CLEAN ENERGY INVESTMENT ACCELERATOR

Business Case for Commercial and Industrial Renewable Energy Development in Vietnam

March 2019

Introduction

Under the RE100 platform, over 165 companies have made commitments to procure 100% of their electricity needs from renewable energy (RE) sources, such as wind, solar photovoltaic (PV), biomass, and geothermal. Given many companies' large energy needs, this presents a significant opportunity to offset corporate and industrial energy demand with lower carbon-emitting resources. In fact, some companies consume as much energy as entire countries. For example, the Anglo-Australian international mining company Rio Tinto, averages an annual consumption of 61.5 terawatt hours (TWh), which is roughly equivalent to that of all Colombia.[1] Samsung consumes 17 TWh annually, nearly equal to the combined consumption of both Myanmar and Cambodia.[2]

There are a variety of ways in which corporations can procure RE-based electricity, including through direct investments in projects, long-term power supply contracts, utility green tariffs, community solar, and buying RE attributes. Corporate procurement presents a tremendous opportunity for driving private sector investment in clean energy, supporting both company- and country-level sustainability goals. The rate of interest in corporate procurement is growing significantly: in 2018 alone, over 120 corporations across 21 countries signed a cumulative total of 13.4 gigawatts (GW) in clean energy contracts, more than doubling the 2017 global volume of deals.[3]

While this growth in corporate procurement is impressive, it also highlights challenges that need to be addressed to enable companies—or in these cases "customers"—to buy RE. Vietnam is in a similar situation as the United States was two decades ago with only approximately 20

1 https://irena.org/-/media/Files/IRENA/Agency/Publication/2018/May/IRENA_Corporate_sourcing_2018.pdf
2 https://irena.org/-/media/Files/IRENA/Agency/Publication/2018/May/IRENA_Corporate_sourcing_2018.pdf
3 https://about.bnef.com/blog/corporate-clean-energy-buying-surged-new-record-2018

Megawatts-peak (MWp) of corporate procurement to date. In part, this is due to a relatively volatile and constraining regulatory environment in Vietnam, hindering investment beyond onsite solar designed for self-consumption.[4] This is relatively small compared with Singapore's over 174 MWp of non-residential rooftop solar PV (RTS), as of January 2019.[5]

The Clean Energy Investment Accelerator (CEIA) seeks to address these barriers through an innovative partnership model that convenes leaders from the public and private sectors to spur investment in emerging markets. Our model focuses on three essential pillars to advancing sustainable growth and mobilizing clean energy finance at scale:

- **Purchasers**: Create opportunities for credit-worthy private sector customers 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.

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 and catalyze investments in clean, affordable energy through innovative procurement and financial models, policies, and regulations. The CEIA provides technical support to commercial and industrial (C&I)[6] 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.

This business case illustrates the potential investment opportunity for onsite corporate RE in Vietnam, explicitly for self-consumption and possible export of excess generation to the grid. It is also intended to help developers and investors understand the business environment and project pipeline opportunities. We focus on the RE technology type that is currently the primary option available for C&I customers in Vietnam: onsite RTS generation systems.

[4] "MWp" refers to the DC size of a PV generation system, derived from manufacture testing under ideal conditions. In contrast, the simple "MW" size of a system refers to the maximum anticipated AC watts of a PV generation system, as rated by the interverters' output.

[5] https://www.ema.gov.sg/cmsmedia/Publications_and_Statistics/Statistics/31RSU.pdf

[6] Often in Vietnamese translations such as under retail electricity tariff rate listings the web page of Vietnam's electric utility, the word "commercial" is written instead as "business" and "industrial" is written as "manufacturing". However, international convention primarily uses the terms *commercial* and *industrial* instead. Therefore, we will utilize those two latter terms throughout this paper.

We provide a brief policy and regulatory background as it pertains to the enabling environment in Vietnam for RTS at the time of this paper's publication. We look at the current market in terms of the level of investment made to date, the key barriers and opportunities. We also explore the available financial models and demonstrate how various factors such as retail electricity tariffs, net billing remuneration for excess energy exported to the grid, anticipated costs and revenues, and cost savings can influence project financials. We then assess the strengths, weaknesses, opportunities, and threats from the perspective of a prospective corporate onsite solar investment. Finally, we provide guidance on key considerations when procuring RTS.

Policy and Regulatory Updates

Vietnam's economy has grown rapidly in recent years, and to fuel this growth, it has turned to multiple sources of power generation. In its Nationally Determined Contribution (NDC) under the Paris Agreement on climate change, Vietnam set a goal of reducing country-wide greenhouse gas (GHG) emissions by 8% below the 2030 "Business as Usual" (BAU) scenario. Vietnam also states its NDC target could realistically be raised to 25% contingent on international and private sector funding. However, the government's current plans include adding roughly 40 GW of new coal generation by 2030, which would undermine Vietnam's efforts to meet its GHG emissions reduction targets.

Vietnam has tremendous natural resources to generate wind and solar electricity, but only recently have the Prime Minister's office and the Ministry of Industry and Trade (MOIT) moved to create the regulatory structures needed to establish a strong clean energy market. For solar power specifically, the legal and regulatory regime is rapidly evolving within the last 2 years. In fact, the Prime Minister's office released three major policy changes just in the first quarter of 2019. These changes include enabling additional options, such as direct power purchase agreements (PPAs). we anticipate expanding our guidance documents to include more information on these additional corporate RE options.

The current solar market in Vietnam is structured primarily by five recent government policies. The first three policies listed below are still in effect until 30 June 2019. However, we expect the Draft Decision 2019/QD-TTg, initially issued on February 22, 2019, to supersede many if not most of those previous three's components, beginning in as early as July 2019. ***Thus, for the rest of this paper, we will be describing the Vietnam solar market as if the Draft Decision 2019/QD-TTg has already come into effect.*** Nonetheless the three previous policies are still important, as some components are not addressed in Draft Decision and therefore will remain in effect into the future:

- **Decision 2068/QD-TTg (2015) – "Decision Approving the Viet Nam's Renewable Energy Development Strategy up to 2030 with an outlook to 2050"**

- Declaration by the Prime Minister articulating high-level RE goals, and outlining of broad responsibilities within the government for fleshing-out the goals' implementation details.[7]

- **Decision 11/2017/QD-TTg (2017) [as amended 8 January 2019] – "Decision on the Support mechanisms for the Development of Solar Power Projects in Vietnam"**
  - This second Prime Ministerial solar decision, originally issued in October 2017 and revised in January 2019, provides specific policy frameworks within the RE goals outlined in Decision 2068. Among other rules, it establishes: who can buy, sell, and own PV generation systems and their electricity (both RTS and off-site systems); PV system size limits for net billing of excess solar generation; feed-in-tariff (FIT) regulations; and tax and other incentives. The declaration also delineates responsibilities of MOIT and EVN.[8]

- **Circular 16/2017/TT-BCT (2017) – "Circular regulating solar power project development and Standardized Power Purchase Agreement for solar power projects"**
  - This MOIT-issued regulation provided specific implementation details and clarified ambiguities in the original Decision 11. Many such details have been superseded and rendered moot by Decision 11's 2019 Amendment, particularly related to payment rates for net billed electricity. Nonetheless, some components remained in effect such as PV system size limitations, and details regulating project equity investment.[9]

- **Circular 78/2014 / TT-BCT (2014) – "Guiding the Implementation of the Government's Decree No. 218/2013/ND-CP of December 26, 2013, Detailing and guiding the Implementation of the Law on Enterprise Income Tax"**
  - Articles 19 and 20 of this policy establish regulations impacting taxes on PV-generated revenue.[10]

- **Draft Decision 2019/QD-TTg – "Decision on mechanisms for encouragement of the development of solar power projects in Vietnam" (February 22, 2019)** [*Note: This Decision from the Prime Minister's office was only in draft form at the time this report was published. However, it is anticipated the final Decision will adhere closely to this text*.]

[7] Decision 2068/QD-TTg (2015) – "Decision Approving the Viet Nam's Renewable Energy Development Strategy up to 2030 with an outlook to 2050", See links: English translation -- Vietnamese original.
[8] Decision 11/2017/QD-TTg (2017) [as amended on 8 January 2019] – "Decision on the Support mechanisms for the Development of Solar Power Projects in Vietnam", See links: English translation -- Vietnamese original.
[9] Circular 16/2017/TT-BCT (2017) – "Circular regulating solar power project development and Standardized Power Purchase Agreement for solar power projects", See links: English translation -- Vietnamese original.
[10] Circular 78/2014 / TT-BCT (2014) – "Guiding the Implementation of the Government's Decree No. 218/2013/ND-CP of December 26, 2013, Detailing and guiding the Implementation of the Law on Enterprise Income Tax", See links: English translation -- Vietnamese original.

- If implemented, this Decision would make significant alterations to Vietnam's solar regulations beginning in July 2019. Among the most significant changes would be to the net billing payment and FIT structures; and an authorization of who can be owners, sellers, and buyers of PV systems and their generated electricity (although it still does not permit direct PPAs for most RTSs).[11]

These edicts collectively, including the current Draft Decision, render key policy implications for C&I procurement of RTS starting in July 2019. These implications create significant procurement option constraints for companies buying RTS systems for self-consumption:

- **System size limited to 1 MWp:** Only PV systems of 1 MWp in capacity and smaller are considered RTSs and eligible for self-consumption, net billing, and receiving payment from EVN for excess generation exported to the grid.[12] Even if it sits on a rooftop, any PV system larger than 1 MWp is considered a "ground mounted" system.[13] In these cases, the customer is prohibited from self-consuming the PV generation and must both apply for a grid connection through MOIT, and sell 100% of its generation to EVN's grid via a Standardized Solar PPA. Projects over 1 MWp also require approval by the Prime Minister for incorporation into the Power Development Plan. Therefore we do not address solar projects 1 MWp or larger in this paper.

- **Payment rates for net billed, excess solar generation are geography-based:** Solar projects under 1 MWp can interconnect to the grid and sell unused, excess energy back into the grid. In exchange for this energy, the utility, EVN, pays the customer for each kWh, at the stated net billing rate, plus a value added tax (VAT). (This amount appears to be calculated monthly, but future circulars are anticipated to give greater clarity). Net billing payment rates are calculated at the regional level or "zone" level. There are four zones, as shown in Table 1 below. Zone I has the least sun exposure and is in the north of the country. Zone II has medium sun exposure and is mostly in the middle region but also includes the northwest Dien Bien province. Zone III has high sun exposure and is primarily in the south, plus two central provinces. Lastly, Zone IV has very high sun exposure, covering six of the country's southern-most provinces.[14] Possibly in order to incentivize greater solar development in less-sunny parts of the country and away from areas with already congested grids (see *Figure 1 below*), the Vietnamese government has set higher net billing rates in provinces with lower solar resources.

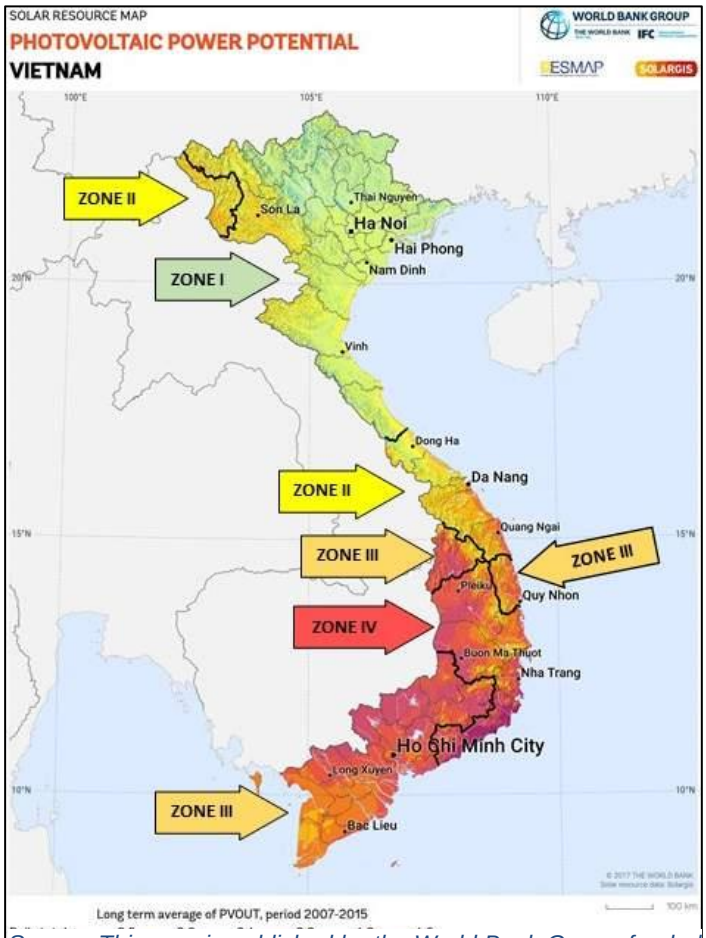
[11] Draft Decision/2019/QD-TTg (22 February 2019) [as anticipated but not yet formally approved]- "Decision on mechanisms for encouragement of the development of solar power projects in Vietnam", See links: English translation -- Vietnamese original.
[12] Draft Decision/2019/QD-TTg (22 February 2019); Article 3, Paragraph 4.
[13] Draft Decision/2019/QD-TTg (22 February 2019); Article 3, Paragraph 7.
[14] Draft Decision/2019/QD-TTg (22 February 2019); Article 8, Paragraph 1.

Table 1. Anticipated Net Billing Payment Rates by Zone

Per kWh Net Billing Payment by Zone				
(in U.S. Dollar Cents)	**Zone I**	**Zone II**	**Zone III**	**Zone IV**
Starting July 2019	¢ 10.87/kWh	¢ 9.36/kWh	¢8.38/kWh	¢ 7.89/kWh

- **Net billing payment rates pegged to the U.S. dollar and locked-in for 20 years:** The net billing payment rates are set in U.S. dollars (USD), but paid in Vietnamese Dong (VND). The rates in USD "shall apply for 20 years" from the date of the RTS system's commissioning.[16] The exchange rate used to determine the monthly payments per kWh in VND is reset each year on December 31 of the previous year.[17] Regardless of the exchange rate, the payment customers will receive from EVN for each excess PV kWh net billed to the grid, will remain constant in USD for two decades.[18]

- **Net billing payments vs. retail Time of Use (ToU) commercial rates:** All non-manufacturing businesses pay a ToU retail commercial tariff, with the tariff's level changing based on the time of day the kWh is consumed from the EVN grid. These ToU rates are the same everywhere across Vietnam. However, as *Table 2* below shows, within each geographic zone the net billing payment never varies, regardless of the time of day the customer sells the PV kWh to EVN.



Source: This map is published by the World Bank Group, funded by ESMAP, and prepared by Solargis. For more information and terms of use, please visit http://globalsolaratlas.info.

Figure 1. Vietnam's Solar Remuneration Zones

[15] Vietnam's solar regulations label net billing payments as a "FIT" for excess generation. Yet, this naming convention differs from common international practice, where "FIT" normally only refers to utility payments to an Independent Power Producer via a PPA. Thus, here we use "net billing payment rate".
[16] Draft Decision/2019/QD-TTg (22 February 2019); Article 10., Paragraph 3.
[17] Throughout this paper, we use the exchange rate on December 31, 2018, of: $1 USD = 23,125.6 VND, and 1 VND = $0.0000432421. (https://www.oanda.com/fx-for-business/historical-rates)
[18] Draft Decision/2019/QD-TTg (22 February 2019); Article 8., Paragraph 3.

For example, excess PV electricity in Zone III exported to the grid at the Peak hour of 11am Tuesday, earns only ¢8.38/kWh. But if minutes later, at 11:10am the customer draws electricity back from the grid, they pay EVN over twice as much for that same kWh. This is true for both Peak and Standard hours. Since together, Peak and Standard hours cover 100% of daylight hours (4am-10pm daily) and the RTS will never export PV kWhs during Off-Peak hours, every net billed kWh is a loss.[19]

- **Net billing payments vs. retail ToU industrial rates:** All manufacturing businesses pay a ToU retail rate just like commercial businesses above. However, their retail ToU industrial rates are much lower. So, while excess generation in "Peak" hours still is always a loss, the loss is lower than for commercial customers that over-produce during Peak hours. Moreover, depending on the geographic location of the RTS and the customer's purchasing voltage, industrial customers could earn a significant profit if they are over-producing during "Standard" hours. Assuming exchange and tariff rates remain constant, this profit ranges from ¢1.02 to ¢4.60 for every PV kWh pushed to the grid.

Table 2. Comparison of Industrial, Commercial and Net Meter Rates

Retail Time-of-Use Tariffs vs. Net Billing Payment Rates[20] (¢/kWh)						
(in U.S. Dollar Cents)	Industrial >110 kV Tariff[21]	Commercial >22 kV Tariff[22]	Net Meter Rate Zone I	Net Meter Rate Zone II	Net Meter Rate Zone III	Net Meter Rate Zone IV
Peak Hours	11.11	16.96	10.87	9.36	8.38	7.89
Standard Hours	6.20	9.75				
Off-Peak Hours	3.82	5.43				

- **Tax incentives:** As of yet only one tax incentive relevant to RTS generation consumers is in effect: exemptions on import duties for all solar project components that are "imported goods as fixed assets of the projects."[23] These exemptions mean the project developer can pass the components' cost savings on to the customer. However, no Corporate Income Tax (CIT) discounts or exemptions yet exist for customers' revenue generated by net billing payments. Also, No VAT discounts or exemptions exist in any form.

[19] Except for Zone I, net billed Standard kWh when customers receive ¢1.12 more than they pay for kWhs purchased from the grid. But even they still lose a lot of money (¢6.09) on every Peak kWh.
[20] Net billing payment rates listed here will take effect July 1, 2019. Although, on March 5, 2019 the MOIT announced an April 2019 retail tariff increase averaging 8.36% across all categories: (https://www.vietnambreakingnews.com/2019/03/electricity-prices-to-increase-by-8-percent-this-month).
[21] These are in fact the lowest group of EVN Industrial ToU tariffs. The prices for voltage of 22kV-110kV = (Peak: ¢11.56, Standard: ¢6.28, Off-Peak: ¢3.97 per kWh), for 6kV-22kV = (Peak: ¢11.93, Standard: ¢6.50, Off-Peak: ¢4.12 per kWh), for and for voltage of below 6kV = (Peak: ¢12.38, Standard: ¢6.80, Off-Peak: ¢4.34 per kWh).
[22] These are in fact the lowest group of EVN Commercial ToU tariffs. The prices for voltage of 6kV-22kV = (Peak: ¢17.56, Standard: ¢10.49, Off-Peak: ¢6.17 per kWh) and for voltage of below 6kV = (Peak: ¢18.30, Standard: ¢10.64, Off-Peak: ¢6.47 per kWh).
[23] Decision 11/2017/QD-TTg (2017), Chapter III, Article 10., Paragraphs 2.

- **Net Billing and VATs:** Regardless of the procurement and financing model (details of the three models of *Turnkey Purchase*, *Onsite Solar Lease*, and *Third Party Onsite PPAs* will be addressed below), any time the customer's RTS produces excess PV kWh, and the customer sells the kWhs to EVN's grid, EVN pays the customer a 10% VAT for each kWh. If at the end of the year, the customer has collected more in VAT from EVN than they have paid in VAT to EVN (for grid kWhs the customer has consumed), the customer must pay the government the difference. If the customer has collected less in VAT than they have paid in VAT to EVN, the customer does not need to pay any VAT tax to the government.

Market Assessment

As noted in the introduction, to date Vietnam has seen an estimated 20 MWp of corporate procurement via onsite solar PV installations. This is about two-thirds of the country's total 30.12 MWp of RTS (C&I and residential combined) installed as of February 2019.[24] Part of this growth had been spurred by Decision 11 described above in the Policy and Regulations section. And Vietnam still holds significant potential for rapidly scaling RTS investments pending regulatory improvements. However rather than incentivizing business customers to install RTS systems as large as possible, Vietnam's post-July 2019 regulatory regime as described above likely will discourage development of RTS systems at a scale that would export electricity to the grid.

If the government of Vietnam wanted to spur more solar investment in the C&I sector, the following regulatory changes could help:

- Aligning net billing payment rates, equal to, or greater than, ToU retail tariffs.
- Eliminating or reducing the CIT on customers' revenue received from EVN in net billing payments for excess PV generation.
- Eliminating or reducing the VAT paid to project developers and PV equipment in general. Eliminating or reducing the CIT and/or VAT on lessor's revenue received from customer under solar leases.
- Increasing the size of RTS systems permitted for self-consumption and net billing from 1MWp to 5 MWp.
- Explicitly permitting onsite RTS PV systems with third party owners, to sell their generation to C&I consumers via PPAs.

[24] Quoted by EVN in Hanoi RTS workshop on February 27, 2019: Total C&I and Residential consumers-1,800, Total installed capacity-30.12 MWp, Total net billed to the grid: 3.97 million kWh.

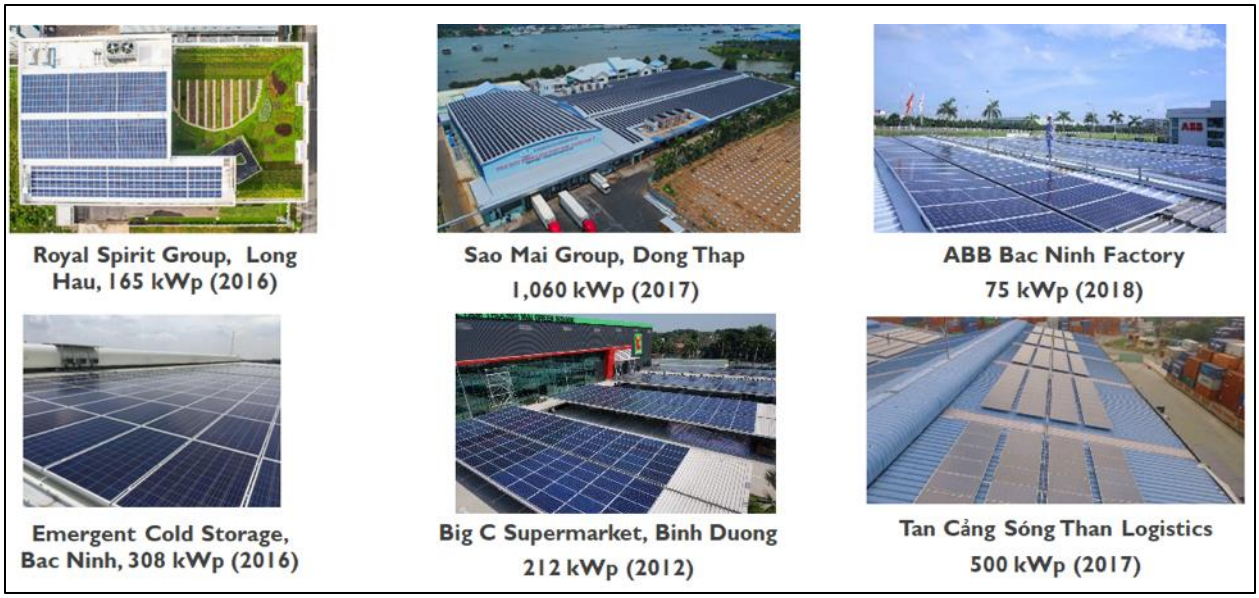


Figure 2: Examples of companies that have procured onsite solar PV in Vietnam to date.

Nonetheless, PV development in Vietnam has progressed. In addition to the companies that have made investments to date, the CEIA has also identified over 70 corporate partners country-wide that are interested in procuring solar energy either onsite or through off-site contracts. The CEIA continues to regularly convene these companies through the CEIA Vietnam Working Group to identify ways in which CEIA can provide buyer-side support through the project evaluation, preparation, and procurement process.

Onsite Solar Procurement Options

The current regulations provide for two primary models for a private company to procure an RTS system. A third model is proposed to become available under limited applications.

Option 1: Turnkey Purchase

In Turnkey, the private company that consumes the PV energy (the "customer") will be the RTS owner. The customer pays the developer or EPC firm, either from its own funds or a variety of standard financing mechanisms (bank loans, bonds, etc.). The developer physically installs the PV system on the customer's roof. The customer consumes all the PV electricity, or net meters the excess to the grid in exchange for a payment from EVN. The proposition for financial gain through an investment under the Turnkey model, is meeting or beating the utility rates paid to EVN. This means securing financing terms and PV system operating costs that are equivalent, or less than the price the customer would pay to EVN for grid electricity on a ¢/kWh basis. If the customer can obtain a cheaper cost of capital than the developer, the turnkey option may be the most cost-effective model on a per kWh basis.

Option 2: Onsite Solar Lease

In a lease, similar to the Turnkey Purchase, the customer contracts with a developer who physically installs the PV system on the customer's roof. However, the customer pays the developer a flat monthly fee (or, sometimes, a variable rate), regardless of how much PV electricity the RTS generates. In this scenario the developer (possibly along with outside, third-party investors) finances and owns the installation, and leases the physical system to the customer. The customer consumes all the PV electricity, or net meters the excess to the grid in exchange for a payment from EVN. Solar leases can also include "lease-to-own" provisions 10-20 years down the road, enabling the customer to buy the system at the end of the lease contract.

Option 3: Third-Party Onsite PPA [Permitted Exclusively on Private Grids]

These PPAs are not permitted by regulations as of yet, under most circumstances. However, they are a very common energy business model in much of the world and it is very possible Vietnam will permit its utilization in the near future. Therefore, we discuss it here. The PPA is when a developer and/or third-party investor finances, and owns, the RTS installation on the customer's roof. The customer usually pays nothing up front. Instead, it is a long-term contract where the customer pays the RTS owner only for each PV kWh generated. However, the customer also is obligated to buy 100% of the generation. PPAs may include an annual escalator set to inflation or another index.

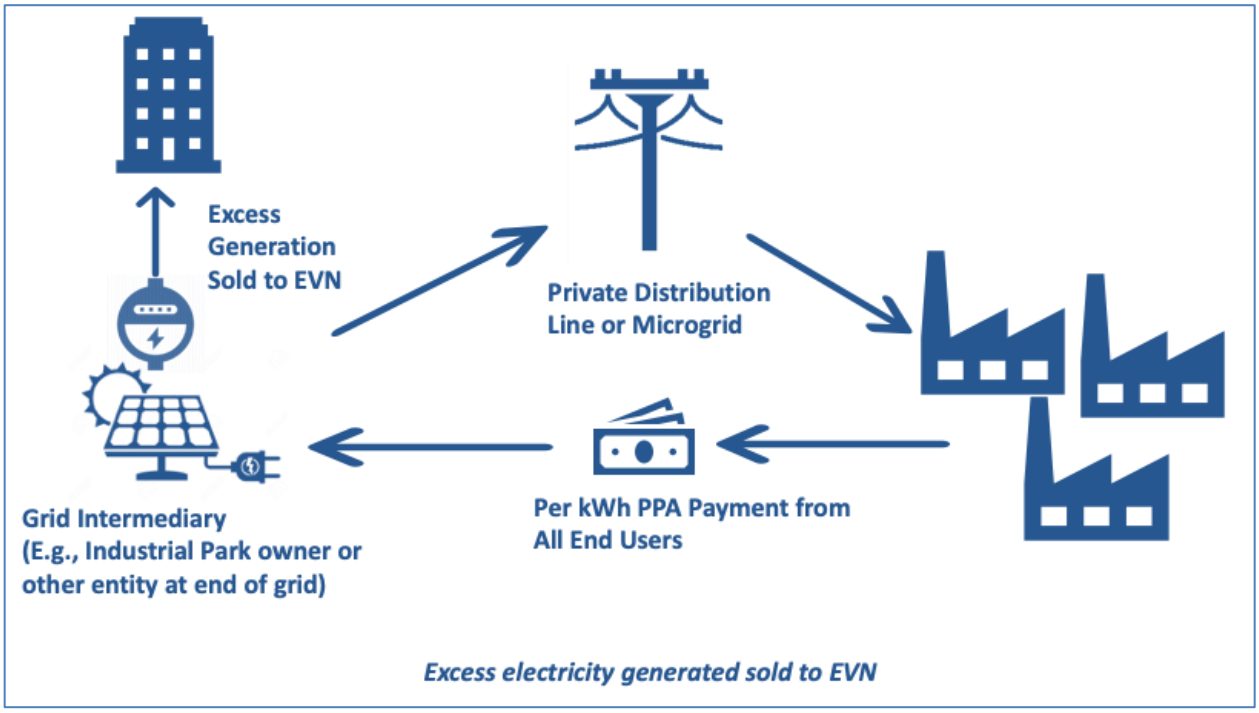


Figure 3. Diagram Illustrating Direct PPA Model Allowed via Private Grid

Figure 3 above outlines the specific application under which a third party PPA is proposed to be legal in Vietnam. Third Party Onsite PPAs are only permitted in the unusual context of, at a terminus point of the grid (such as an industrial park), where an intermediary takes EVN electricity

and re-sells it to final customers. If these final customers are not directly connected to the grid themselves, then the intermediary may set up a RTS and sell the PV kWh directly to the final customers via a PPA.

Table 3. Comparison of On-site Financing Options

Vietnam Onsite Rooftop Solar Procurement/Financing Options			
Traits	**Turnkey Purchase**	**Onsite Solar Lease**	**Third Party Onsite PPA**
Key Dynamics	Customer invests into and owns RTS PV system. Obtaining corporate loan from Vietnam bank may be an option if customer has existing credit line.	Customer signs 7-25 year lease with project developer and/or 3rd party investors. Customer pays lessor flat monthly rate, regardless the number of kWhs generated. Sometimes contracts have "lease-to-own" option at contract's end.	***Mostly not permitted*** Customer signs long-term contract to buy 100% of RTS electricity from project developer and/or 3rd party investors. Customer pays investor per kWh generated.
PV RTS Owner	Customer	Solar Vendor /Investors	
Net Billing	Permitted (Under 1MWp)	Permitted (Under 1MWp)	
Financing	On customer's balance sheet	Solar developer's responsibility	
VAT	Customer pays VAT on project cost to project developer	Customer pays VAT on monthly lease cost to PV system owner/lessor	Customer pays VAT on each PV kWh generated by RTS to PV system owner
Operations and Maintenance	Requires separate solar vendor contract (or 3rd-party O&M)	Cost included in lease for term of the lease contract	Cost & risk carried by RTS owners as customer only pays for PV kWh generated
Equipment Warranties	Yes, possible		
Performance Guarantees	Yes, possible with added costs	Performance Guarantees	Yes, possible with added costs
Permitting & Interconnection Licenses	Customer's responsibility	Solar developer's responsibility	
Insurance Included	No	Yes	
Lowest Lifetime per KWh Cost	Yes	No	

Vietnam Onsite Rooftop Solar Procurement/Financing Options			
Traits	**Turnkey Purchase**	**Onsite Solar Lease**	**Third Party Onsite PPA**
Risk	Highest	Medium	Lowest
YR1 Positive Return on Investment?	Not Possible	Possible	Guaranteed

Internationally, PPAs are typically 20-25 years in length, although customers often seek shorter terms (e.g., 7-10). A key difference between the PPA and a lease structure is that the PPA may have lower operations and maintenance (O&M) risk for the customer. This is because, the normally take-all/pay-all PPA contracts, incentivize the third party RTS owners to maximize the PPA system's production. Whereas in a lease, even with a minimum-production guarantee, the lessor gets paid a flat rate, regardless of whether the PV system under-produces (within limits) or not. A side-by-side comparison of the three models can be viewed in *Table 3* above.

Modeling a Case Study

Below, we utilized a free renewable energy performance and feasibility assessment tool, the System Advisor Model (SAM) created by the National Renewable Energy Laboratory to model the turnkey purchase and onsite solar lease procurement options under the Draft Decision for a representative industrial facility in Binh Phuoc Province in southern Vietnam. C&I customers as well as developers can utilize SAM to recreate the modelling we have done for this business case, to adjust the parameters for their particular project(s). [25]

Overview of Investment options and SAM model analysis

The turnkey purchase and onsite solar lease business models for rooftop projects under the Draft Decision described above, both offer potential for cost savings or a return on investment, depending on the parameters of the investment opportunity. The results can provide investors with a deeper understanding of the policy mechanisms and the factors that can drive project financial outcomes. We anticipate the Draft Decision will be adopted and implemented with only relatively minor modifications as early as July 2019, along with related government-issued Circulars that provide implementation instructions. We did not conduct a SAM analysis of a PPA given the narrow applicability of PPAs described in the previous section.

Key characteristics of the industrial facility used in SAM's analysis are detailed in *Table 4* below.

[25] SAM is a software package that is downloadable and free to anyone online (https://sam.nrel.gov). SAM considers the key technical, policy, and financing characteristics that define a project, enabling the user to model energy production and financial results. Key characteristics essential to SAM's modeling include the customer's load profile, solar resources available, system sizing, retail electricity tariffs, net billing payment rates, interest and discount rates, taxes, and investment timelines.

Table 4. Key Characteristics of Sample Industrial Facility

Location	EVN Net Billing Payment Zone	Solar Irradiation[26] (Daily Avg)	EVN Customer Class	Nominal Discount Rate	Annual Electricity Use
Binh Phuoc Province	Zone 3	5.58 kWh/m2/d	Industrial Retail Tariff 22 kV to 110kV	10.24%	8.8 GWh

An additional key input for the SAM analysis is the facility's load profile illustrated in Figure 4 below.

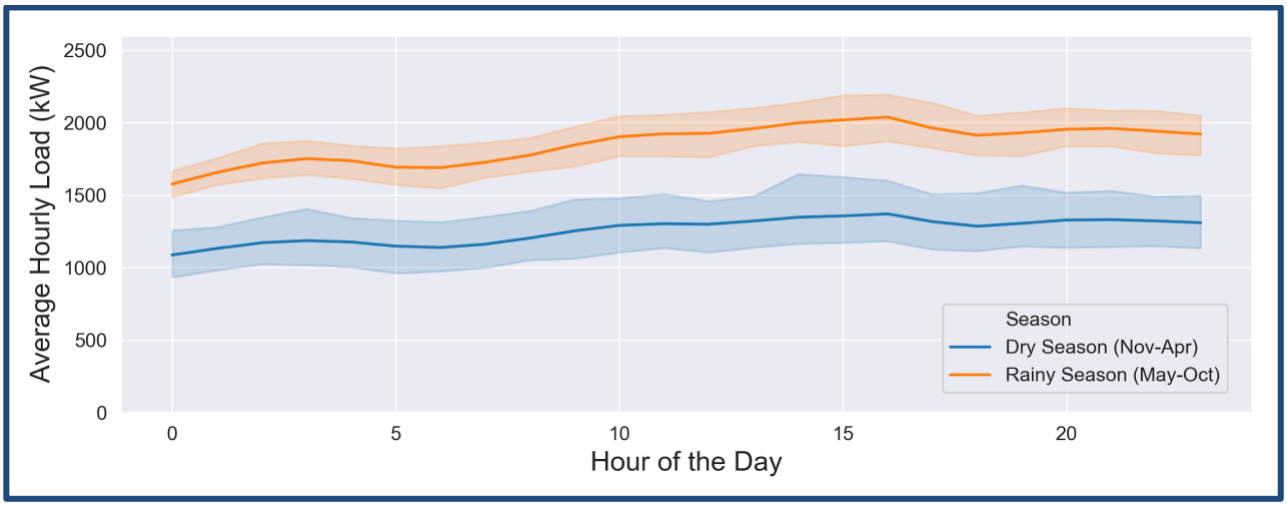


Figure 4. Sample Facility's Load Profile

Table 5 below highlights additional key policy parameters from the Draft Decision used in SAM.

Table 5 Key Policy Parameters from Draft Decision

Policy Iteration	Net Billing Payment (¢ per kWh)	ToU Retail Rates (¢ per kWh)	Corporate Income Tax	VAT	RTS System Size Limitation
Draft Decision Feb 22, 2019	¢8.38	Peak: ¢11.56 Standard: ¢6.28 Off-Peak: ¢3.97	20%	10%	1 MWp

26 http://re.jrc.ec.europa.eu/pvg_tools/en/tools.html#TMY

Based on the inputs above, SAM returns the results presented below in *Table 6*.

Table 6. Summary SAM Analysis Results

Financing Structure	Net Present Value	Installed Cost* / Lease Price**	Avg Monthly Costs (Elect and Financing)[27]	Avg Monthly Net Savings	Internal Rate of Return	Simple Payback
Turnkey Purchase	$8,758	$0.94/W[28]	$70,901	$9,525	10.39%	10.3 yrs
Solar Lease	$32,810	$10,000/mo[29]	$79,132	$1,294	n/a	n/a

*Turnkey Purchase
**Solar Lease

The results (shown in *Table 6* above) of the model runs for the turnkey purchase and solar lease using the Draft Decision policy parameters indicate that the lease option has a more attractive Net Present Value (NPV). Both procurement options assume the same system size of 1 MWp, the maximum allowed for RTS systems under the Draft Decision. These procurement options would produce the same amount of solar electricity and offset the same amount of grid electricity purchased (roughly 17% of the customer's load in the first year). Neither option would generate revenue from net billing through exporting to the grid due to the small system size compared to facility's high electricity demand.

The lease's advantage in NPV is driven by the principle of time value of money, which states that a dollar is worth more today than in the future, due to its current potential earning capacity. The turnkey purchase appears to have multiple advantages such as greater monthly savings and lower monthly costs. However, the fact that turnkey purchases require spending cash upfront on a down payment, reduces the customer's cash on-hand available for investing elsewhere, thus reducing NPV. In this case, the upfront cost for the turnkey purchase is $374,000, while the solar lease's upfront cost is zero.

The average monthly net savings in *Table 6* above compares the savings for each model that appear in the monthly utility bill, minus the model's average monthly costs. This figure is somewhat misleading in that it shows the average savings but does not reveal that both options save the same amount on the monthly electricity bill. The difference instead results from financing an 8 year loan costing less averaged over a 25 year period, than for 25 years of lease payments.. Monthly savings are in fact similar, until the loan in the turnkey model is paid off. At that point, turnkey net savings increase dramatically, thus increasing the lifetime average savings of the project. The net savings from the lease changes less dramatically during the project timeframe.

[27] Average monthly costs for the turnkey purchase cover electricity purchases from the utility, PV operations, and financing; for the solar lease these include electricity purchases and monthly leasing fees.
[28] The installed cost is based on field data collected by CEIA staff in Vietnam.
[29] The monthly lease price was selected to provide a roughly 25% margin over a levelized cost of energy (LCOE) of $0.06/kWh based on expected kWh generated by the PV system, but warrants field validation. The $0.06/kWh LCOE comes from the modeling of the Turnkey Purchase.

SAM calculated the turnkey purchase model's internal rate of return (IRR) at 10.39%. This indicates the turkey has potential to be a reasonable investment. However, because there is zero initial cash outlay for the solar lease, no IRR is computable for comparison.

The simple payback represents the time in years required for cumulative annual savings to equal cumulative annual costs, without regard to discount rates. Companies differ in their expectations of payback periods depending on the nature of the investment they are considering. CEIA's discussions indicate that Vietnamese industrial companies normally expect energy investments to reach payback within nine years. Based on this metric, a turnkey purchase may not be appealing. In contrast, the solar lease offers immediate savings on utility electricity bills.

Further details on the assumptions and parameters used in the models such as loan and discount rates are included in Appendix A.

Sensitivity Analysis

We anticipate that the Draft Decision will be implemented with most of its current key provisions unchanged. However, some of the parameters and assumptions we used to model the turnkey purchase and onsite solar lease could change prior to finalization of the policy. Furthermore, key financial parameters, such as interest rates and equipment costs are subject to changes based on evolving market conditions, as are other policy-dependent variables such as retail tariff rates.

To assess the impacts on NPV based on changes in these factors, as well as to highlight which variables have the greatest impact on NPV, we performed sensitivity analyses on both business models. For the turnkey purchase (see *Figure 5*) we assessed the impacts of variations in installed cost, discount rate, utility rate, and debt percent.

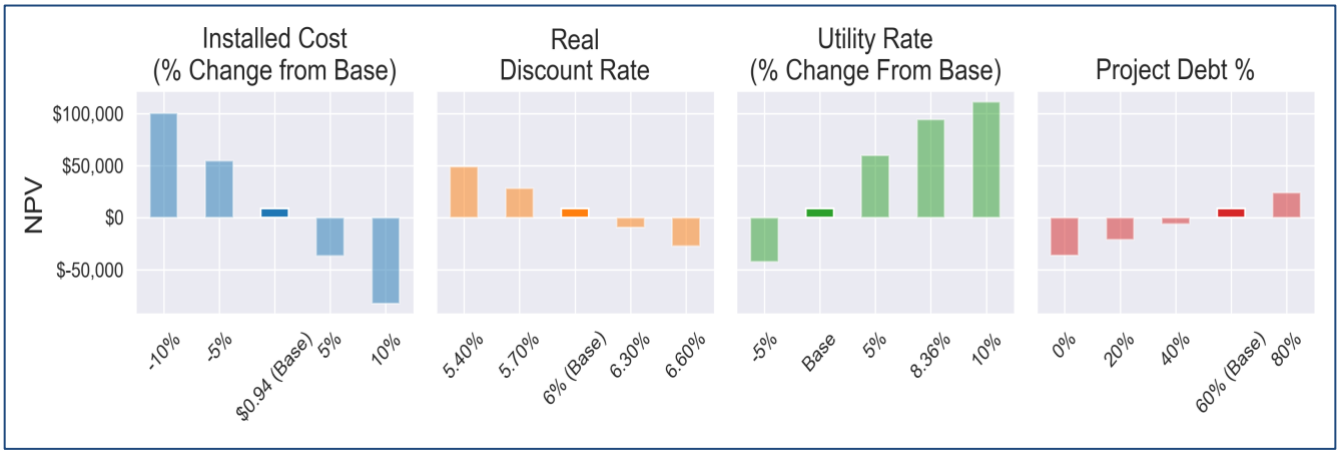


Figure 5. Summary of Sensitivities Analysis for Turnkey Purchase Model

For the solar lease (see *Figure 6*) we assessed the impacts of variations in lease price, discount rate, and utility rate.

Figure 6. Summary of Sensitivities Analysis for Solar Lease Model

Under these modeled scenarios, turnkey purchases largely result in less attractive NPVs than solar leases. These results significantly depend on the turnkey installed cost and lease price. Decreases in each of these variables result in increases in NPV. The base turnkey installed cost of $0.94/W is a relatively aggressive estimate that depends on low installation costs and will be challenged to become more attractive in the near term. The base lease price of $10,000/month is largely driven by PV module costs. However, the price can include other cost components such as installation costs, O&M contracts, and production guarantees that can significantly change the value of the contract offerings.

Retail electricity tariffs for purchasing electricity from the grid also play an important role in determining NPV. Increases in retail rates improve the NPV for both options since they increase the value of self-generated and self-consumed solar electricity that replaces grid power. The variations of retail tariff rates included in the graphs above include an 8.36% increase over current rates to reflect estimated average increases in rates expected to be implemented by EVN in the coming months.

As would be expected, the net billing payment has no impact on the NPV. The systems are limited to 1MWp in capacity, which for this facility covers less than 17% of the demand. As a result, no excess generation is produced that isn't immediately consumed by the customer, and therefore, no power is fed back to the grid. An additional analysis shows that even if this company could increase the size of the system beyond 1 MW, the NPV becomes negative between 4-5 MWp, at which point excess electricity sold to the grid increases significantly. This indicates that it is best to size the system for consumption rather than selling excess to the grid for this particular scenario and load profile.

Of the variables modeled, the debt percentage for Turnkey Purchases is the one that can be most influenced by the buyer through contract negotiations. The graphs above highlight that higher debt percentages result in higher NPVs due to the discounted value of future cash.

Appendix A provides further detail on the data inputs and model results for each of the three procurement types.

SWOT Analysis for the Industrial Corporate Customer Onsite Solar Market in Vietnam

The analysis below in *Table 7* examines the decision for a private sector manufacturing facility owner such as a cannery or furniture fabrication plant, and whether or not to install an RTS system on their rooftop. It asks this question from the perspective of what would be the short-term strengths and weaknesses of executing such a project, as well as what would be post-installation opportunities and threats/risks?

Table 7. SWOT Analysis for Industrial Customers

SWOT Analysis
For Potential Industrial Corporate Customer
of Rooftop Solar Generation System for Self-Consumption

STRENGTHS	WEAKNESSES

• High sun exposure = strong solar resources
• 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 workforce
• Trade policies driving down system costs.
• Lower Peak and Standard ToU retail tariffs allow some net billing payment profits
• A couple of procurement/financing model choices:
  ○ Turnkey Purchase--Self-financed & owned, higher-risk, higher long-term savings.
  ○ Solar Lease--Vendor or 3rd Party financed and owned (possible lease-to-own), medium-risk, likely immediate savings
	• Net billing RTS projects capped at 1 MWp
	• No net billing revenue tax incentives
	• ToU retail tariff vs net billing payment rate disparities often undermine savings/project RoI.
	• Net billing disincentives and prohibitions drive undersizing projects, designing to never generate excess beyond self-consumption
	• Third Party PPAs mostly not yet permitted.
	• Low EVN retail tariffs undermines savings and RoI
	• Local banks rarely lend & at unfavorable rates:
	  ○ Corporate loans only for firms w/ existing credit lines and substantial annual revenues.
	  ○ CAPEX at 9-11% interest rate @7yr tenor.
	  ○ OPEX at lower interest rate @10-15 yr tenor.

OPPORTUNITIES	**THREATS**

• PV prices continue to fall, improving economics
• Vietnamese government has made public commitment to positive regulations so possibility of incentives growing over time
• Currently, a high-level of interest from international solar developers and investors
• Net billing payments tied to USD$ & set for 20 years, but retail tariffs aren't, so value of self-consumed PV kWh can grow
• Tax incentives mandated by MOIT either not yet activated or not currently applied to net billing payments revenue:
  ○ Import duties exemption
  ○ CIT exemption & discount
• Establish more transparent and faster permitting and interconnection processes
	• 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 PV equipment or contractors
	• Lack of market knowledge in vendor quality
	• Lack of transparent permitting and interconnection processes
	• Net billing payments tied to USD$ and set for 20 years, but retail tariffs aren't, so value of self-consumed PV kWh can shrink
	• Lack of net billing payment transparency and/or pricing roadmap
	  ○ Potential decline in net billing payment rates

Procurement Guides and Tools

There are several key questions to consider when exploring whether your company should go solar, including:

- ✓ Does your company own the building or have a long-term lease (20+ years)?
- ✓ 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?)
- ✓ Are there any trees, walls, buildings or other structures that shade the area where the solar panels would be located?
- ✓ Does the facility's operational schedule and electricity consumption align with top solar production hours (9am – 3pm)?
- ✓ 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 an Onsite Solar Lease, would it be able to sign at least a 10-year contract?
- ✓ Would your solar PV system qualify for incentives, such as net billing and tax breaks?

If your company answers 'yes' to these key questions, you may be a good candidate for an onsite solar PV system. However, there are an additional number of important further considerations companies should consider when looking to go solar, such as those related to building ownership, physical characteristics of the site, building operations, business and financing and access to incentives which are detailed further in this guide, "Key Questions When Considering Onsite Solar PV."

Many larger companies have multiple facilities within Vietnam and/or are co-located with other major manufacturers, industrials, or commercial operations. While a company can choose to do on single onsite procurement at a time, it may make sense both economically as well as for streamlining the process to do an aggregated procurement. Aggregated procurements can be done for multiple sites operated by one company or for multiple sites with multiple operator-owners. Aggregated procurements can help lower both the soft and hard costs by enabling developers to reduce project development costs, especially when sites are co-located or near to one another and also to buy system components in greater bulk. And by taking a portfolio

approach, developers may be able to access a lower cost of capital that can be passed down to the buyers.

However, aggregated procurements are not without challenges. Aggregated procurement approaches may require greater coordination among a larger number of stakeholders (i.e., several companies, or in the case of one company with multiple sites, multiple facilities managers, etc.). This coordination role also may be best fulfilled by a neutral third party that can serve as a convener that can coordinate the process and provide objective advice to the buyers throughout each step without any perceived or actual conflicts of interest. Another key consideration is how to ensure each buyer is committed to the process and does not drop out mid procurement. Such a challenge may be of especial concern for aggregated procurement efforts consisting of multiple companies. And related, it is important to build out the procurement documents in such a way that it is readily apparent what the implications are, in terms of the project costs for the buyers, if one of the buyers were to drop out.

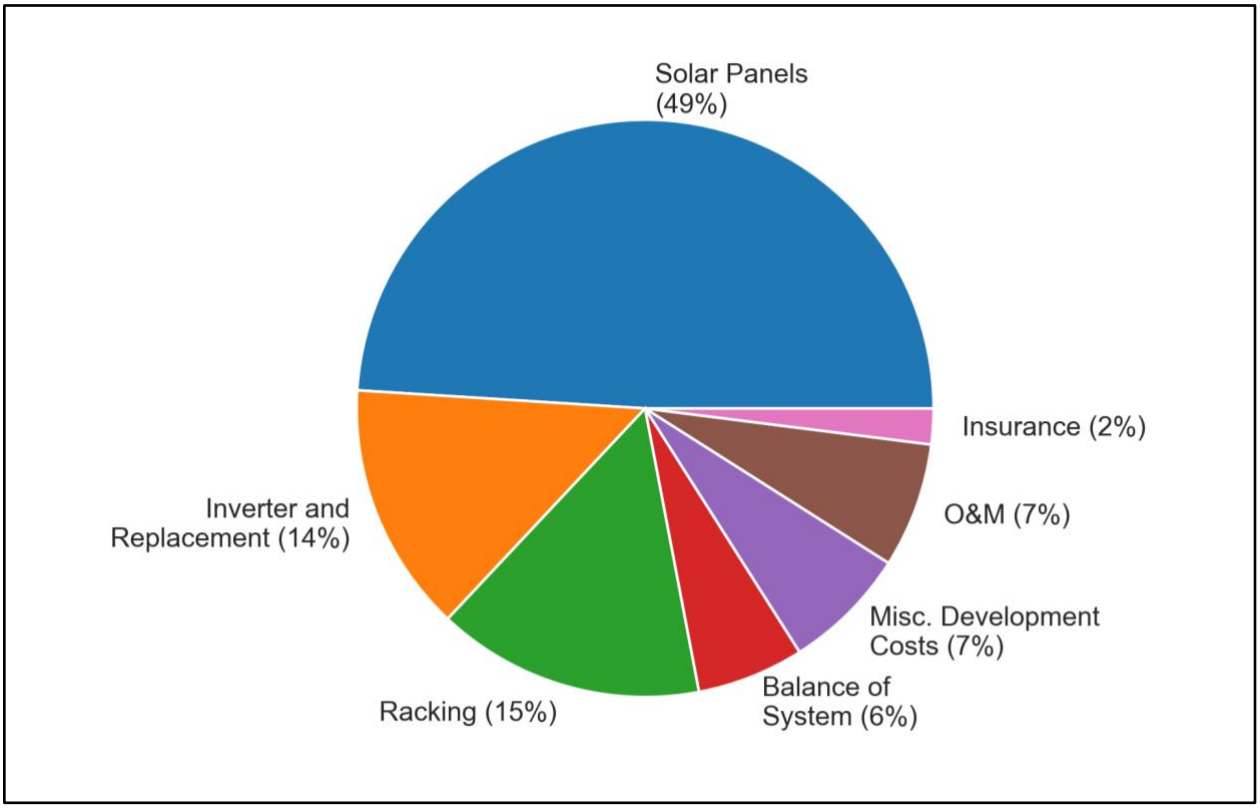
Appendix A: Details of SAM Modeling Analysis

This appendix provides further detail on the data and assumptions used to model the turnkey purchase and onsite solar lease procurement mechanisms in this report.

Turnkey Purchase

As discussed in the body of this report, the proposition for financial gain through an investment under the Turnkey model, is meeting or beating the utility rates paid to EVN. This means securing financing terms and PV system operating costs that are equivalent, or less than the price the customer would pay to EVN for grid electricity on a ¢/kWh basis.

Figure 7. Percentage of Costs by Component over Project Lifetime



The primary categories that drive overall project costs and rough estimates of their proportion of lifetime project costs are shown in *Figure 7* above. Warranty costs or other provisions that guarantee performance may be wrapped into equipment costs or covered as separate line-items; we have included them in equipment costs in our modeling. In addition, PV projects may require that roof structures be repaired or replaced depending on the age and condition of the existing roof; our SAM modeling has assumed these costs to be $0.

Table 8. Financial Parameters used for Turnkey Purchase Analysis

Financial Parameters Used in SAM modeling for Turnkey Purchase PV System						
Total Project Cost	**Loan Amount**	**Loan Term**	**Loan Rate**	**WACC**	**Inflation Rate**	**Real Discount Rate**
$935 K	$561 K	8 years	10%	8.9%	4%	6%

Solar Lease

The proposition for financial gain through a PV system leasing model hinges on meeting or beating EVN's utility rates compared to the lease price on a $/kWh basis. Since leasing mechanisms are a workaround for the MOIT provision that prohibits sale of electricity by anyone other than EVN or its subsidiaries, lease agreements between other buyers and sellers are not written in terms of electricity prices, but instead must be equated to $/kWh based on the lease price and expected amount of electricity delivered. Lease agreements may utilize a number of mechanisms to guarantee system performance such that a minimum amount of electricity is produced over particular time frames.

The lease price is largely driven by the same costs as those shown in *Figure 7* above. In addition to these costs, leases typically involve escalating lease payments over the period of the contract to cover inflation. These increases are generally pre-determined and provide the leasee with set operating cost increases to facilitate planning and reduce the impact of fluctuating utility rates.

Table 9 below provides the key parameters used to model the lease option with SAM.

Table 9. Financial Parameters use for Solar Lease Analysis

Financial Parameters Used in SAM modeling for Onsite Solar Lease				
Monthly Lease Price	**Annual Lease Escalation**	**Agreement Period**	**Inflation Rate**	**Real Discount Rate**
$10,000/mo	2%	25 years	4%	6%