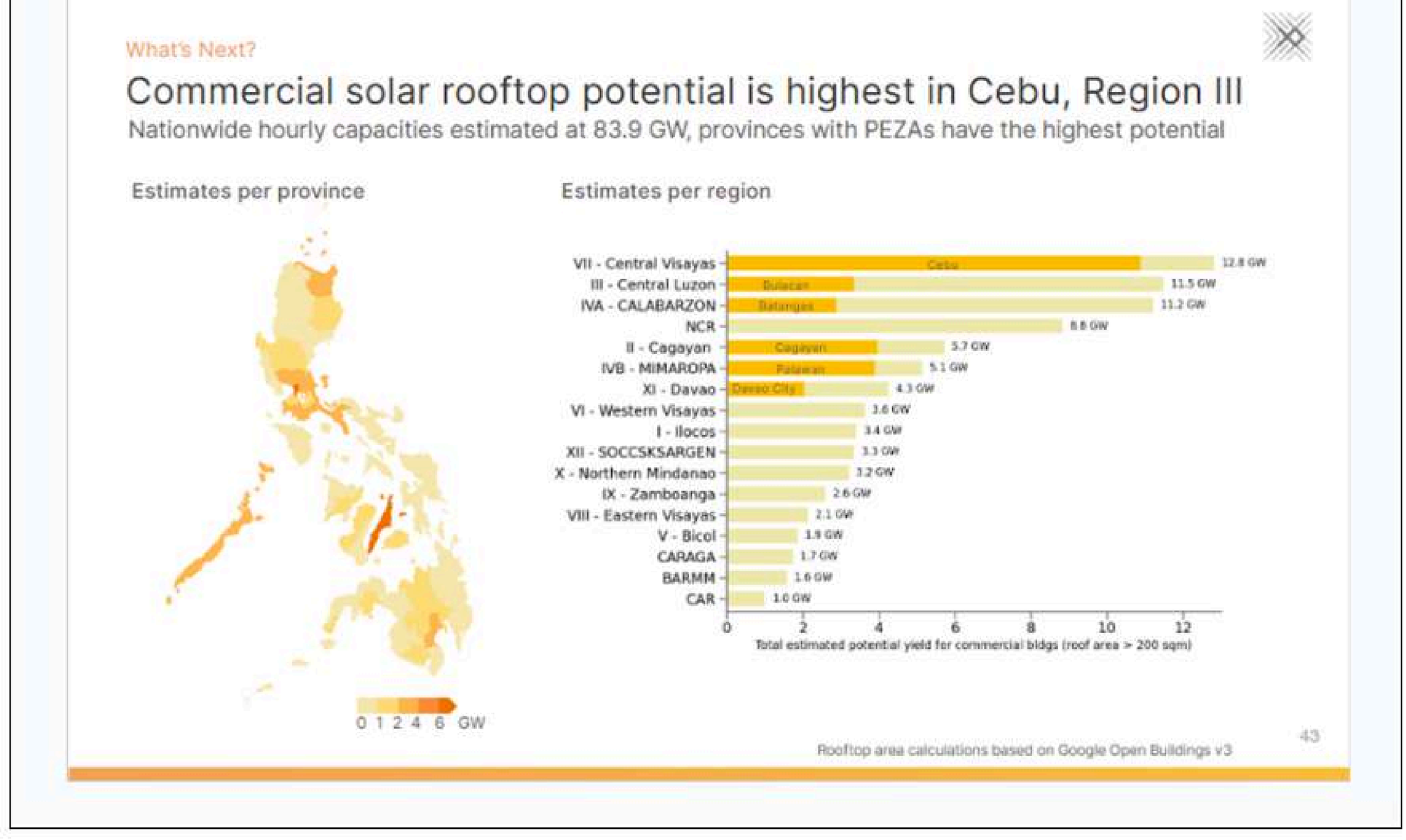
[55] Thinking Machines, Cebu Solar Community Meetup 2024, Cebu Parklane Hotel, April 23, 2024.
[56] Thinking Machines, Solar and Storage Live Philippines, SMX Convention Center Manila, May 21, 2024.

Figure 21. MEZ1 Installed Capacity Vs. Peak Demand.



Source: Thinking Machines.

Figure 22. Philippine Commercial Solar Rooftop Potential.

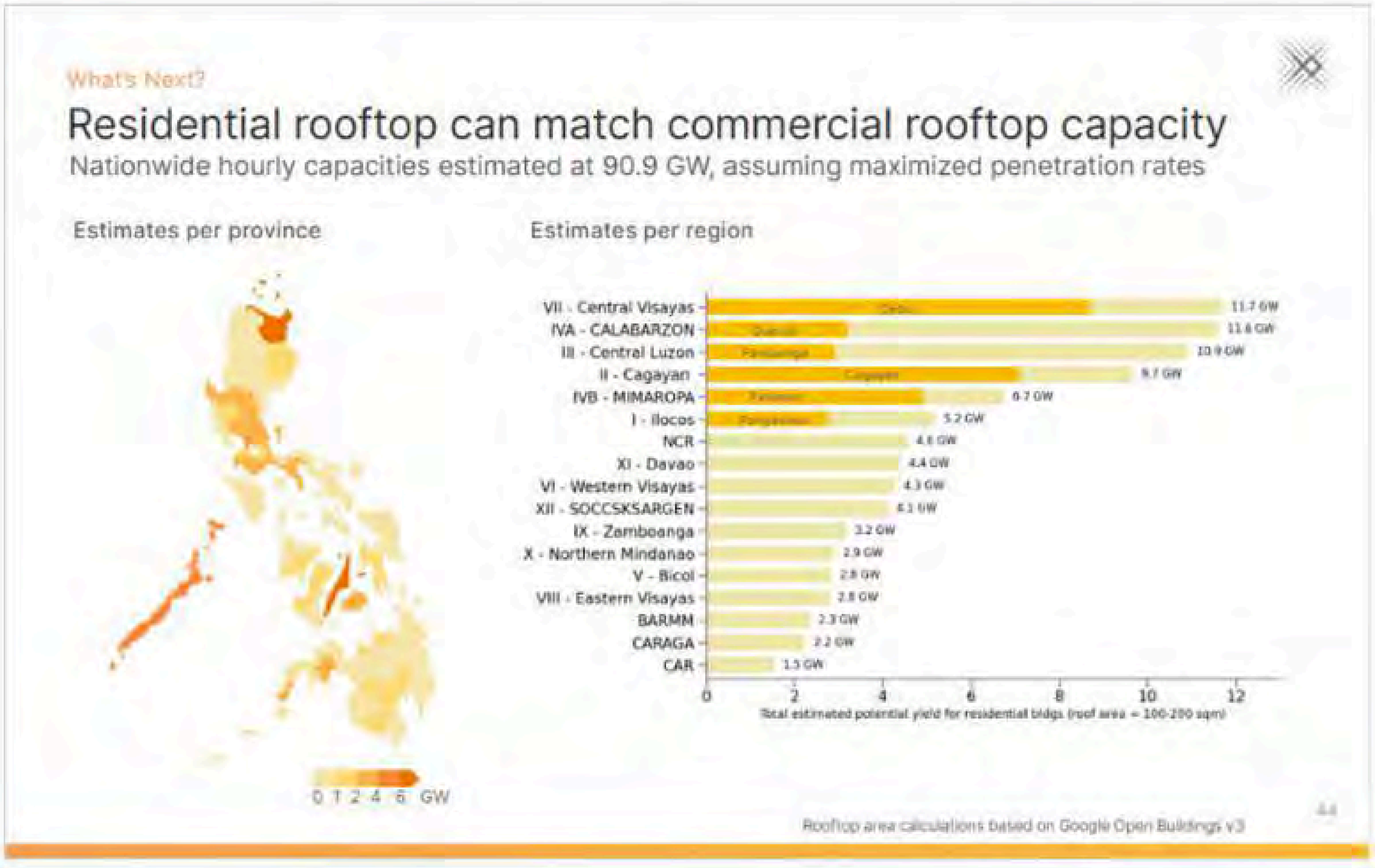


Source: Thinking Machines.

For residential areas the total estimated potential yield for residential buildings with a roof area of 100 to 200 sqm were determined (Figure 23). It shows that the potential nationwide hourly capacities was at 90.9 GW if penetration rates were maximized. Similar with commercial rooftop the region found with the highest solar potential is Region VII: Central Visayas with 11.7 GW. Cebu is the city with the greatest solar capacity, accounting for 2/3 of the region's solar capacity. Solar potential was also high in these areas: CALABARZON (11.6 GW), Central Luzon (10.9 GW), and Cagayan (9.7 GW). Note that Cagayan is the second city in the country where residential rooftop solar potential capacity is greatest. The NCR can generate solar yield reaching 4.6 GW. CAR remains the lowest area of solar capacity with only 1.5 GW.

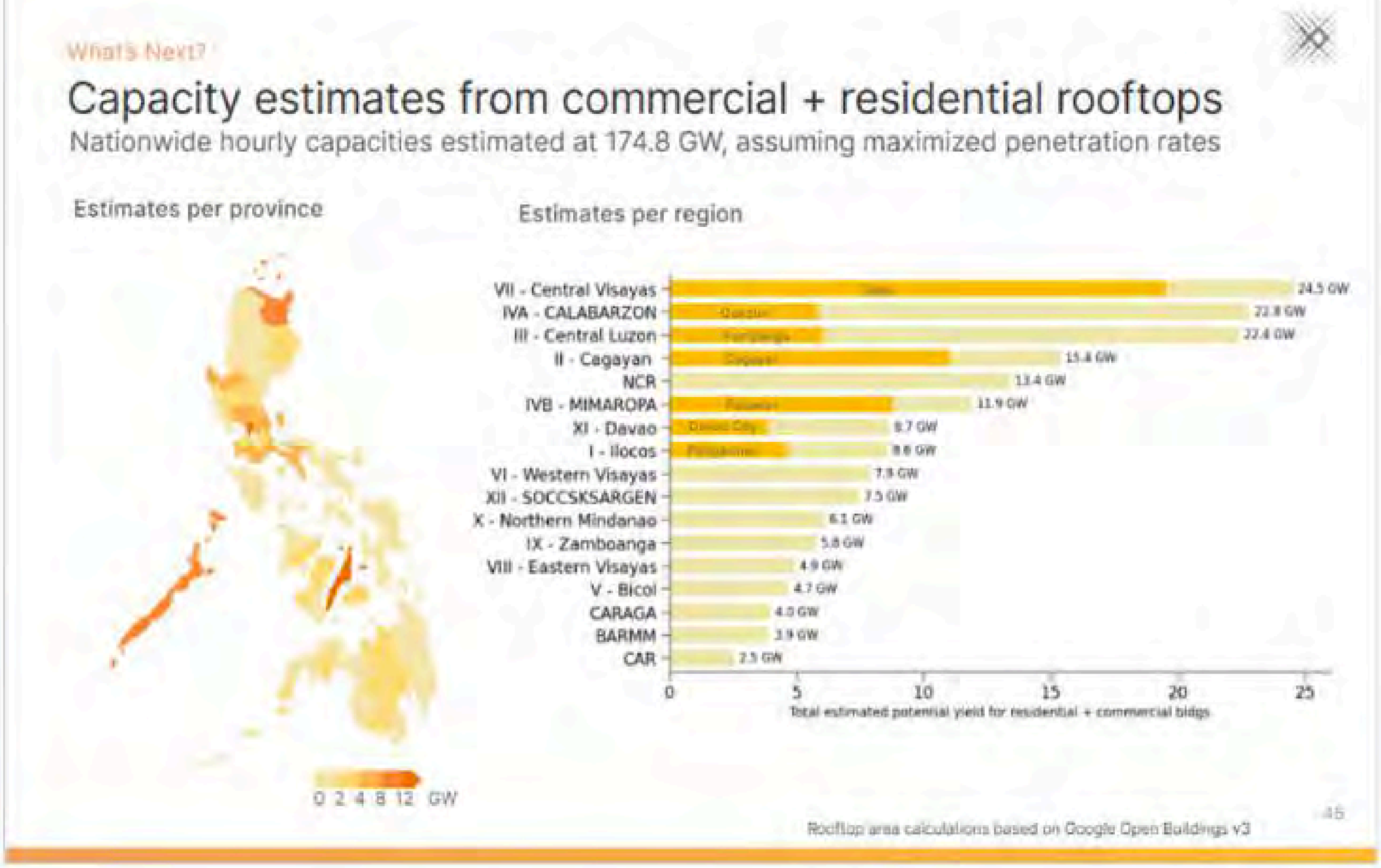
Combining the solar potential of commercial and residential rooftops show that nationwide hourly capacities were estimated at 174.8 GW (Figure 24). Central Visayas tops the regional rankings at 24.5 GW estimated solar potential yield. It is followed by CALABARZON (22.8 GW), Central Luzon (22.4 GW) and Cagayan (15.4 GW). The NCR's solar capacity is determined to be 13.4 GW.

Figure 23. Philippine Residential Solar Rooftop Potential.



Source: Thinking Machines.

Figure 24. Philippine Commercial and Residential Solar Rooftop Potential.



Source: Thinking Machines.

B. Grid Stability

Grid stability is achieved when there is equilibrium between production and consumption of power in an electrical grid. This means that the energy produced should be equal to the energy consumed. To maintain stability, the power grid needs to respond to volatility in voltage and frequency disturbances. This indicates that either more power is generated than consumed or more energy from the grid is consumed than produced. While conventional grids have energy suppliers with synchronous generators to maintain stability, grids running with renewable energy sources need to make adjustments in case of interruptions. For solar rooftop in particular the fluctuations in power arises because the sunlight intensity on solar panels varies from time to time. There can be times when there is low power generation and times when abundant supply leads to wastage.[57]

[57] "Grid Stability Issues With Renewable Energy Sources: How They Can Be Solved," Hive Power, March 22, 2021, https://www.hivepower.tech/blog/grid-stability-issues-with-renewable-energy-how-they-can-be-solved

Conventional grids are faced with three major problems with using renewable energy sources.[58]

1. Frequency and voltage anomalies

The unreliable nature of solar due to variable sunlight and weather conditions can produce frequency and voltage fluctuations. Power inverters which are relied on for adjustment during these times have been proven to be ineffective.

2. Overloading of existing transmission lines

The transmission line has a set capacity and limit which can be damaged. During peak hours a surge can happen when too much power is loaded into the grid without warning. This can cause the system to shut down.

3. Demand and supply mismatch

There can be a mismatch between the demand of energy and its supply as the amount of electricity generated by solar rooftop varies during the day. The power produced maybe insufficient to supply the demand for it.

[58] “Grid Stability,” Hive Power.

The solution to these challenges are the adoption of new technologies and techniques such as:

1. Energy Storage Technologies

The use of batteries can solve grid stability issues by storing the excess energy generated by the solar panels. This will be discussed in detail in the next section.

2. Smart Grids

Smart grids are electricity networks which utilizes digital technologies, sensors, software and other advanced technologies to match the supply and demand of electricity. It efficiently operates the system by monitoring and coordinating the electricity produced by generators to the needs of end-users and other stakeholders. It minimizes cost and ensures the stability and reliability of the grid.

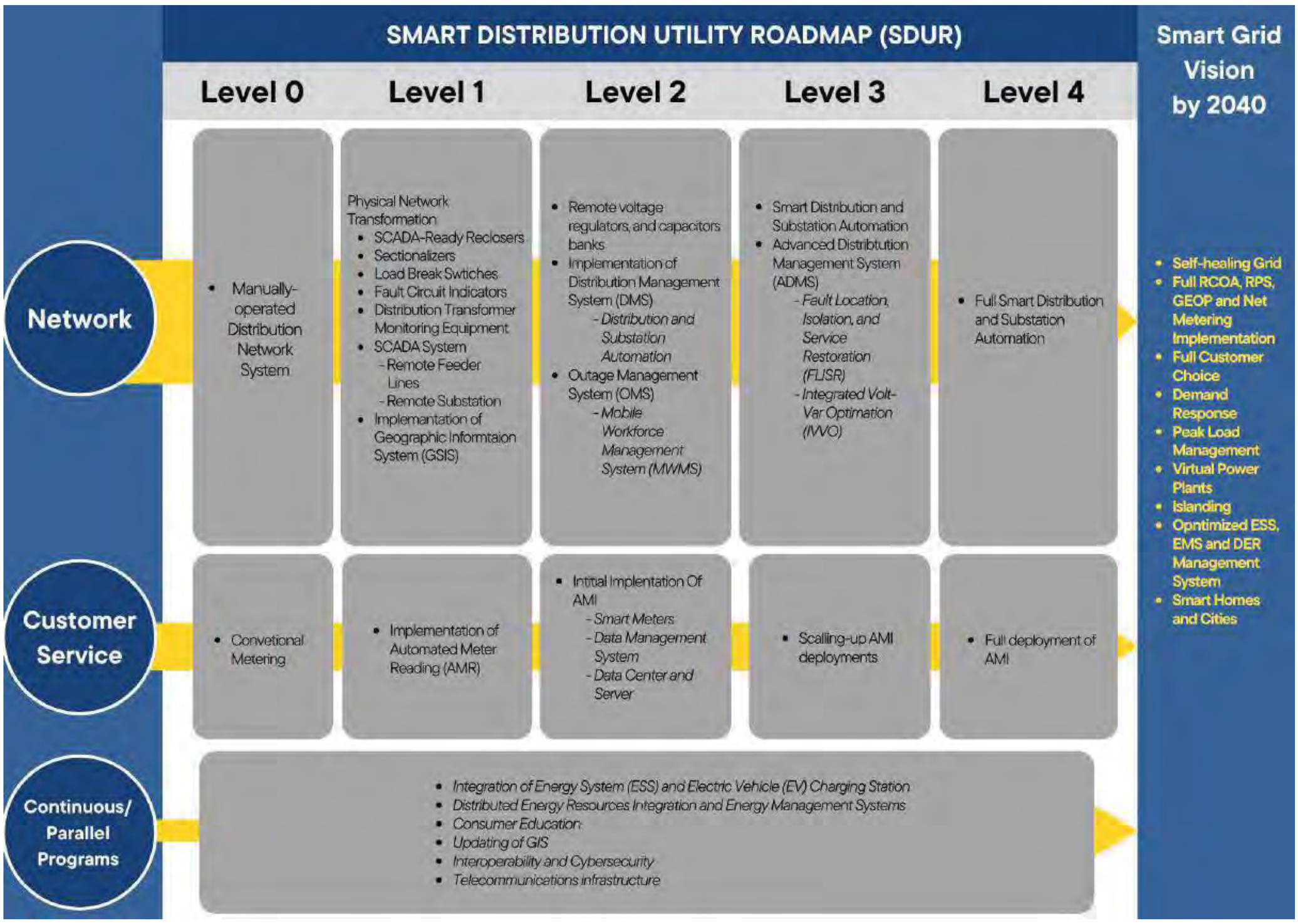
On February 2020, the DOE has issued the Department Circular No. DC2020-02-0003 Providing a national smart grid policy framework for the Philippine electric power industry and roadmap for Distribution Utilities. It created the roadmap for a smart distribution utility (SDU) to guide DUs and aims to integrate decentralized energy resources into an automated distribution system by 2040. This will encourage consumers to adopt net-metering and use energy efficiently.[59]

[59] Department Circular No. DC2020-02-0003, Providing a National Smart Grid Policy Framework for the Philippine Electric Power Industry and Roadmap for Distribution Utilities, February 6, 2020.

The country's power grid is expected to be self-healing and enables the full implementation of other policies aside from NM which are Competition and Open Access (RCOA), Renewable Portfolio Standards (RPS), Green Energy Option (GEOP). In addition, it will facilitate the development of energy storage systems (ESSs), energy management systems (EMSs), distributed energy resources (DERs) management systems, and smart homes and cities.

The roadmap has five levels towards the establishment of a smart grid network. The first level contains the planning and the pre-development stage for Advanced Metering Infrastructure (AMI) (Figure 25). This allows two-way communication between utilities and customers through an integrated system of smart meters, communications networks and data management systems.

Figure 25. Smart Grid Road map to 2024.



Source: DOE.

C. Battery and Energy Storage Systems (BESS)

Department Circular No. DC2023-04-0008, entitled as "Prescribing the Policy for Energy Storage System in the Electric Power Industry" was issued to address the excess energy generated by RE on peak hours of the day. The circular applies to Generation Companies, Distribution Utilities, end users, system operator, transmission network provider (TNP), among others.[60]

Energy storage system or ESS is defined as a facility which can absorb energy from the grid or distribution system, or from a power plant tied to the grid. It stores power for a time to be used when needed. Among the ESS technologies considered are battery energy storage systems (BESS), compressed air energy storage (CAES), flywheels and pumped hydro energy storage (PHES).

The aim of ESS are to deliver ancillary services, provide energy through bilateral agreements or WESM trading, manage the variability of RE, augment conventional generation facilities' output, improve the transmissions system and quality, and help end-users manage their demand.

End-users, who applied for an ESS faced the same required permits as net-metering from the local government and the DU such as electrical permits. The capacity of the ESS should be in line with DER and Net-metering. In addition, end-users should also provide these documentary requirements: 1) type of ESS; 2) capacity of rate of charge and discharge; 3) purpose of the facility and 4) other information requested by the DU. The end-user will also apply for distribution impact study with the DU.

[60] Department Circular No. DC2023-04-0008, "Prescribing the Policy for Energy Storage System in the Electric Power Industry," May 2023.

The responsibilities of DUs in terms of ESS are: a) to develop the business procedures to connect the ESS to its distribution network and ensure compliance with guidelines; b) inform the TNP of ESS applications with capacities of 10 MW and above for Luzon, or 5 MW for and above for Visayas and Mindanao; c) establish the testing standard and procedure for ESS.

One comment on the circular is that there are no financial incentives for BESS to provide "stacked services." Service stacking refers to providing other uses of the BESS aside from its main service. This enables the owner to maximize the technical and economic use of the BESS. According to PSSEA the financial solution is to allow households and small facilities to inject power into the grid similar to the optimized market in Australia and Europe wherein trading periods can be in 5 minute intervals.[61]

[61] PSSEA, Position Paper, 2024.

The advantages of using BESS in solar rooftop to stabilize the grid and provide energy at night are well-accepted. However, a hindrance to its adoption is the cost of the battery system. There are several factors which determine its cost. Firstly, the size of the BESS can affect its price. Larger buildings consuming more energy will need more extensive and expensive systems. Secondly, the choice of battery technology also determines the cost. The average price of lithium-ion battery technology ranges from US$393 per kWh to US$581 per kWh. This is higher than the cost for the same sized lead acid battery system. This is because lithium-ion batteries perform better with high depth of discharge at 85% and high lifetime of up to 6,000 discharge cycles. Lastly, installation costs are also determined by the complexity of integrating BESS into building. Energy storage systems are composed of many elements such as batteries, fire detection equipment, controllers, and inverters, among others.[62]

A solution to deploy batteries at lower cost is through community batteries that can store energy and supply it to a group of homes with solar power. Homeowners can realize the benefits of storage without having to pay for a household battery. This will also encourage more households to install rooftop solar. Moreover, having storage near the generation of energy improves the efficiency of the energy network lowering electricity prices in the community.[63]

[62] Yun Hong, “Battery Energy Storage Systems In Philippines: A Complete Guide,” GetSolar, October 18, 2023, https://getsolar.ai/blog/battery-storage-philippines/

[63] Alexander Lewis, “Why community batteries could be the next step in the solar power revolution,” News, January 19, 2023, https://www.abc.net.au/news/2023-01-19/qld-community-batteries-energy-electricity-green-power/101863958

VI. BENEFITS OF SOLAR

A. Economics

1. It reduces the electricity cost of powering the home, commercial and industrial establishments. Solar panels have 25 years to generate free renewable energy. This means that every kilowatt-hour (kWh) of solar energy produced is one less unit of power purchased from the DU. Electricity from the grid and utilities will still be relied on but much less with solar panels. It also protects the homeowner from the volatility of electricity prices. The country still relies on fossil fuels to generate electricity. These are primarily imported and thus, subjected to unstable market factors, geopolitics, and unpredictable foreign policy.[64]

2. It increases the property value. Homes outfitted with solar panels are priced more than homes without the installations. In the US, homes with solar panels increase their value by 4.1% or by an average of $9200 (around Php538,000).[65] The size of the solar panel installation is one of the factors that can influence the price. Every 1 kilowatt (kW) size increase in the solar panel amounts to approximately USD$5,911 (around PHP345,800).[66]

[64] "The benefits of going solar: There might be more than you think," energysage, updated Jun 21, 2024 https://www.energysage.com/solar/benefifits-of-solar/

[65] "Homes With Solar Panels Sell for 4.1% More," Zillow, accessed July 25, 2024, https://www.zillow.com/research/solar-panels-house-sell-more-23798/

[66] "6 Ways Solar Panel Installations Can Increase Home Value," SolarNRG, July 26, 2022, https://solarnrg.ph/blog/ways-solar-panel-installations-increase-home-value/

3. Independence and energy security are provided by solar systems. The Philippines is subjected to severe typhoons throughout the year which can cause loss of electricity in households and commercial establishments. Having solar rooftop and solar batteries for back up energy ensures less disruptions in daily operations and facilitates the provision of humanitarian assistance during these times. Homes with solar roofs are also insulated from grid outages brought about by energy supply limitations exacerbated by global warming. At a community level, as more households consider solar energy systems the overall demand for electricity from utilities lowers, reducing strain on the energy grid. This leads to a more stable, resilient and sustainable energy system for the country.

B. Environment

Using renewable energy in electrification is an effective solution to rising carbon emissions which worsens climate change. Solar rooftop systems are an easy, fast and cost-effective way for the Philippines to transition towards clean energy. It utilizes and maximizes a resource that is already existing which are rooftops.

Another benefit of solar rooftops is the conservation of natural resources and biodiversity by avoiding air and water pollution which is a byproduct of using traditional electricity generation methods. In addition, solar panel installations on rooftops do not require converting land from other uses to generate power. Hence, it promotes sustainability.

C. Job Creation Potential

A problem with NM cited by Meralco is the need for a certification program for solar installers. Solar installers have different interpretations and implementations of Net Metering standards. A certification program ensures that correct standards are followed and allows a faster process of activation of the installation. Moreover, training would enable the installers to select the right size needed by the customer, provide them better guidance, and avoid potential problems. Hence, Meralco proposed a mandated training and certification program for all solar installers and contractors. Likewise, publishing the list of accredited installers would be beneficial to the public.[67]

Currently, the Philippines has a Green Jobs Act (GJA, RA 10771) which was adopted in 2016 followed by its Implementing Rules and Regulations (IRR) in 2017. The Act intends to transform the country to a greener economy by promoting green jobs to harness the abundant workforce. However, this law is not yet implemented.[68]

[67] PSSEA, Deep Dive Session.

[68] World Bank, Philippine Jobs Report (Taguig City, Philippines: World Bank, 2023), 158.

There is interest to operationalize the GJA. According to the World Bank there are two ways to implement it: (1) the National Green Jobs Human Resource Development Plan (NGJ HRD Plan) and (2) financial incentives to firms in green sectors and for greening activities. Under the NGJ HRD Plan, the government created an online labor market information platform on green jobs. It also established an inter-agency committee which will work on statistical data to measure green jobs in terms of size, composition, and contribution to GDP. DOLE also launched in 2021 the Career Information System which provides information about green careers as well.[69]

As part of the GJA implementation, the Climate Change Commission establishes the standards for assessment and certification of green jobs. This will guide financial incentives to firms in green sectors and for greening activities. Some of the incentives are: (i) special tax deduction from taxable income incurred by business enterprises on skills development and research development for green jobs, and (ii) exemption from customs duties and taxes for the importation of capital equipment that are used directly and exclusively in promoting, generating, and sustaining green jobs. The law also provides business development support, special business facilitation program, preferential business packages for business enterprises that create green jobs.[70]

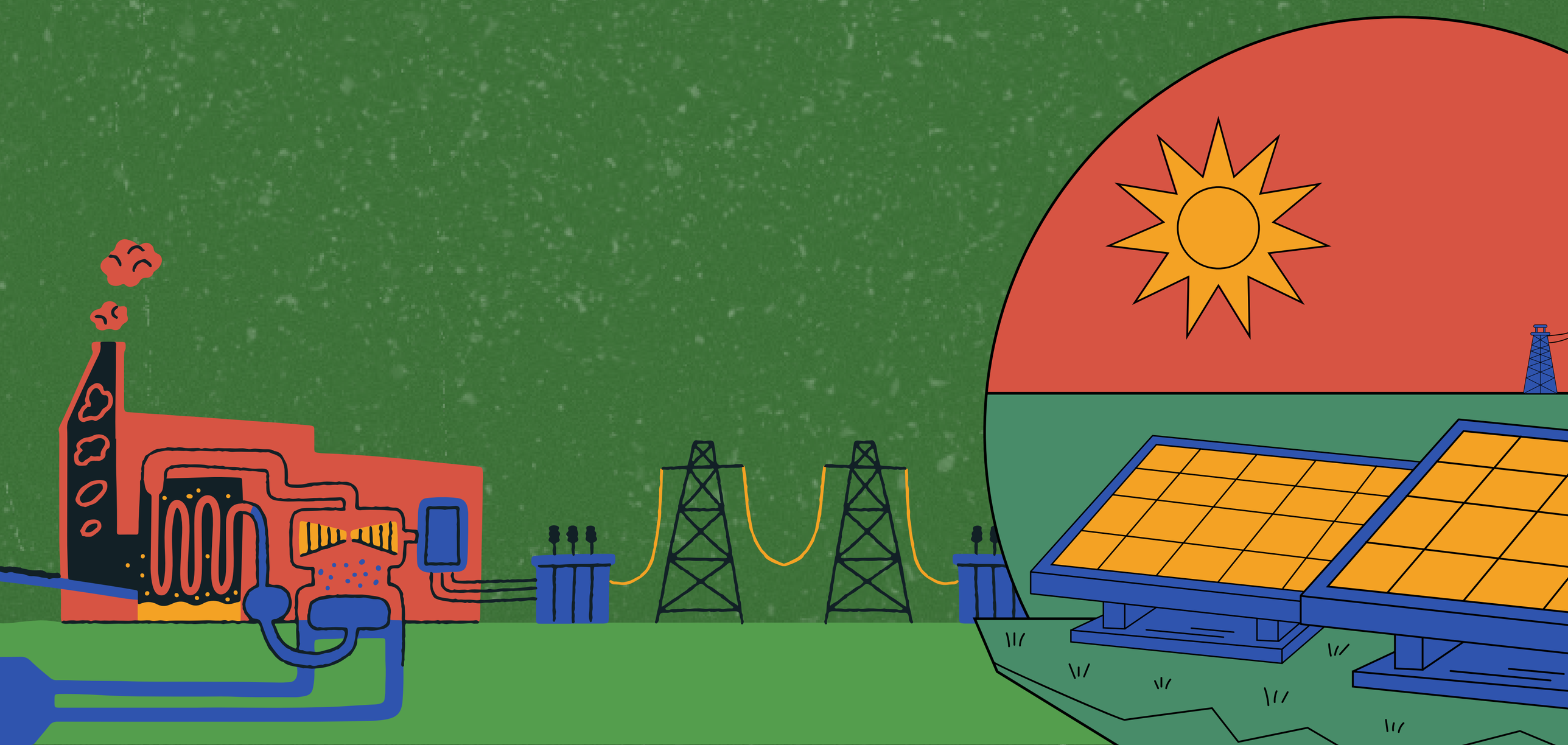
[69] World Bank, Philippine Jobs Report, 158
[70] World Bank, Philippine Jobs Report, 160

On the reskilling and upskilling of the workforce in green areas, The Technical Education and Skills Development Authority (TESDA) developed a framework for greening the technical and vocational education and training or TVET system (TESDA Circular Number 58 Series of 2018). These include setting up Green Technology Centers (GTCs), starting the process of greening training regulations (TRs), orienting stakeholders on greening TVET, and documenting green TVET good practices. The GTCs provide various green skills training courses to respond to green industry personnel needs. Aside from technical competencies, TESDA also include environmental literacy, occupational safety and health work practices.[71]

Likewise, JOBS4RE is a Danish initiative created to produce qualified installers in the RE industry, particularly in the solar and wind industry. It will set the standard for installers. Its objective is to train, upskill, reskill, and educate new workers for companies and developers. The Philippine Solar and Storage Energy Alliance will collaborate with the Royal Danish Embassy in Manila in developing the talent base for the local solar industry. Discussions with Ambassador Franz-Michale Mellbin has highlighted the skills and training gap in the local industry and the value of standardization and certification.[72]

[71] World Bank, Philippine Jobs Report, 160
[72] PSSEA, Deep Dive Session.

APPENDIX A



CHECKLIST OF REQUIREMENTS FOR BUILDING PERMIT: PASIG CITY

TECHNICAL DOCUMENTS:

□ 1 set duly accomplished application forms completely and properly filled-out –

□ 4 copies Unified Building Permit (notarized),

□ 4 copies Civil/Structural Permit

□ 4 copies Sanitary / Plumbing Permit

□ 4 sets of complete plan with key plan, location map and vicinity map duly signed and sealed by a licensed Engineer and Architect and signed by the owner / applicant.

□ 1 copy of latest Verification Survey Plan and Survey Report - originally signed and sealed by a Geodetic Engineer.

□ 1 copy of Bill of materials signed and sealed by an Engineer / Architect.

□ 1 set Material Specification signed and sealed by an Engineer / Architect.

□ 1 set of Complete Structural Design and Analysis signed and sealed by a Civil / Structural Engineer. (Ring bind).

□ With Seismic Load Analysis – FOR 3-STOREY AND UP

□ 1 set of Soil Boring Test – FOR 3-STOREY AND UP signed and sealed by a civil / structural engineer with DPWH accreditation.

□ 1 copy of latest PTR and Valid PRC ID and UAP / IAPOA (for Architect) of Licensed Engineers / Architect.

(Originally SIGNED and SEALED)

□ Civil Engineer

□ Architect

□ Geodetic Engineer

□ Sanitary Engineer / Master Plumber

□ Rainwater collection system (City Ordinance No. 13 series of 2017), to be incorporated in Plumbing Plan

□ 1 Copy of duly accomplished Green Building evaluation checklist (FOR BUILDING/S WITH 10,000 SQM. GROSS FLOOR AREA) (if applicable)

□ 1 copy of STP Design Analysis originally signed and sealed by Sanitary Engineer, ALL PAGES, (if applicable)

CLEARANCES / CERTIFICATION:

□ 1 copy of Locational Clearance (original copy)

□ 1 copy of Fire Safety Evaluation Clearance (FSEC) with checklist (blue copy)

□ 1 copy of DOLE Clearance (original copy)

□ 1 copy CEDULA (Residence Certificate) (xerox copy)

□ 1 copy Barangay Clearance for Building Permit Application (original copy)

□ 1 copy Home Owners Association Clearance (original copy) (if any)

□ 1 copy of Updated Tax Receipt (Xerox copy)

□ 1 copy certificate of No Improvement or with Improvement (original copy)

□ 1 copy of Secretary's Certificate. Authority to Sign (if corporation) (original copy)

□ 1 copy of Authorization Letter (original copy)

□ 1 copy of CAAP Clearance (if applicable) (original copy)

□ 1 copy of DOH Clearance (permit to construct) (original copy) (if applicable) – for Health Facility

□ 1 copy of PHIVOLCS Clearance (if the structure is near the fault line) (original copy)

□ 1 copy of DPWH Clearance (if applicable) (original copy)

□ 1 copy of MMDA Clearance (if applicable) (original copy)

□ 1 copy of CENRO Clearance (if applicable) (original copy)

□ 1 copy of Environmental Compliance Certificate from DENR (if applicable) (original copy)

PROOF OF OWNERSHIP

□ 1 copy of Certified True Copy of original or Transfer Certificate of Title (TCT / OCT) covering the subject lot- within the last 4 MONTHS.

If in case the applicant is not the registered owner of the said lot, in addition to TCT, the following documents must be attached whichever is applicable:

□ 1 copy of duly notarized Deed of Absolute Sale

□ 1 copy of duly notarized Deed of Donation

□ 1 copy of assignment of Rights or any proof of land ownership and possession.

□ 1 copy duly notarized Affidavit of Consent from the Lot Owner

□ 1 copy duly notarized Extra Judicial Settlement (if registered owner is deceased)

□ 1 copy duly notarized Special Power of Attorney

□ 1 copy of Tax Declaration of Land and Building, Certified True Copy (if any)

□ 1 copy of Lease Contract (if leased)

CHECKLIST OF REQUIREMENTS FOR OCCUPANCY PERMIT

APPLICATION FORMS

□ 1 Duly accomplished Unified application form for Certificate of Occupancy

□ 3 copies of duly accomplished and notarized Certificate of Completion, signed by the owner / applicant and signed and sealed by the duly licensed Architect or Civil Engineer in-charge of construction.

□ 2 copies duly accomplished Electrical Completion Forms originally signed and sealed by Professional Electrical Engineer and Electrical Engineer In-Charge.

□ 2 copies duly accomplished Mechanical Completion Forms originally signed and sealed by Professional Mechanical Engineer and Mechanical Engineer In-Charge. (PER EQUIPMENT) (if any)

□ 2 copies duly accomplished Electronics Completion Forms originally signed and sealed by Professional Electronics Engineer and Electronics Engineer In-Charge. (if any)

*If the construction was undertaken through a contract, the all Certificate of Completion shall be signed by the contractor/Authorized Managing Officer.

□ 1 Duly accomplished CFEI application form originally signed and sealed by PEE (if with Application for Meralco meter)

TECHNICAL DOCUMENTS:

□ 2 sets copy of approved plan

□ 2 sets Architectural Plan

□ 2 sets Structural Plan

□ 2 sets Sanitary / Plumbing

□ 2 sets Electrical Plan

□ 2 sets Mechanical Plan (if any)

□ 2 sets Electronics Plan (if any)

□ 4 sets As-Built Plan (signed and Sealed by Architect / Engineer in-charge of Construction and signed by owner / applicant (*in case there are changes in the approved plans)

□ Architectural Plan

□ Structural Plan

□ Sanitary / Plumbing

□ Electrical Plan

□ Mechanical Plan (if any)

□ Electronics Plan (if any)

□ 1 daily construction Logbook – duly accomplished and signed and sealed by the supervising Engineer / Architect on EVERY PAGE.

□ 1 copy of Fire Safety Inspection Certificate (FSIC) for Occupancy (pink copy)

□ 1 set copy of Building and Ancillary Permit

□ Building Permit

□ Civil / Structural

□ Sanitary / plumbing

□ Electrical

□ Mechanical (if any)

□ Electronics (if any)

□ 1 copy of Technical Specifications signed and sealed by the supervising Engineer / Architect. (If with major changes)

□ 1 copy of detailed Bill of Materials (actual cost) signed and sealed by the supervising Engineer / Architect. (if with major changes)

□ 1 copy of detailed Bill of Materials (actual cost) for Electrical works originally signed and sealed by Professional Electrical Engineer.

□ 1 copy of Insulation Test / Megger Test

□ 1 copy of PCAB license of Electrical Contractor (for bldg. / structure with 200 Amperes and above Main Breaker)

□ 1 copy Yellow Card from Meralco (Xerox), if any (if with Application for CFEI)

□ 1 copy of detailed Bill of Materials / P.O. of equipment (actual cost) for Mechanical works originally signed and sealed by Professional Mechanical Engineer. (PER EQUIPMENT) (If with mechanical application) (If with major

changes)

□ 1 copy of Specification; originally signed and sealed by a Professional Mechanical Engineer (PER EQUIPMENT) (if with mechanical application)

□ 1 copy of detailed Bill of Materials (actual cost) for Electronic works originally signed and sealed by Professional Electronics Engineer (if with electronics application).

□ 3 copies of latest PTR and Valid PRC ID, UAP-IAPOA (for Architect), IECEP (for Electronics) of licensed Engineer / Architect. (Originally SIGNED and SEALED)

□ Civil Engineer

□ Architect

□ Sanitary Engineer / Master Plumber

□ Electrical

□ Mechanical (if any)

□ Electronics (if any)

□ 1 copy Photo of Structure with substantial completion showing inside, front, sides, and rear areas.

□ 1 copy of duly notarized Affidavit of Change of Engineer / architect / sanitary, if any

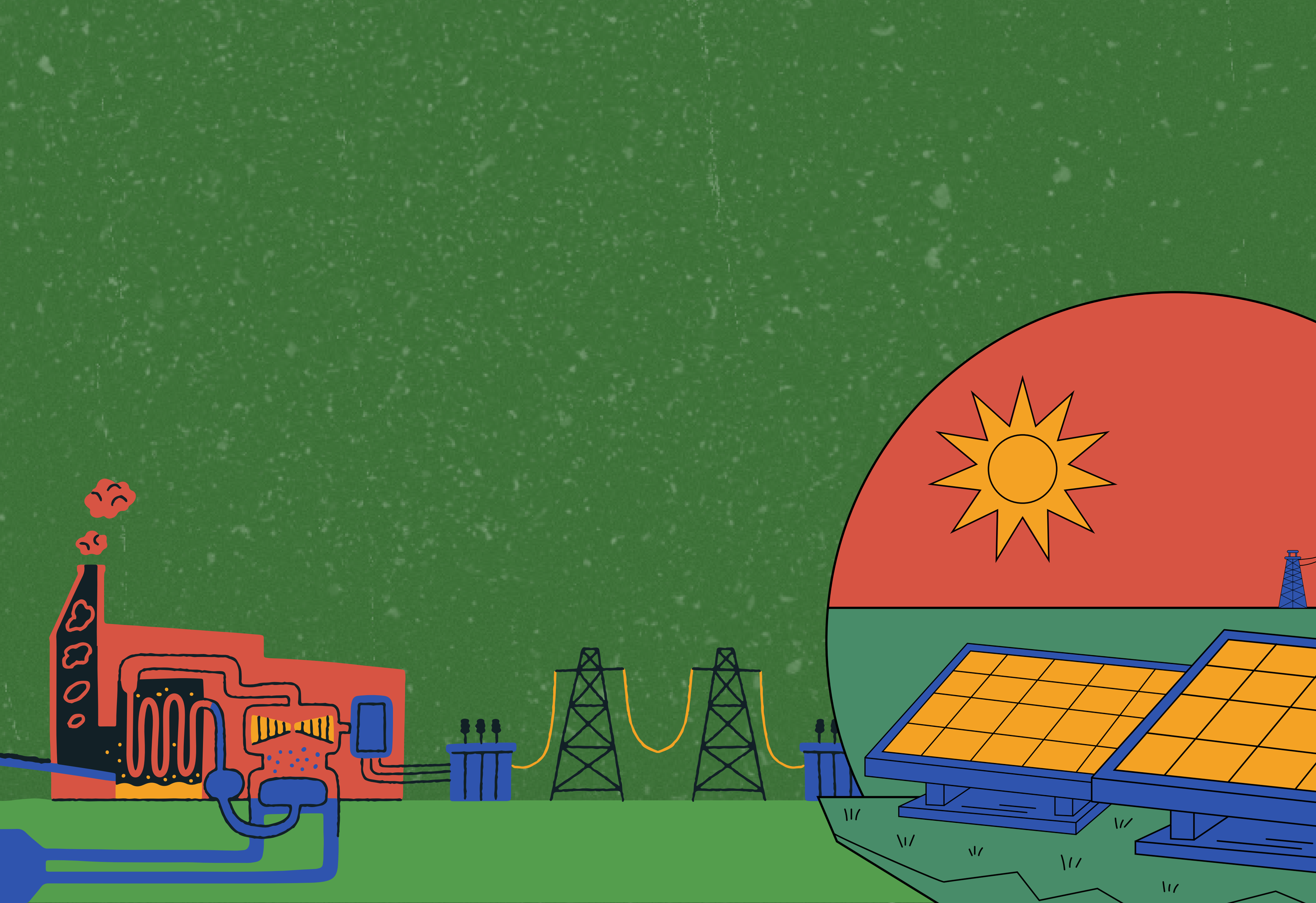
□ 1 copy of Secretary's Certificate. Authority to Sign (if corporation) (original copy)

□ 1 copy of Authorization Letter (original copy)

□ Others that maybe required as provided under the National Structural Code of the Philippines. (NSCP) 2015

Source: Office of the Building Official of Pasig City.

APPENDIX B



BUILDING PERMIT APPLICATION EVALUATION CHECKLIST: CEBU CITY

LINE AND GRADE / GEODETIC SECTION

□ Unified Application Forms signed and sealed by Engr/Archi and Owner

□ Inspection Report (for approval of Inspector Recommendation)

□ Certified True Copy of Lot Title

□ Certified True Copy of LAND Tax Declaration

□ Certified True Copy of LAND Tax Clearance

□ Lot Owner Consent and Authority/ Deed of Absolute Sale/ Lease of Contract (Notarized)

□ Extra Judicial Settlement (If applicable)

□ Sketch Plan signed and sealed by Geodetic Engineer (w/ complete details)

□ Relocation Plan (if applicable)

□ Updated PTR and PRC ID of Geodetic Engineer

□ Barangay Clearance (Original and Updated)

□ SRP Clearance (If applicable)

□ Homeowners Clearance. If none, Affidavit of No Homeowners

□ CCTO Clearance (if applicable)

□ DPWH Clearance (if applicable) for National Roads

□ Affidavit-For Building Lots affected by Road Widening and other Proposed Development Projects

□ Zoning Board Resolution for Granted Variance

□ Other Clearances from Other Agencies (if applicable) □ Corporate Secretary Certificate / Corporate Board Resolution

(For Corporation) or DTI Certificate (for Sole Proprietorship)

□ SPA for the Authorized Representative (notarized)

□ Easements and Setbacks compliance (refer to NBC/CO 1656, respectfully)

□ Technical Description at Site Development Plan

(Reflect boundaries, monuments, lot name, lot area, lot line) Additional Req. for Renovation/ Interior Renovation Projects:

□ Occupancy Permit of the Building

□ If no occupancy permit

A. Certified True Copy of Land and Building Tax Declaration

B. Certified True Copy of Land and Building Tax Clearance

C. Certified True Copy of Lot Title

D. Sketch Plan

STRUCTURAL / CIVIL SECTION

□ Civil/Structural Permit forms, duly accomplished signed and sealed by Civil/Structural Engr and Owner

□ Updated PTR and PRC ID of Civil/ Structural Engineer

□ Boring test for 3-storeys and higher, if necessary, load tests shall be required. However, adequate soil exploration shall also be required for lower buildings/structures at areas with geological/geotechnical hazards.

□ Structural Analysis and Design for all buildings/structures signed and sealed by Civil/Structural Engineer and Owner

□ Construction Safety and Health Program/ DOLE Clearance

□ Structural plans and details signed and sealed by Civil/Structural Engr

A. construction notes and gen. specs. - schedule of column, footings, wall

B. foundation plans and details footings, and floor slabs

C. floor framing plans and details - schedule of beams and girders with

D. roof / roof deck framing plans and details details

E. schedule of trusses with details

Addt'l Req. for High-rise buildings and / or buildings with substructures/lower ground

□ Earthquake Recording Instrumentation (E.R.I.) and its corresponding location (DPWH-NBCDO MC # 01 of 2015)

□ Detailed Construction Methodology (SP Resolution # 15- 0241-2019)

□ Soil protection analysis and methodology, signed and sealed

□ Detailed slope protection drawings, signed and sealed

MECHANICAL SECTION

□ Mechanical Permit Forms, duly accomplished signed and sealed by PME and Owner

□ Mechanical plans and details signed and sealed by PME

- location and key plan - general layout plan

-isometric drawings as stated -design computation

-detailed plans of all machinery/ equipment

□ Updated PTR and PRC ID of PME

PLUMBING / SANITARY SECTION

□ Plumbing Permit Forms, duly accomplished signed and sealed by RMP and Owner

□ Updated PTR and PRC ID of RMP/ SE □ Drainage Tapping Permit from DEPW/TIC Office – for Cebu City roads and National roads (CO 2135)

□ Plumbing Analysis for 20 water closets and more, signed and sealed.

□ Plumbing plans and details signed and sealed by RMP

I. locational plan and site plan - water supply/ line plan

II. legend and general notes - drainage, waste, and vent plan

III. pipe joint/ connection details - storm drainage plan

IV. isometric diagram of entire plumbing system

V. blow- up plans and details of the ff: septic tank, catch basin, grease trap, sump pit, rainwater tank, cistern tank, overhead/elevated tank, underground tank STP

□ Rainwater tank with blow-up plans and details (refer CO 1711 and 2103)

□ Residential (3 cu. m. capacity) □ Commercial (7 cu. m. capacity) □ Septic tank shall not be located under the building. Septic tank Certification – distance from artesian well (refer to Sanitary Code and Plumbing Code) □ Sewage Treatment Plant (STP) is required (for high rise offices, condominiums, commercial centers, hotels, sports and recreational facilities, hospitals, and industrial complex)

□ Sanitary Engineer must plan and design the ff: deep well, water purification plants, STP, water collection and distribution system, reservoirs and the like; and apply the permit forms.

ELECTRICAL SECTION

□ Electrical Permit Forms, duly accomplished signed and sealed by PEE and Owner

□ Electrical plans and details signed and sealed by PEE

A. location and site plans - electrical layout - legend or symbols - design analysis

B. general notes and specs - one line diagram

C. schedule of loads, transformers, generating/UPS units

□ Electrical Lightning Arrester details

□ PCAB License specialty in Electrical Works

(for 200 amp and above main breaker)

□ Updated PTR and PRC ID of PEE

ELECTRONICS SECTION

□ Electronic Permit forms signed and sealed by PECE and Owner

□ Electrical plans and details signed and sealed by PECE

- gen. layout plans w/ legends - isometry system

-single line diagram -riser diagram

-design analysis (if applicable) -unit/equipment specs

□ Updated PTR and PRC ID of PECE

ARCHITECTURAL / LAND USE AND ZONING SECTION

□ Architectural Permit forms signed and sealed by Architect and Owner

□ Fence permit forms signed and sealed by Architect/Engr and Owner (if applicable)

□ Sign permit forms signed and sealed by Architect/Engr and Owner (if applicable)

□ Enforcement division forms duly signed and sealed

□ Fire Safety Evaluation Certification (OBO copy/pink slip)

□ Updated PTR and PRC ID of Architect

□ Bill of Materials signed and sealed by Architect and Owner

□ Methodology Specifications signed and sealed by Architect and Owner

□ Approved Locational Clearance (Original)

□ If Granted Variance: Board Resolution compliance with Plans

□ Approved Architectural Plans with Zoning stamp

□ Architectural plans and details (2 sets) signed and sealed by an Architect

- perspective - roof plan
- vicinity map/ location plan - ceiling plans (showing light fixtures
- site development plan - schedule of doors and windows
- floor plans - fence details
- elevations (4) - sections (2)
- blow-up plans and details of PWD features: PWD ramp, PWD parking, PWD toilet

□ Parking slots required (refer to City Ordinance 1656)

□ Minimum setback (refer to City Ordinance 1656) free from any obstruction from ground floor level to up in all sides

□Abutting firewalls (refer to City Ordinance 1656)

□ R1 and R2 (1/3 rear abutment)

□1.00m from the topmost roof line attached (fire code)

□ PWD Compliance (refer to BP344 and City Ordinance 2396)

Applicable for rentable and commercial spaces

□ PWD parking (3.70 x 5.00m)

□ PWD ramp (1:12 ramp slope with landing of 1.50m)

□ PWD toilet (2.00 x 2.00m clear width) Applicable for hotel, motel, pension houses, apartment, and place of lodging (5 rooms & above)

□ PWD unit room with PWD toilet (must be at ground floor if no elevator) Addt'l Req. for

Renovation Projects:

□ As-found or Existing Condition Plans (for comparison purposes)

□Green Building Code Compliant (refer to the green building code for reference)

□ All drawing plans shall be drawn to scale and coincide with other plans of all sections, signed and sealed

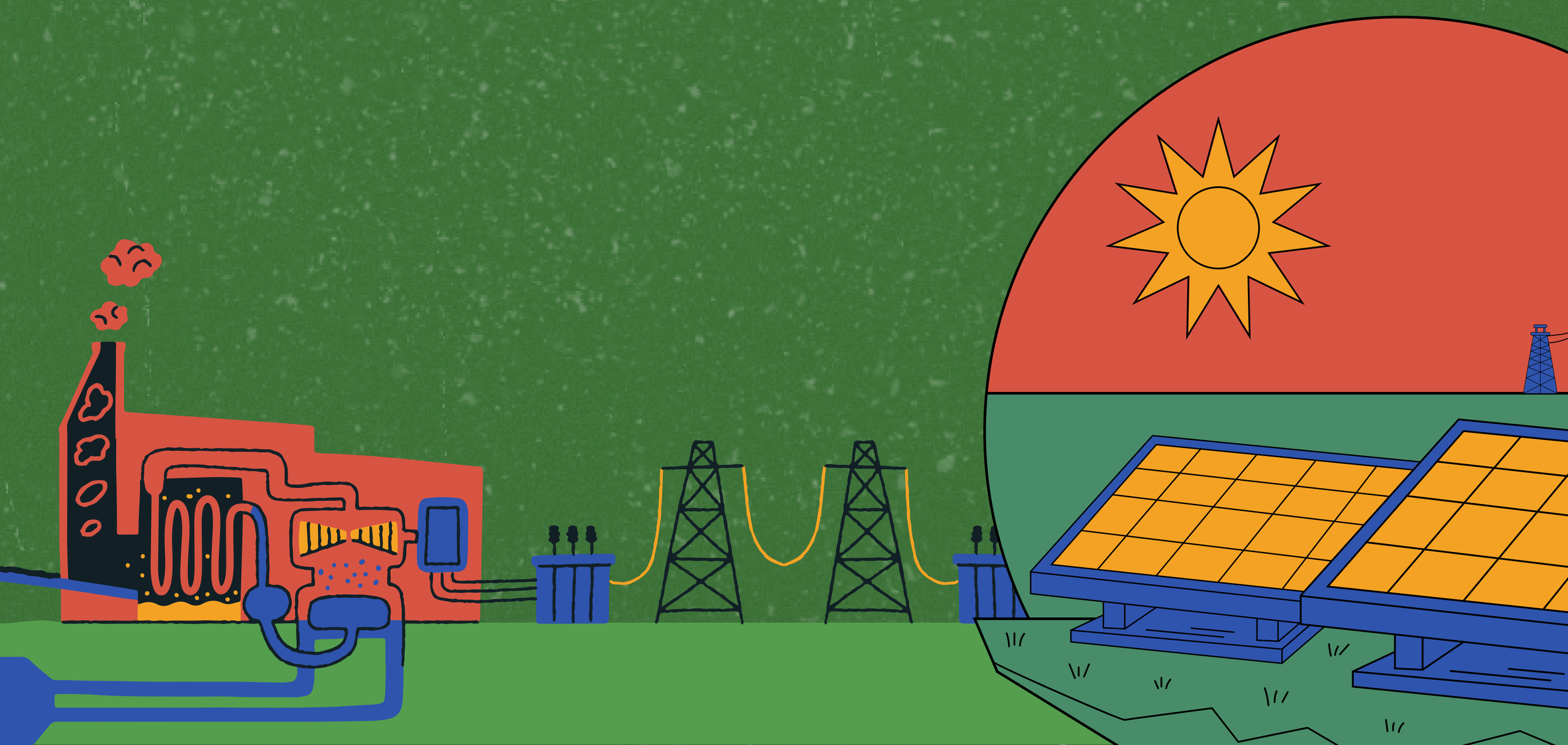
□ Reflect practitioners initials to all the corrections

□ No pasting/ patching/ correction ink or tape

for all working drawing plans and application forms

Source: Office of the Building Official of Cebu City.

APPENDIX C



BUILDING PERMIT REQUIREMENTS : DAVAO CITY

□ Application Letter

□ Accomplished Building Permit Form

□ Certified True Copy of Land Title and Tax Declaration

□ Duly Notarized Copy of Deed of Absolute Sale, or Lease Contract or Contract to Sell, or

□ Associationa Board Resolution and Applicanta Certificate of Membership, or Special Power of Attorney (SPA), or Secretary Certificate, or Authority to Construct (whichever is applicable)

□ Certificate of Zoning Compliance

□ Fire Clearance

□ DOLE Clearance

□ DPWH Clearance (if Project is along National Road)

□ ATO Clearance (if Project is near the Airport Area)

□ Bills of Materials

□ Project Specifications

□ Sketch/Lot Plan with Vicinity Map Drawn to Scale

□ Five (5) Sets of Building Plans

□ Structural Design Analysis (for All Buildings/ Structures except for Residential Buildings with an Area of 20 sq.m.)

□ Boring and Plate Load Tests (for Structures Four (4) Stories and Higher)

□ Seismic Analysis (except for Residential Buildings with Height less than 7.5 meters)

□ Construction Logbook

Source: Office of the Building Official of Davao City.

AUTHOR'S PROFILE

Dr. Cristina Alfonso

Dr. Cristina Alfonso is the economist of the Philippine Solar and Storage Energy Alliance (PSSEA). She received her PhD in Economics at Curtin University in Western Australia, Australia. She has done consultancy services for the Asian Development Bank and the Philippine government. Her extensive research experience covers Asian economics in terms of ASEAN regional cooperation, macroeconomic policies (monetary and fiscal policies), Free Trade Agreements, global and regional value chains, renewable energy including government regulations, and climate change mitigation.

MARKET REPORT ON

ROOFTOP SOLAR IN THE PHILIPPINES