Business Case for Commercial and Industrial Renewable Energy Development in the Philippines

March 2019

Introduction

This paper will provide a business case for corporate procurement of renewables in the Philippines. Declining technology costs and recent policy incentive developments have created an attractive economic environment for new investment in renewable energy (RE), particularly solar photovoltaic (PV) electricity. For some Filipino commercial and industrial (C&I) customers, choosing renewables can result in immediate savings over the Philippines' current expensive retail electricity rates.

This paper's primary audience is corporate customers currently purchasing electricity from a utility in the Philippines. It is also intended to help developers and investors understand the Philippines' evolving RE business environment. We will specifically focus on generation from PV panels mounted on a building's roof, or from ground-mounted PV panels (either on- or offsite).

Around the world, C&I buildings like industrial parks, factories, warehouses, and stores are benefitting from the low-cost electricity and reduced emissions of RE. Almost every link of a company's supply-chain includes a building that could offer cost-savings by switching to renewable sources of electricity. RE resources produce reliable electricity at low or zero marginal cost and the upfront expenses of RE has declined dramatically in recent years. A coalition of some of the world's largest companies have made commitments to procure 100% of their energy needs from renewables under a pact called RE100. Like the other RE100 members, Google understands that switching to RE aligns with customer preferences while providing lower cost electricity and price stability. Urs Hölzle, Google's Senior Vice President of Technical Infrastructure said "renewables are increasingly becoming the lowest cost option. Electricity costs are one of the largest components of our operating expenses at our data centers and having a long-term stable cost of renewable power provides protection against price swings in energy."[1]

[1] RE 100. "RE100 Progress and Insights Report: Approaching the Tipping Point." January 2018. The Climate Group. http://media.virbcdn.com/files/97/8b2d4ee2c961f080-RE100ProgressandInsightsReport2018.pdf

In order to help Filipino corporations realize the benefits of clean energy investments, the Clean Energy Investment Accelerator (CEIA) has developed an innovative partnership model that convenes leaders from the public and private sectors to overcome policy and financial barriers and spur investment in emerging markets. Our model focuses on three essential pillars to advance sustainable growth and mobilize clean energy finance at scale:

- **Purchasers**: Create opportunities for credit-worthy private sector actors to send a strong RE demand signal;
- **Pipeline**: Demonstrating energy demand aggregation models and financial tools to grow the RE project pipeline, attract investors, and unlock investment in emerging markets;
- **Policy**: Engaging with the public sector to strengthen effective, investment-friendly policy and regulatory frameworks that incentivize clean energy deployment.

About the Clean Energy Investment Accelerator

The CEIA is jointly led by the U.S. National Renewable Energy Laboratory (NREL), Allotrope Partners, and the World Resources Institute (WRI). We leverage partner networks—such as the Renewable Energy Buyers Alliance (REBA) and in-country business associations—to build private sector coalitions to catalyze investments in clean, affordable energy through innovative procurement and financial models, policies, and regulations. The CEIA provides technical support to C&I partners interested in implementing RE projects by guiding them through the procurement process, facilitating aggregated pilot projects, and demonstrating innovative finance and procurement models. The CEIA also works to open communication channels with government to promote market-based solutions and investment-friendly policy frameworks.

CEIA is tailoring its focus in the Philippines to specific high-growth **municipalities and local business communities:**

- CEIA is partnering with the City of Santa Rosa and other key municipalities to bring together local government officials and business leaders in a series of **public-private dialogues;**
- Through these workshops, the CEIA is identifying barriers facing C&I buyers and offering solutions to **help businesses understand their purchasing options** and take the first step toward clean energy deployment;
- These outcomes feed into local-level policymaking and influence a **business-friendly subnational policy framework** that encourages the scaled deployment of onsite and offsite RE solutions.

Through our public-private dialogues with municipalities, CEIA will **increase awareness of power wheeling** and provide C&I buyers with **cutting-edge information** to test and implement this new method of offsite purchasing:

- CEIA will walk buyers through the process for power wheeling and share options, of which buyers were previously unaware, and ensure local government support for these efforts;
- CEIA is also **training distribution utilities** to ensure that mandates under the new Renewable Portfolio Standard (RPS) are met ahead of schedule;
- These efforts will **increase understanding of, and support for, power wheeling** among local Filipino utilities.

Market Assessment

Since passing their Renewable Energy Act of 2013, the Philippines has installed over 880 MW of new PV. However, almost all of this RE is owned or contracted to utilities through policies such as feed-in-tariffs (FIT),[2] which inadvertently has proven expensive to the government. So the government now is transitioning to a new policy regime in the hopes of driving private sector RE investments and limiting costs to taxpayers. To date, only 17.18 MW of solar capacity is privately owned by residential, commercial, or industrial rate payers for the purpose of self-consumption.[3] In comparison, other countries in the region such as Singapore have already experienced booms in privately owned solar with over 170 MWp installed by the end of 2018.[4] With a suite of new policies, ideally, the Philippines is poised for similar growth.

Businesses in the Philippines are well-accustomed to paying high and extremely volatile electricity rates. In fact, the Philippines has the second highest electricity rates in Asia, largely due to expensive fossil fuel imports used for power generation.[5] While there are some 144 distribution utilities and electric cooperatives scattered across the Philippines, Meralco has the largest market share and is the only utility providing service to the Manilla region. Moreover, Meralco publishes new retail electricity tariffs every month. The Philippines' GDP grew at an average pace of 5.6% over the last ten years and in 2018 the country leapt from lower-middle income to upper-middle income status.[6] As the Philippines economy continues this growth and consequently most likely, power consumption increases, electricity rates have the potential to rise quickly as well.

This economic expansion has already precipitated significant year-over-year growth in the Philippines' peak electricity demand, from 9 GW in 2007 to 13.3 GW in 2016 (an average growth of 4.6% per year).[7] While fossil fuels have generated the vast majority of the electricity meeting this new demand, continued economic growth (and need for more power) is creating ample business investment opportunities in RE.

In addition to the environmental benefits and potential value in corporate branding as a fighter against climate change, investing in solar today can be an exclusively economic decision for businesses in the Philippines. *Figure 1* below displays the volatile retail tariff rates of Meralco, the Philippines' largest distribution utility. These rates are compared with the Levelized Cost of Energy (LCOE)[8] plus an approximate wheeling charge which represents the cost of delivering renewable electricity generated offsite over wires owned by the utility. *Figure 1* demonstrates that the benchmark, all-in price of procuring offsite PV is already comparable or below most recent C&I retail electricity tariffs in the Philippines.

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2 "2017 Power Statistics," Philippines Department of Energy, https://www.doe.gov.ph/sites/default/files/pdf/energy_statistics/03_2017_power_statistics_as_of_30_april_2018_generation_per_type_05042018.pdf

3 "Net Metering in the Philippines" presentation, by Mylene C. Capongcol, Philippines Department of Energy, Officer in Charge, Renewable Energy Management Bureau, 19 November 2018

4 https://www.ema.gov.sg/cmsmedia/Publications_and_Statistics/Statistics/31RSU.pdf

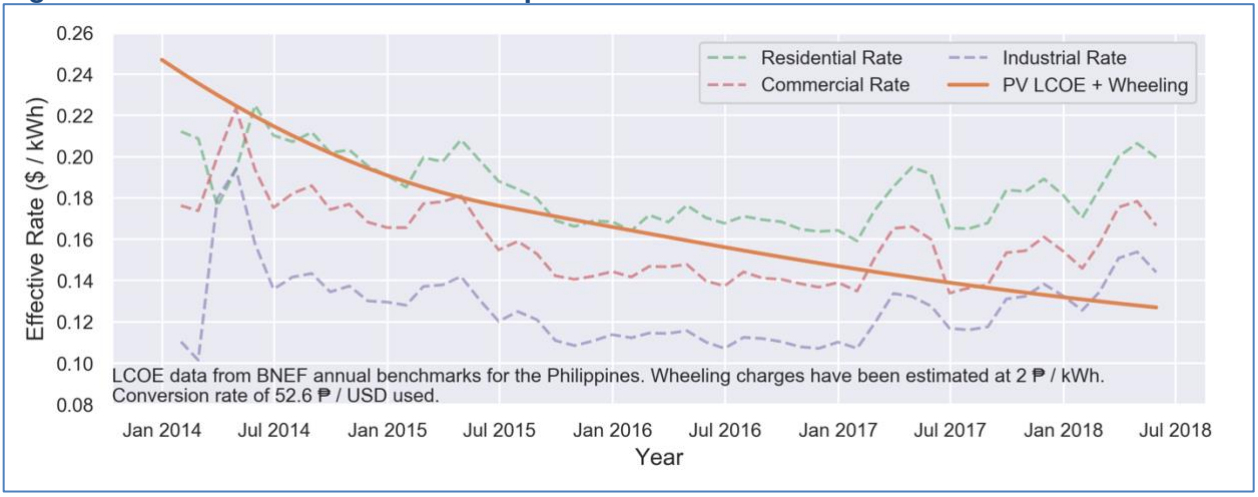
5 "Average Electricity Price in PHL 2nd Highest in Asia—Think Tank," *Business Mirror*, Lenie Lectura, https://businessmirror.com.ph/2018/08/07/average-electricity-price-in-phl-2nd-highest-in-asia-think-tank

6 "The World Bank in the Philippines," The World Bank, http://www.worldbank.org/en/country/philippines/overview

7 "Power Statistics," 2016, Philippines Department of Energy, Only including Luzon/Visayas https://www.doe.gov.ph/sites/default/files/pdf/energy_statistics/annual_system_peak_demand_per_grid_2016.pdf

8 An LCOE comprises the all-in cost of energy generation on a per kWh basis. If a business is buying the PV system for self-consumption, the LCOE provides a complete figure that can be compared with the price the business already pays for electricity using the same units. For a solar installation, the LCOE includes the cost of engineering, permitting, equipment, installation, operations, maintenance, insurance, financing, and a land lease if the system is offsite. LCOE data is based on Philippines specific data from Bloomberg New Energy Finance (BNEF).

Figure 1: Meralco Historic Rates Compared with LCOE



As *Table 1* below shows, the total installed capacity of solar in the Philippines has grown dramatically from virtually nothing in 2013 to 885 MW by January 2018.[9] Looking to sustain rapid RE growth, the Philippines has set a goal of 35% renewable generation by 2035, up from 24.6% today (this could translate to an approximate increase of 52.6 TWh per year.[10] If that growth came primarily from solar (for an additional 52,609 TWh of PV per year), it would require more than a 23% annual increase in year-over-year generation for the next 17 years. Although the Philippine's PV-specific goals are not quite that ambitious, the government has set the explicit goal of more than tripling PV generation capacity in the next four years to 3 GW by 2022, and then reaching 8.7 GW installed by 2030.[11]

Following the Renewable Energy Act of 2008, around 2,200 PV systems of the combined residential, commercial, and industrial sectors have been connected to the Philippines grid on net billing contracts.[12] Thus there is a growing collection of around 15 significant, experienced PV installation companies across the islands.

The best way to understand how the cost of purchasing a PV system compares with your current retail electricity rate is by using the LCOE. Issuing a Request for Proposals (RFP) for bids from developers can often return several bids. Using the LCOE is a typical way to assess the cost effectiveness of a bid. When evaluating proposals, consider if there are any other costs that might be worth including in the LCOE calculation. One important consideration included in an LCOE is the system's anticipated lifetime, 20-25 years are typical lifetimes of modern PV systems,

9 "Philippine Renewable Energy at the Crossroads: Webinar from Country Experts on Green Energy Options & Renewable Portfolio Standards," Philippines Department of Energy, Director Myulene C. Capongcol, Renewable Energy Management Bureau, 11 January 2019, https://www.youtube.com/watch?v=gd744nnvfWk&feature=youtu.be

10 SolarPlaza. "Updated Facts & Figures, Solar Energy 2018, SouthEast Asia." 2018. https://sun-connect-news.org/fileadmin/DATEIEN/Dateien/New/Solar_Facts___Figures_-_Southeast_Asia_2018.pdf, Says that the Philippines will require 65.7GWp of capacity by 2040 (~52.2GWp by 2035), which translates to approximately 216,641 TWh of total consumption, 35% of which is 75,824 TWh of RE.

11 SolarPlaza. "Updated Facts & Figures, Solar Energy 2018, SouthEast Asia." 2018. https://sun-connect-news.org/fileadmin/DATEIEN/Dateien/New/Solar_Facts___Figures_-_Southeast_Asia_2018.pdf

12 CEIA. Philippines Market Analysis Guidebook. Forthcoming.

although inverters are typically replaced half way through a system's life.[13] In our modelling, we used a 20-year system lifespan, which is standard in the Philippines.

Table 1: Philippines Installed Solar Capacity and Generation by Year[14]

Year	New Installed Capacity (MW)	Cumulative Installed Capacity (MW)	Generation (TWh)
2013	1	1	1
2014	22	23	17
2015	82	105	139
2016	600	705	1,097
2017	180	885	1,201

Figure 2 illustrates the benchmark LCOE for new projects in the Philippines according to BNEF. Solar PV's range of $0.07 to $0.11 per kWh of generation is about equal with the cost of new coal generation plants in the Philippines.[15] The costs in this figure only represent the price of energy from the perspective of the owner of the generation system; they do not necessarily represent what an electricity consumer will be paying on their bill.

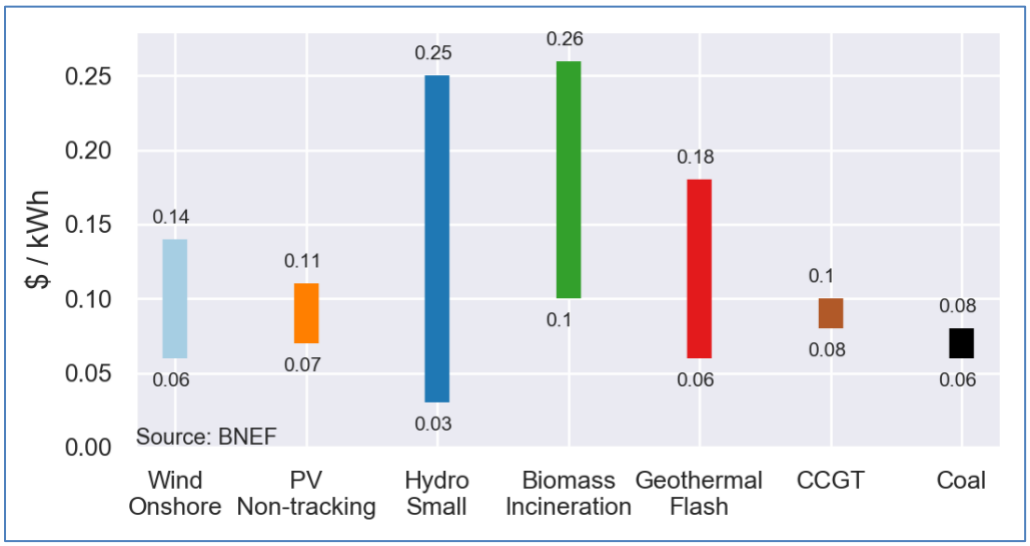


Figure 2: LCOE Range for Various Technologies in the Philippines, BNEF[16]

Fortunately, available data indicates that solar PV's LCOE is well below the retail cost of electricity in the Philippines. For instance, in Meralco's service territory around Manilla, the average

[13] Dirk Jordan and Sarah Kurtz. Overview of Field Experiences – Degradation Rates & Lifetimes. NREL. September 2015. https://www.nrel.gov/docs/fy15osti/65040.pdf

[14] "Philippine Renewable Energy at the Crossroads: Webinar from Country Experts on Green Energy Options & Renewable Portfolio Standards," Philippines Department of Energy, Director Myulene C. Capongcol, Renewable Energy Management Bureau, 11 January 2019, https://www.youtube.com/watch?v=gd744nnvfWk&feature=youtu.be

[15] "Philippines Country Profile," BNEF, February 2019.

[16] "Philippines Country Profile," BNEF, February 2019.

electricity tariffs for C&I tariffs are between $0.14 - 0.17 per kWh.[17] Recent bids shared with CEIA for an actual 600 kilowatt (kW) solar PV project in Manila had LCOEs between $0.04 - 0.06 per kWh. While these bids might not be representative of all projects, they are even lower than the BNEF's LCOE benchmarks in *Figure 2* above.

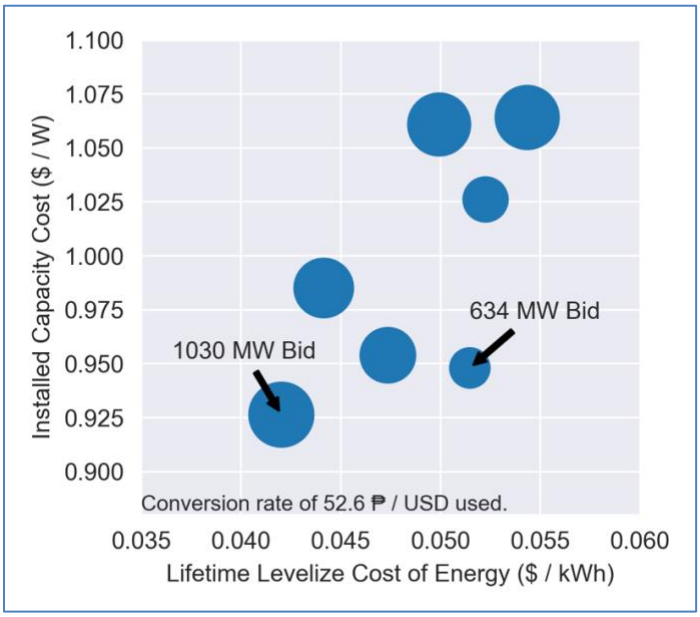


Figure 3: RFP Responses in the Philippines

Another way to consider the value of a solar project to a business is the installation's total cost per kW. Based on interviews with developers and examining bids, a typical PV installation costs around $1045 USD (₱55,000) per kW in the Philippines. *Figure 3* above displays bids for the previously-mentioned 600 kW PV project. Normally, there is a generally linear correlation between the LCOE and installation's cost per kW. However, some developers charge higher operations and maintenance (O&M) fees than others. Thus O&M and other variables such as amount of sunlight and quality of the inverter, can lead to differences in the relationship between the two metrics. The size of the bubbles represents bid's proposed capacity size, as many of these are not exactly 600 kW.

The LCOE demonstrates the all-in cost for onsite generation, which for many businesses is the most appealing mechanism for purchasing solar. However, the Philippines' new Green Energy Option Program (GEOP), allows businesses to enter into a Power Purchase Agreement (PPA) with offsite, large-scale, third-party-owned PV projects. When the GEOP is used the utility will additionally charge a "wheeling fee", to deliver the power from the PV project to the business over the utility's distribution system. The exact formula for this wheeling fee has not yet been announced, but estimates exist based on the known current cost of delivery to utilities.[18]

Some utilities like Meralco have faced scrutiny because of non-proportional components of the wheeling fee. While some components like the energy charge, and demand charge scale uniformly to the customers' demand, other charges for metering and supply are tiered to favor larger generators (those over 1 MW in size). *Figure 4* below displays what estimated wheeling

[17] The February 2019 conversion rate of 52.6 PHP per USD is used throughout this report.
[18] Philippines Energy Regulatory Commission. "Case No. 2016-002 DR." September 26, 2016. http://lia.erc.gov.ph/documents/2221

fees would be per kWh of electricity generated for a PV system of a given size. The price staggers upwards of $0.045/kWh for systems between 100-250 kW in size, before beginning to decrease. For systems 1 MW and above, the charge stabilizes to around $0.03/kWh.

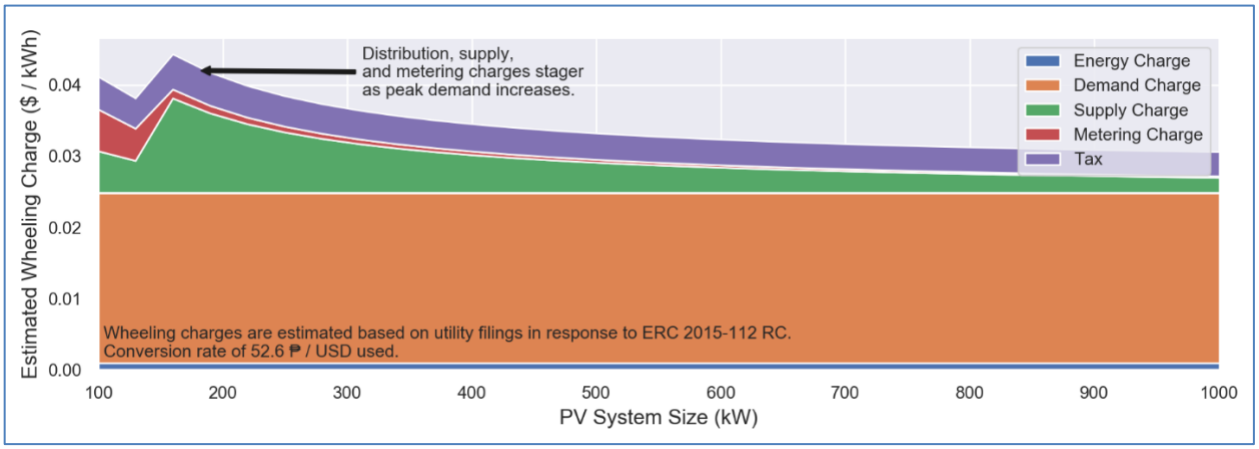


Figure 4: Estimation of Wheeling Charges for Meralco[19]

GEOP participants can expect to pay approximately $0.03/kWh in wheeling charges, although the exact amount could vary widely. Even with a high wheeling charge of $0.04/kWh and a solar PPA price of $0.07 per kWh, the total cost of $0.11 is still below existing retail C&I electricity rates. This example does show how significant the amount of the wheeling rate could be in determining total electricity costs. While the final calculations to determine wheeling rates have not been revealed yet, amounts higher than $0.04 - $0.05 per kWh could have a significant impact on project economics.

An additional benefit of pursuing renewable generation is price stability. Payments for a solar system can be easily calculated and anticipated, versus extremely unpredictable retail electricity prices from the grid. Between 2010 and 2018 the average *annual* year-over-year Meralco industrial electricity rate rose 0.81%, and the commercial electricity rate dropped 0.83%. Nonetheless, intra-month variation has been extraordinarily high and unpredictable with radical fluctuations. From February to September 2017, Meralco commercial retail rates increased over the previous month's rate by 12%, then 10%. In April it didn't change. Then in May and June it dropped 4% and 16%. It then bounced up 2% in July, 1% in August, and 11% in September. This extreme volatility is a challenge for C&I customers as it has a large impact on operational costs. Externalities like coal shortages, tariffs, and load growth all affect these grid electricity rates.

Policy and Regulatory Updates

Underlying all recent policy developments in the Philippines is a new Renewable Portfolio Standard (RPS) regime. This RPS was mandated by the Renewable Energy Act of 2013. With its rules released in 2017, the RPS is now moving towards implementation.[20]

[19] Philippines Energy Regulatory Commission. "Case No. 2016-002 DR." September 26, 2016. http://lia.erc.gov.ph/documents/2221

[20] An RPS is a legislative requirement for utilities to increase their use of renewable resources such as solar, wind, hydropower, and biomass. An RPS establishes yearly quotas for utilities to meet. Typically, mandates are based on a desired percentage penetration of renewables. To learn more about the Philippines' Renewable Portfolio Standard, see

In order to meet this RPS, other policies have been implemented to incentivize and accelerate private sector PV procurement. Two are specifically pertinent to C&I electricity customers: net billing and GEOP. Of course, customers can always choose to purchase RE without using one of these policy options, such as developing a PV system exclusively for self-consumption either via a turnkey purchase, or an onsite solar lease.[21] All of these options have specific costs and benefits which are explained in more detail below. Following this section some specific procurement options will be comparatively modeled to demonstrate each's potential economic value to C&I customers in the Philippines.

Green Energy Option Program: *For customers with demand over 100 kW, and lacking the space or resource availability to pursue a PV system onsite.*
The GEOP is an innovative program that allows large (an average monthly peak demand over 100 kW) C&I customers to procure their own solar electricity by signing PPAs with Independent Power Producers (IPPs). The program generally requires utilities to deliver the power from the IPP to the customer. The utility is allowed to charge a "wheeling fee", which serves as a type of postage stamp on every kWh of electricity distributed over their wires. The utility also acts as the power supplier of "last resort" under the GEOP. This means that if the solar electricity secured through the PPA is unavailable, the customer can still buy power from the utility.

Additionally, the utility retains all Renewable Energy Certificates (RECs) generated by the IPP. RECs are used by utilities to meet RE mandates under the Philippines' RPS. However, some corporates also value RECs for their own voluntary corporate social responsibility reporting. This is important because RECs contain the legal representation of all environmental attributes associated with RE. Therefore, it could be illegal for a GEOP participant that is the actual buyer in the PPA, to claim that they are powered by carbon-free electricity, or are paying for RE. ***Thus, this option may be at odds with the objectives of companies like those under RE100.***

Some details about the GEOP remain uncertain. For instance, the Philippines Department of Energy (DoE)'s Department Circular No. DC2018-07-0019, which authorizes the GEOP, states that a PPA must provide 100% of a customer's ordinary power consumption, but it is unclear at what time scale this is balanced.[22] Similar programs in the United States typically balance at a monthly level and clarification from the DoE has been sought. Additionally, the exact formula for determining appropriate wheeling charges has yet to be published, although reasonable estimates are provided in the financial sensitivities section of this paper.

While not fully implemented yet, the GEOP will offer an opportunity for private companies to secure their own reliable electricity, potentially at a rate below current utility retail rates. The GEOP

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the forthcoming (to be released in 2019) CEIA *Hot Topic Brief: Opportunities for Mobilizing Private Sector Investment into Clean Energy in the Philippines*.

[21] Regardless of which financing mechanism is used to secure an onsite PV installation, both the turnkey purchase and the onsite solar lease can be used either exclusively for self-consumption, or for self-consumption-plus-net- billing of excess generation.

[22] For example, if balancing is done instantaneously then the customer would have to align their power consumption with the real time generation of their IPP. This would be a unique policy globally, and extraordinarily difficult for the utility and customer to coordinate. In fact, if taken literally, it would be impossible for the customer to consume *any* electricity at night if the IPP is only providing solar electricity. It is more likely that the DoE will require customers to balance their consumption with their PPA generation over a longer time period, ensuring that they have not consumed more than they've paid to be generated over days, weeks, or months.

Philippines Department of Energy. "Department Circular No. DC2018-07-0019." https://www.doe.gov.ph/laws-and-issuances/department-circular-no-dc2018-07-0019

also enables businesses to pursue sources of RE (not just solar) that are not available onsite, including large offsite solar or wind farms, geothermal, or even hydro resources.

Net Billing: *For customers under 100 kW with space available onsite.* Net billing programs have inspired rapid solar growth around the world. Net billing allows electricity customers to consume PV electricity generated onsite. When excess solar power is generated beyond what the business can use right then (such as in the middle of the day on a Sunday), it is exported to the grid and sold to the power utility at a predetermined rate. Under current Filipino regulations, this rate is equal to the utility's cost of generation for that month (generally about 40% of the retail rate).[23] Electricity sales are 'banked' on a customer's bill and can be used to offset electricity purchases from the utility in periods when the customer's solar generation is not sufficient to meet the customer's demand. Net billing can provide value for customers with rooftop solar systems that often exceed the customer's consumption at any given moment in time.

The Philippines' net billing program was established in 2013, yet participation remains low—it is estimated that only 13 MW of solar has been registered for net billing. The largest barrier to adoption is project permitting. One analysis found that 14 different permits were required from a combination of federal and local governments, power system operators, regulators, and the utility for a single net billing project to be approved.[24] However, there are now multiple developers who are now highly experienced at navigating the permitting process on behalf of their customers. Some developers operate as Energy Services Companies (ESCOs) who execute Energy Service Performance Contracts (ESPCs). Under the ESPC, the ESCO installing the system will finance a turnkey project, and the customer is contractually obligated to use their electricity bill savings from self-consumption to pay off the ESCO in monthly installments. This sometimes allows businesses to install solar panels as the owner of a turnkey project, without a down payment.

Net billing is only permitted in the Philippines for systems smaller than 100 kW. Filipino regulations mean customers receive minimal compensation for net billed electricity that is pushed to the grid. However, net billing still could be financially a net-positive, depending on a given PV project's specific parameters.

Development Exclusively for Self-Consumption: *For projects larger than 100kW with space available onsite.*
Regulations in the Philippines prohibit onsite PV installations larger than 100 kW that include net billing. However, systems larger than 100 kW can still be installed on C&I customers' rooftops exclusively for self-consumption (as long as if there is no excess generation, or if there is, it is not exported to the grid).

In general, this procurement option works best for smaller solar systems that will only supply a proportion of the customers load, and for customers with a load profile that aligns well with the PV system's generation timeline. Thus, the economics of net billing versus exclusively self-consumption are unique to each individual project.

[23] Meralco. "Rate Archives." March 2019. https://company.meralco.com.ph/news-and-advisories/rates-archives
[24] Tetchi Capellan. "Getting to the Finish Line: Lessons on Solar PV Development." Clean Energy Forum. June 2016. https://d2oc0ihd6a5bt.cloudfront.net/wp-content/uploads/sites/837/2016/04/05-Getting-to-the-End-Line_final.pdf

Overview of procurement options and SAM model analysis

Three primary models exist for businesses seeking to invest in solar electricity in the Philippines: turnkey purchases, onsite solar leases, and offsite third party PPAs via GEOP. All three offer a potential for cost savings or a return on investment, depending on the particular parameters of the customer's situation and opportunity, such as the financing terms and contract timeframe. A basic qualitative understanding of when each purchasing model could be the best option can be gained by studying *Figure 5* below.

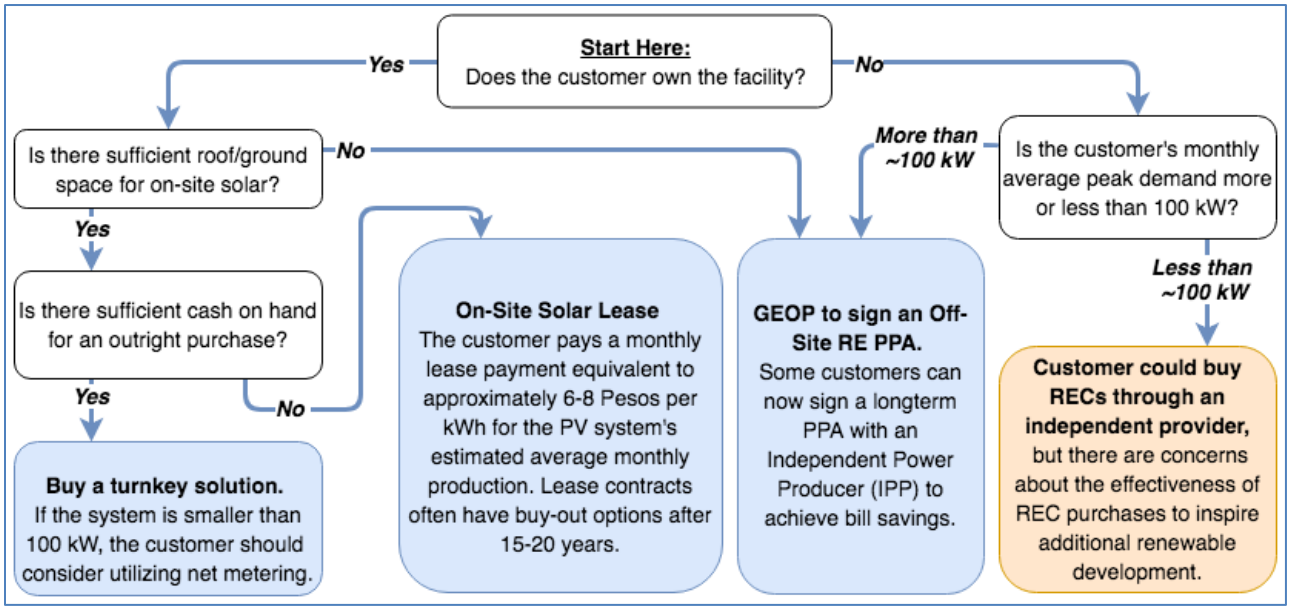


Figure 5: Decision Tree for C&I RE Purchasing Methods in the Philippines

In order to better understand the customer economics of adoption, we selected a representative commercial customer from the Philippines and modeled the costs and benefits of adopting solar. As see in *Table 2*, the customer has an annual energy consumption of 8,834 MWh, and a peak demand of 2.18 MW which are approximately the consumption levels of a shopping mall. Although this represents a fairly large commercial customer, the results of this modeling can scale to other sizes of commercial or industrial customers.

Table 2: Modeled Customer & System Attributes

Site	Utility	Customer Class	Annual Energy Use	Peak Demand	Irradiation (daily avg.)	System Size
Manila	Meralco	Commercial	8,834 MWh	2.18 MW	4.29 kWh/m2/d	997.09 kWp (828.0 kWac)

We input this and other key data into NREL's System Advisor Model (SAM), which considers technical, policy, and financing characteristics of a project to model energy production, system

sizing, and financial results. Top such data points used in SAM include the load profile (our model's load profile is in *Figure 6* below), solar resources, system sizing, utility and net billing compensation rates, interest rates, taxes, and investment timelines. This allows us to see the costs and benefits to a customer, of selecting a turnkey purchase, an onsite solar lease, or an offsite third party PPA via GEOP procurement methods.

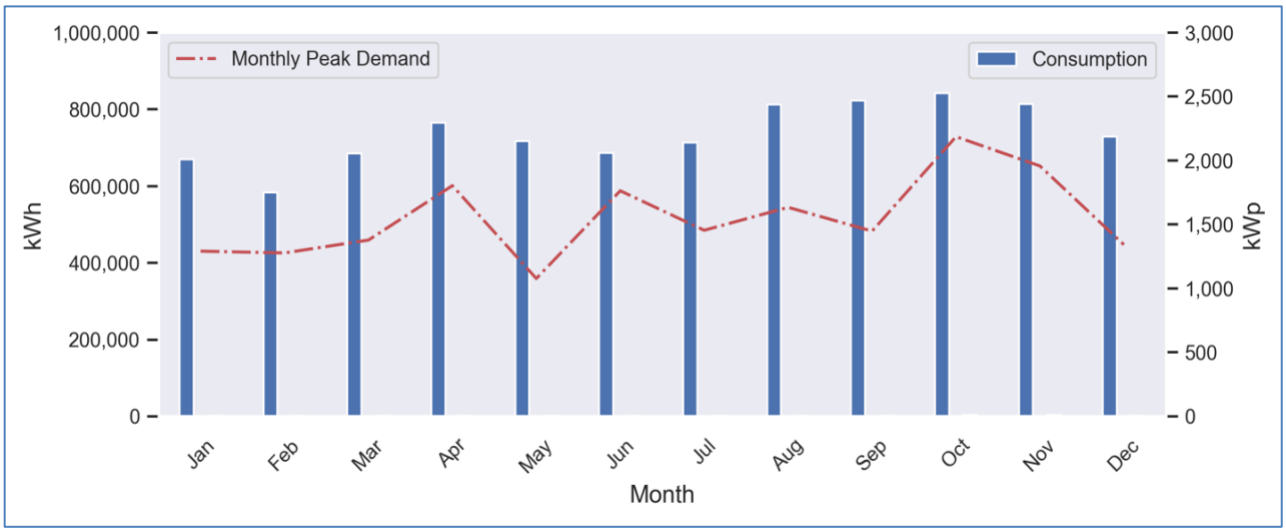


Figure 6: Modeled Customer Monthly Consumption and Demand

For each model, a variety of metrics listed in *Table 3* below, are used to gauge—and compare—the cost-effectiveness of the purchase for the customer.

Net Present Value (NPV) represents the savings from adopting solar, versus the alternative of continuing to purchase all electricity from the utility, while incorporating the cost of capital (discount rate).[25]

Internal Rate of Return (IRR) is a different way to express the value of a project which describes what the customer's discount rate would have to be for the project to have an NPV of zero, an IRR higher than 10-20% is generally considered to represent significant value.

Up-front cost indicates the total costs paid for the procurement of the PV system in the first year. In the case of our case study's turnkey purchase, a debt/equity ratio of 70/30% was selected with a loan term of 10 years and a baseline interest rate of 6.5%. While the turnkey purchase requires an upfront investment, the other two procurement methods are designed to not require any upfront payment. Likewise, while an onsite solar lease or a GEOP PPA might not offer the same amount of savings over the system lifetime, they do not require companies to have cash on-hand for a purchase.

[25] The discount rate used in this modeling is 10%.

Year 1 Net Savings demonstrates the real savings that would be achieved over purchasing electricity from the utility in the first year after the system's installment (although this does not include the cost of the down-payment for a turnkey purchase).

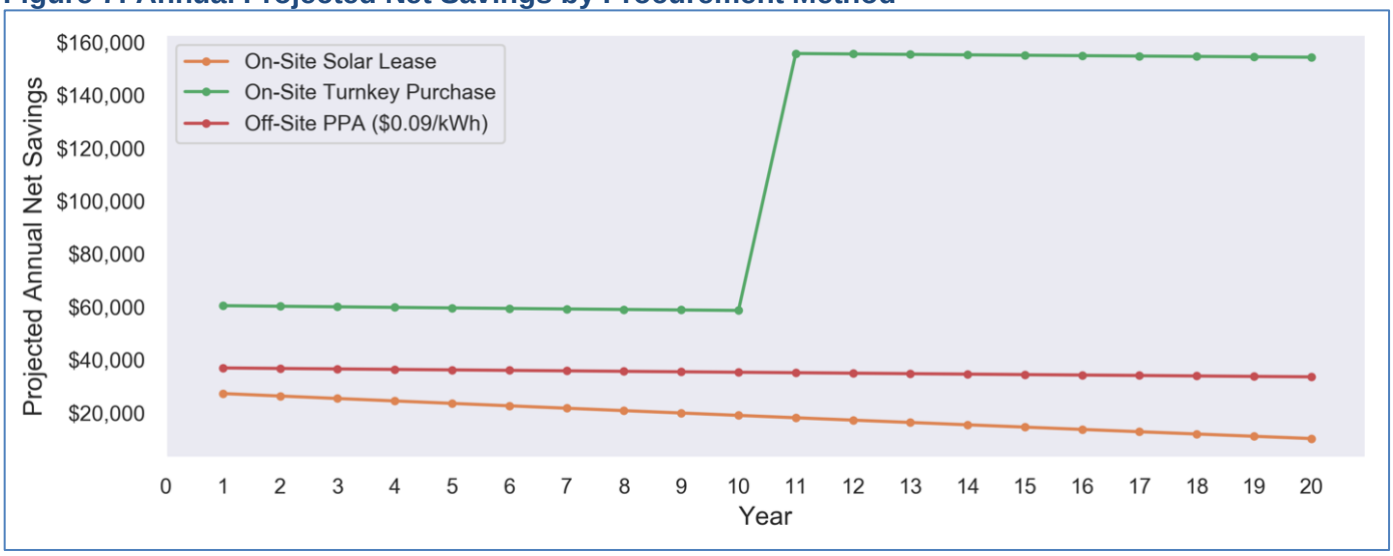
Simple Payback is the number of years that it would take for the resulting electricity bill savings to pay-off the system purchase. LCOE was discussed above and represents the total Levelized Cost of Energy on a per kWh basis over the life of the system. However, as the LCOE is a measure of generation cost, it only applies to the turnkey purchase. So for the onsite solar lease and third party offsite PPA w/ GEOP, we show the lifetime average cost per kWh over 20 years.

Table 3: Baseline Financial Results for Procurement Methods

Financing Structure	NPV	IRR	Up Front Cost	Year 1 Costs	Year 1 Net Savings	Simple Payback	LCOE/ Lifetime Average Cost of Energy
Turnkey Purchase	$435,140	23.16%	$299,501	$126,532	$60,509	6.35 Yrs	$0.1118/kWh
Onsite Solar Lease	$182,053	—	$0	$159,716	$27,324	—	$0.1394/kWh
Third Party Offsite PPA w/ GEOP	$304,980	—	$0	$150,042	$36,998	—	$0.09/kWh (LCOE) **+** ~$0.035/kWh (Wheeling Fee) **=** $0.1235/kWh

Figure 7 below shows the annual savings that would be present under each of these procurement methods. While the turnkey purchase requires a significant upfront investment, it leads to higher annual savings once the system is paid off. PPAs and solar leases are designed to provide stable electricity prices over the lifetime of the system.

Figure 7: Annual Projected Net Savings by Procurement Method



Our analysis found, as shown in *Figure 8* below, that on a monthly basis, savings were found to be higher during the Philippines' sunniest months of March to June. Although some of this is also the result of the modeled facility having lower monthly energy consumption during this time period. For the SAM model we selected a 997.1 kWp (828 kW_{ac}) PV system,[26] which supplies 10-13% of the facility's electricity consumption during its peak consumption months of August to November. This customer's energy consumption would require a PV system of multiple MWp to generate any excess electricity for net billing back to the grid for payment from Meralco.

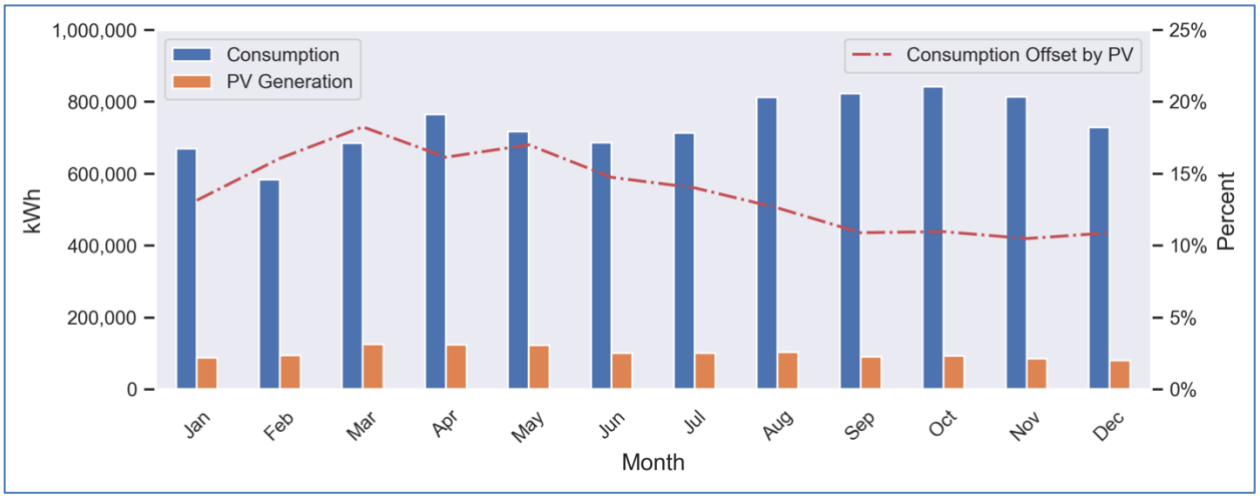


Figure 8: Monthly Electric Bill Savings from Rooftop Solar

In order to gauge the variability of these cost savings we modeled each procurement model under various sensitivities including potential Meralco rate escalations, loan financing rate changes, and installed technology costs.

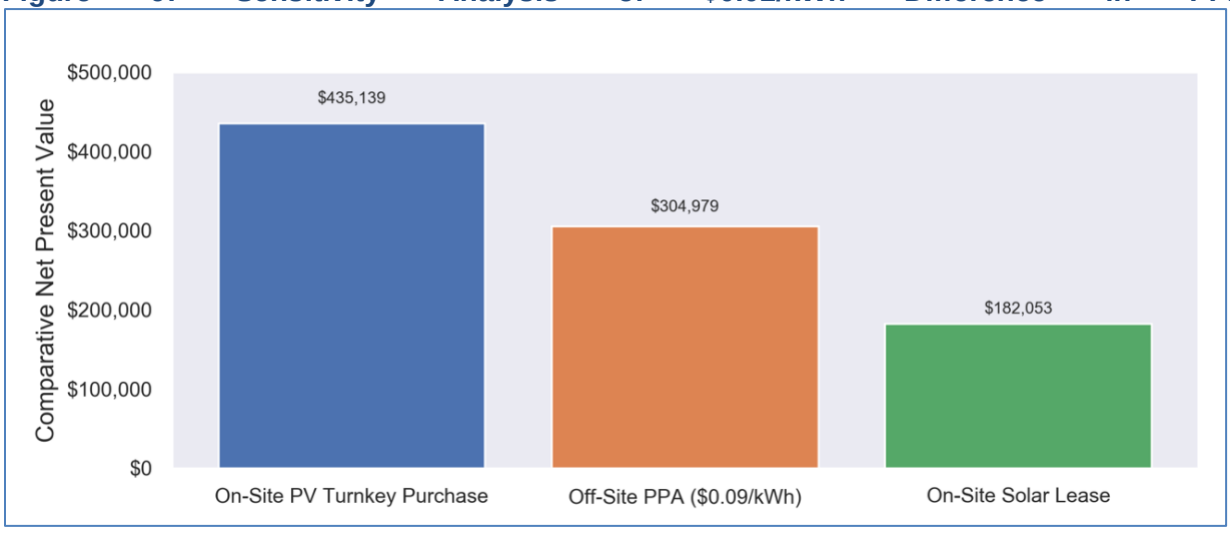
[26] "kWp" (or "MWp") refers to the DC size of a PV generation system, derived from manufacture testing of the solar panels under ideal conditions. In contrast, the simple "kW" or "kW_{ac}" (or "MW" and "MW_{ac}") in a system's size refers to the maximum anticipated AC watts of a PV generation system, as rated by the interverters' output.

As discussed previously Meralco rates have historically been extremely volatile, often with dramatic swings from one month to the next. For instance, commercial rates stood around $0.133/kWh in January 2017 before swinging up 23% to approximately $0.166/kWh in April 2017. Two months later, in June, they were back down to $0.134 /kWh. These fluctuations are due to the Philippines' reliance on regional oil and coal markets. Over the past ten years, while rates at times have periodically increased or decreased over 1-2 years, they have generally reverted close to a mean. Therefore, in our baseline analysis, we have modeled for no increase in the cost of electricity over time. However, for sensitively modeling purposes, we examined both this one with constant commercial retail tariffs over the duration of the system lifetime, and one with a 1% annual rate escalation in these tariffs. Rate escalations were found to have a significant impact on project economics, the presence of a 1% escalation improved the NPV of a solar loan by 17.3% - 18.7%.

Consultation with experts in the Philippines as part of this research has revealed that a typical installed price per watt is $1.00. This price point is already competitive on a global scale for C&I projects, contributing to the low LCOE of solar mentioned in the Market Assessment section. The installed price will likely continue to decrease in the coming years due to decreased technology costs and improved supply chains. To capture this effect, we included price per watt as a sensitivity and modeled installed prices at $0.80/W, $0.90/W and $1.00/W (our baseline) .

For offsite third party PPAs, where the installed price per watt is not directly felt by the purchaser, we modeled similar incremental decreases in PPA prices of $0.07/kWh, $0.09/kWh (our baseline), and $0.11/kWh. Our analysis, as seen in *Figure 9* below, shows that for every $0.01 change in the PPA cost of a PV kWh, there is approximately a $200,000 difference in the NPV to the customer.

Figure 9: Sensitivity Analysis of $0.01/kWh Difference in PPA



We also conducted another sensitivity test regarding the impact of solar loan interest rates, which only impacts the project economics of a turnkey purchase. Low (5.5%), medium (6.5%), and high (7.5%) loan interest rates were used as inputs (6.5% was our baseline rate). This was found to be a less significant factor in determining the NPV of a project. For each 1% increase in the loan interest rate, there was an impact on the NPV of only 3.7% - 4.9%. *Table 4* below highlights the impact of these sensitivities on the NPV of a turnkey purchase with a solar loan. In all sensitivities, the payback period for a turnkey purchase solar loan was between 5.7 and 5.9 years.

Table 4: NPV of a Turnkey Purchase Dependent on Interest Rate and Rate Escalation

		Solar Loan Interest (%/year)		
		5.50%	6.50%	7.50%
Annual Commercial Retail Tariff Escalation	0%	$462,780	$435,140	$406,880
	1%	$565,938	$538,297	$510,037

In summary, our modelling demonstrates that while a turnkey purchase is likely to offer the largest savings over the lifetime of a PV system, there are limiting factors including the customer's equity available for a down payment and financing availability that could present hurdles. Other procurement methods including the GEOP (offsite PPA) and an onsite solar lease still offer significant bill savings as well for the customer modelled in this analysis. Additionally, a PPA can reduce risk associated with system performance and O&M costs.

Analysis of Strengths, Weaknesses, Opportunities, and Threats

The "Strengths, Weaknesses, Opportunities, and Threats" (SWOT) analysis below in *Table 5* examines the decision for a private sector C&I facility owner—such as of a fish cannery or mall—and whether to procure solar electricity. This question is asked agnostic of which procurement model above is being contemplated. The table examines this question from the perspective of: 1) what the short-term strengths and weaknesses of would be of executing such a project, as well as 2) what would be post-commissioning (after beginning to consume the solar electricity) opportunities and threats or risks to the profitability of the investment?

Table 5: SWOT Analysis for Potential C&I Solar Customers

STRENGTHS	WEAKNESSES

- Strong solar resources from high sun exposure.
- Wealth of experienced vendor options:
  - RTS system installation companies, and
  - Clean energy service-support providers, such as bankers, lawyers, and insurers.
- Relatively strong technical capacity of indigenous workforce, particular in light of current utility-scale solar market scale up.
- Supportive trade policies and, generally, an attractive business environment for foreign investors.
- Local financing is generally available

- For both Onsite and Offsite
  - No more than 40% of a project can be foreign owned
- Onsite turnkey or solar lease
  - Project sizes are limited by a capacity cap on net billing
  - Onsite projects with third-party financiers still face significant regulatory and project risks due to rapidly changing policy environment, tax incentive uncertainty, and variable contract arrangements for different buyer classifications
  - Complex regulations can be cumbersome for C&I customers to navigate
- Offsite GEOP PPAs
  - New GEOP creates power wheeling possibility for customers with demand over 100 kW, but new rules' implementation dates are still uncertain
  - Lack of clarity on key details slows implementation. Wheeling charges vary across different distribution utilities and there is not a central platform to provide transparency on retail supply rates

OPPORTUNITIES

- Solar PV prices continue to fall, improving economics
- Currently, a high-level of interest from international solar developers and investors.
- Establish more transparent and faster permitting and interconnection processes
- International incentives to reduce GHG emissions and growing demand from C&I energy users for solar; an attractive solar market in Vietnam will be attractive to FDI investors and companies with strong sustainability, climate and energy agendas.

THREATS

- Changes to the overarching energy policy framework that focus on coal development.
- Inexperienced solar developers and lack of information for potential customers to determine qualified vendors.
- Underperformance of solar PV equipment or contractors and other factors impacting consumer satisfaction.
- Lack of transparent permitting and interconnection processes

Procurement Guides and Tools

Solar PV costs are falling dramatically. As utility electricity rates increase in the Philippines, C&I facilities will increasingly have opportunities to save money by utilizing onsite solar PV power generation. The following guide provides key questions for C&I facility operators to consider when exploring solar PV options which include, but are not limited to: site ownership, physical characteristics of the site, operational practices, and access to financing. This checklist is not intended as a comprehensive resource, but as a high-level introduction to the key factors that can impact whether or not C&I businesses and facilities have the right conditions to make a cost-effective procurement of an onsite solar PV system.

If a customer decides that onsite PV is of interest, based on this checklist, the next step would be to perform a more detailed technical and engineering feasibility assessment.

- ✓ Does your company own the building or have a long-term lease?
- ✓ Do you have space available on your roof for solar panels and/or sufficient land for a ground-mounted system?
- ✓ Is the roof structurally sound and will it be in place for the duration of the economic life of the solar PV system (typically, 20-25 years?)
- ✓ Is the area where the solar panels would be located free of trees, walls, buildings, or other structures that would create shade?
- ✓ Does the site's operational schedule and electricity consumption align with solar production?
- ✓ Does your company allow the use of operational budgets to lease equipment? Or does your company's budget allow for equipment to be purchased with capital budgets?
- ✓ If your company is interested in a solar lease, would it be able to sign at least a 10-year contract?

If you answer YES to all these questions, your company is well positioned to consider onsite solar.

If you answered *NO* to some of these questions, there may still be other options for RE procurement. The following sections provide a deeper look at these considerations and a more detailed explanation of the financing options for onsite solar PV electricity in the Philippines.

Additional CEIA Resources:

- CEIA Report: Philippines Market Analysis Guidebook[27]
  - The CEIA is working with municipalities in the Philippines like the City of Santa Rosa to bring together city officials alongside the local business community to help purchasers overcome clean energy barriers. As part of this effort, the CEIA has published a Market Analysis Guidebook which can answer additional questions

[27] CEIA. "Philippines Market Analysis Guidebook." Forthcoming

businesses might have about renewables, including the costs and benefits of various procurement methods, additional case studies of successful installations, a database of experienced solar developers in the Philippines, and answers to technical questions such as rooftop structural considerations and equipment warranties.

- CEIA Report: Philippines Hot Topic Brief[28]
  - This analysis examines the existing market and policy context within the Philippines. It provides a list of existing challenges for renewable development including details of the GEOP's implementation, and implementation of the new Renewable Portfolio Standard. It would be a useful read for any customers with questions about the larger policy context of renewables in the Philippines.
- CEIA Webinar: Philippine RE at the Crossroads[29]
  - Experts including Marlon Apanada of Allotrope Partners and Mylene Capongcol, the Director of the Philippines DoE's Renewable Energy Management Bureau participated in this webinar providing a status update on programs like net billing and the GEOP, and an overview of procurement mechanisms.
- CEIA Factsheet: Key Questions When Considering Onsite Solar PV[30]
  - As part of the CEIA's work in Vietnam, this document provides a detailed comparison of financing structures and a discussion of physical and operational opportunities available to businesses.
- RFP Template
  - CEIA has developed this RFP as a model upon which C&I customers world-wide can base their own RFP, to procure solar electricity or a solar electric system. However, as this is a generalized document, CEIA strongly advises that anyone using it must adapt many key components to the specific nature of their own company's requirements and their own country's solar legal and regulatory regimes.

Additional Documents:

- The World Bank's Sample Power Purchase Agreement (PPA) Library[31]
  - This library of documents provides example and sample PPAs from a variety of countries and contexts. Documents are broken down by system size. While companies should always pursue legal assistance to formulate their own PPA, these documents can provide a general idea of what features should be included in a well-designed PPA.

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[28] CEIA. "Hot Topic Brief: Opportunities for Mobilizing Private Sector Investment into Clean Energy in the Philippines." Forthcoming.

[29] CEIA. "Philippine RE at the Crossroads." Clean Energy Solutions Center. https://www.youtube.com/watch?v=gd744nnvfWk&feature=youtu.be

[30] CEIA. "Key Questions When Considering On-Site Solar PV: An Introductory Guide for Commercial & Industrial Facilities in Vietnam." November 2018. https://static1.squarespace.com/static/5b7e51339772aebd21642486/t/5bec9bdecd83667c6998cc79/1542233057233/Key+Questions+to+Assess+Solar+Investment+Opportunities+in+Vietnam.pdf

[31] The World Bank Public Private Partnership Legal Resource Center. "Power Purchase Agreements (PPAs) and Energy Purchase Agreements (EPAs)." https://ppp.worldbank.org/public-private-partnership/sector/energy/energy-power-agreements/power-purchase-agreements

Freely Available Financial and Performance Modelling Tools:

- System Advisor Model (SAM)[32]
  - SAM is an advanced software modeling package that calculates performance and financial metrics of RE systems. SAM can model a variety of financial structures for distributed projects and outputs useful project-specific financial data including energy bill savings, pay back periods, and net present values.
- PV Watts[33]
  - PVWatts is an easy to use online application for estimating the energy production for grid-connected PV energy systems anywhere in the world. Users can compare the cost performance of different DPV siting locations and configurations against electricity purchased from the grid.
- Renewable Energy Data Explorer (RED-E)[34]
  - A map-based data-visualizer with renewable resource data for the Philippines and Southeast Asia. Interactive layers include multiple solar radiation models, wind speed at varying elevations above surface, transmission lines, environmental attributes including frequency of natural disasters, and administrative boundaries. Optimized to provide supply-value curve information to prospective RE projects in developing countries.

[32] NREL. "System Advisor Model (SAM)." https://sam.nrel.gov/
[33] NREL. "PV Watts." https://pvwatts.nrel.gov/
[34] NREL. "Renewable Energy Data Explorer, Southeast Asia." https://maps.nrel.gov/rede-southeast-asia/