FORMULATING A NATIONAL ELECTRICITY GRID CODE AND DEVELOPMENT OF A NET METERING POLICY IN TIMOR-LESTE

Draft Report by IES and AMC to United Nations

Output 3: Net Energy Metering Policy for Timor Leste Report

CASE REF: 3100005838

FINAL REPORT

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1 Report Introduction

1.1 Project Background / Context

Timor Leste has requested technical assistance to develop a net metering policy and grid code that will encourage the use of distributed energy resources and facilitate grid integration. The country's power system currently has a high reliance on generation from diesel fuel, which results in high electricity prices. The solar resource assessment, net metering policy, and grid code design will support the development of DERs, which could reduce the reliance on diesel generation and lower electricity prices.

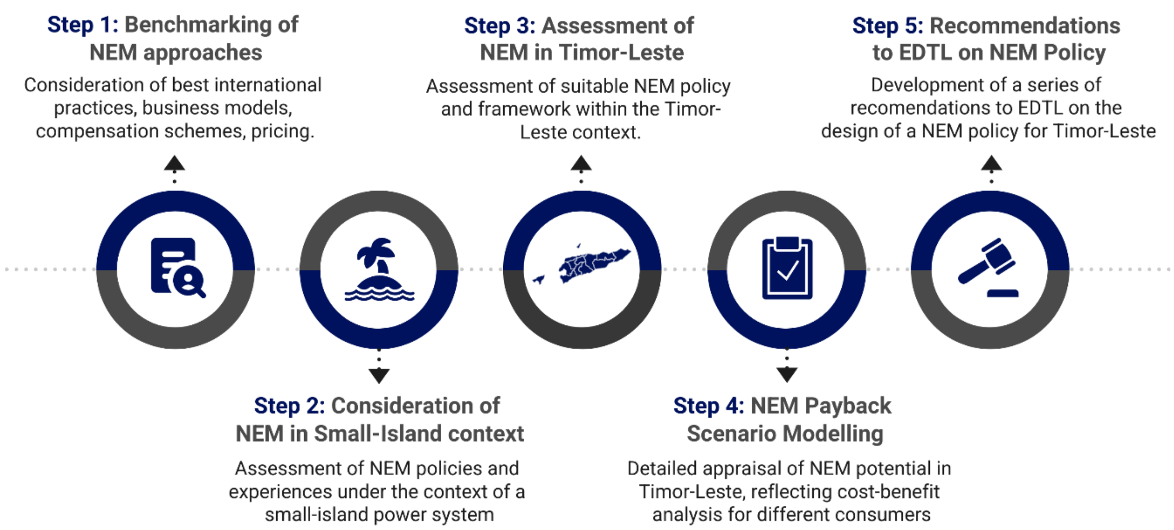
The United Nations Environment Programme (UNEP) Climate Technology Centre and Network (CTCN) have contracted IES Advisory and AMC (the 'Consultant') to carry out the project ***Formulating a National Electricity Code and Development of a Net Metering Policy in Timor-Leste***.

This report contains the ***Activity 3: Net Energy Metering Policy for Timor-Leste*** component, including ***Activity 3.1: Program Design Options***, and ***Activity 3.2 Solar Project Payback Scenarios under Different NEM*** components of the project.

1.2 Net-Metering Policy Methodology for Timor-Leste

Figure 1 summarizes the net-metering policy approach for Turkmenistan considered in this study. The first step involves benchmarking NEM approaches against best international practices and consideration of NEM in a small-island context. Next, an assessment of NEM framework and policy design is considered for Timor-Leste, followed by an NEM payback scenario modelling, featuring a cost-benefit analysis for different consumer classes. Lastly, a series of recommendations are set out for designing a NEM policy in Timor-Leste.

Figure 1 Net-Metering Policy Methodology for Timor-Leste



1.3 Report Structure

Section #	Page #	Description
Section 1	5	**Report Introduction** – Sets out the background, purpose and structure of this Report on Net-Energy Metering Policy for Timor Leste.
Section 2	7	**Designing Net Energy Metering Policy for Timor-Leste** – Provides key principles of net-energy metering and provides examples of net-energy metering compensation schemes that have been implemented, while applying to the Timor-Leste context.
Section 3	14	**International Experience in Net-Metering (Island Context)** – Sets out a review of international experience in Net-Metering within an island context, including Hawaii, the Philippines, Indonesia, Singapore, and New Zealand. It then provides a summary on key lessons learned for Timor-Leste.
Section 4	27	**NEM Payback Scenario Assumptions for Timor-Leste** – This section details key assumptions considered for simulating different payback scenarios in Timor-Leste, including Rooftop Solar PV costs, the Net Metering Model composition, exporting potential considered, and load profiles by consumer classification.
Section 5	37	**NEM Payback Scenario Calculations for Timor-Leste** – Features the results of the NEM Payback Scenario Calculations across different types of consumers, including Residential, Schools, Commercial / Public / Government, Hospitals, Hotels, universities. It provides a summary table and analysis on the results at the end of this section.
Section 6	49	**NEM Policy Design for Timor-Leste** – Outlines the overall approach to developing a NEM Policy document for Timor-Leste, detailing the range of parameters that would need to be included and provides guidance / recommendations to policy makers within the local context.
Section 7	58	**Annex A: Additional International Experience in NEM** – This section features some additional review of international NEM experience from countries that are not islands but have relevant lessons learnt that were considered when designing the approach for Timor-Leste.
Section 7	68	**Annex B: Compensation Mechanism** – Provides additional explanation of the Net Metering Policy's compensation mechanism.
Section 9	69	**Annex C: References** – Sets out the references that were utilized throughout this report.

2 Designing Net Energy Metering Policy for Timor-Leste

This section first sets out key principles of net-energy metering and outlines the potential benefits that are typically seen from implementing policies. It then highlights a series of net-energy metering compensation schemes that have been implemented in best practice, while applying them to the local Timor-Leste context.

2.1 Key Principles of NEM

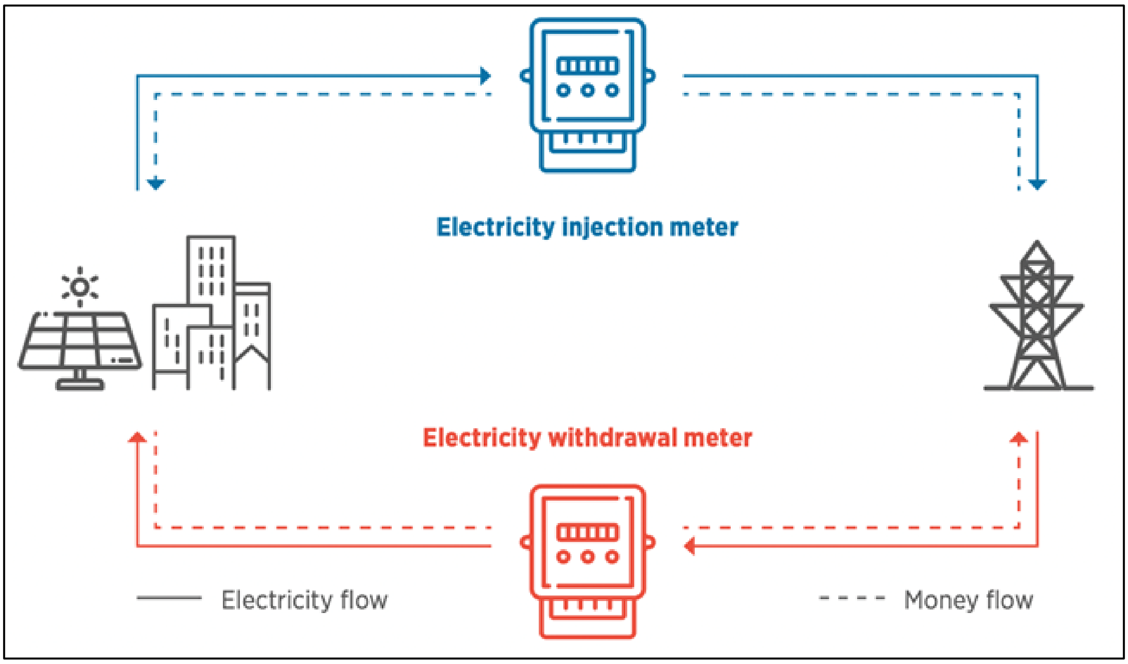
Net Energy Metering (NEM) is a billing and metering mechanism that allows consumers with distributed energy resources, typically solar photovoltaic (PV) systems, to actively participate in the energy market. Through NEM, consumers can export surplus capacity generated by their systems to the grid and are billed based on their net electricity consumption, calculated as the total electricity drawn from the grid minus the electricity exported to the grid.

The primary objective of NEM policies is to enhance power system flexibility by encouraging active participation from "prosumers" by incentivizing:

- Self-consumption and injecting electricity in the grid when prices are high, and
- Withdrawing electricity from the grid when prices are low.

Typical flows and payments in Net-Metering schemes are shown in Figure 2.

Figure 2 Net-Metering Scheme[1]



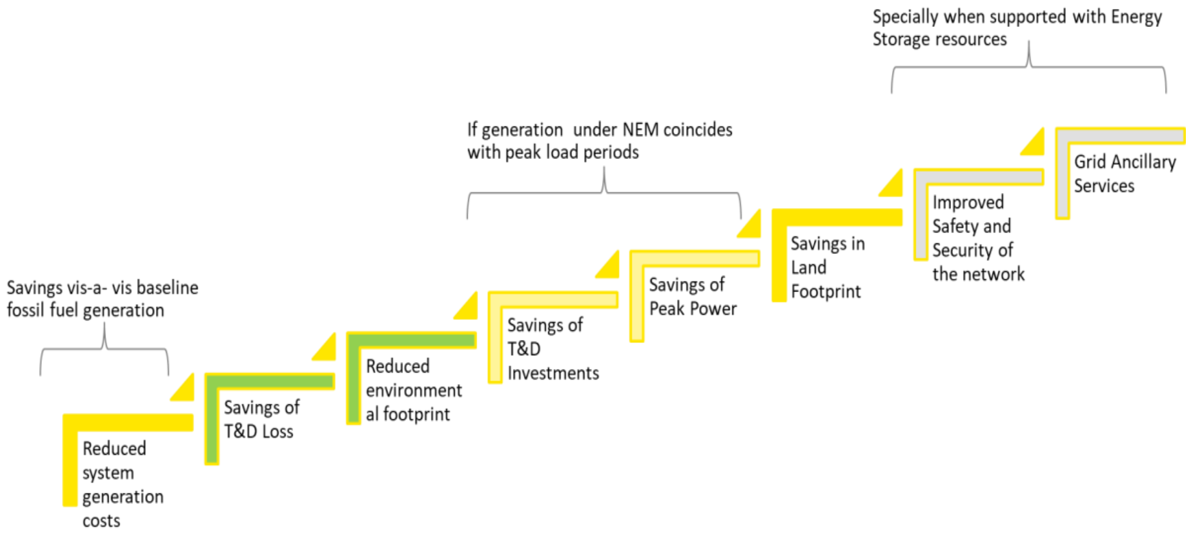
2.2 Net-Energy Metering Benefits

When formulating a policy, a NEM policy should be developed with three different perspectives in mind: the regulator, the utility, and the consumer. The benefits desired by all stakeholders are different and need to be considered differently, even though the decision taken in favour of one

[1] IRENA 2019, Net Billing Schemes: Innovation Landscape Brief

stakeholder, affects the other. There are a wide range of system benefits that should be evaluated, ranging from reduced generation costs, environmental and land use, and investments in network and grid ancillary services.

Figure 3 Net-Metering Scheme[2]



2.3 Net-Energy Metering Compensation Schemes

At the high-level, there are four types of compensation schemes applied in RTS Net Energy Metering policies:

1. Net-Metering
2. Net-Billing
3. Time of Use (ToU) Pricing
4. All Buy & All Sell

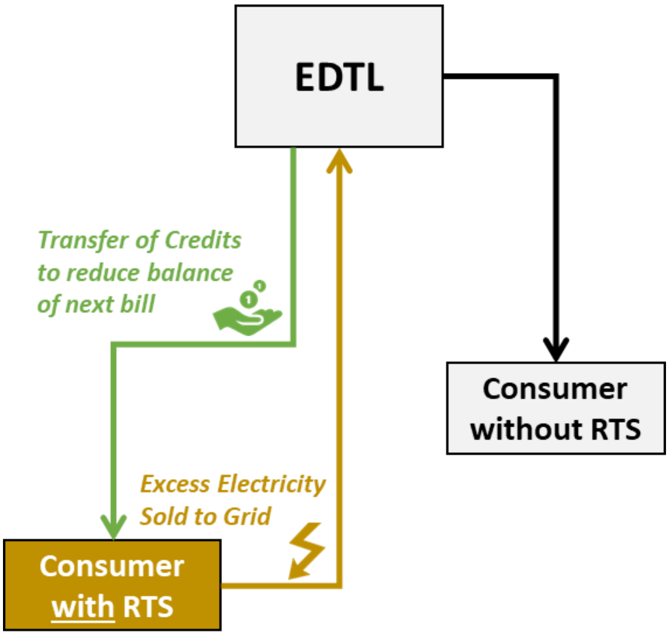
Each jurisdiction has its own compensation scheme that depends on the type and framework of net metering policy adapted in the country. Schemes typically start of more basic and straight forward and adapt over time to fit the local context. Compensation schemes typically are designed to incentivize both utilities to purchase electricity from consumers, and on the other hand, consumers to invest in RTS systems and export additional energy.

2.3.1 Net-Metering Compensation Schemes

A Net-Metering scheme is typically the basic mechanism that NEM policies begin with. Exported electricity is credited to consumers account by the retailer at a benchmarked rate. Net electricity consumed is billed as normal under the tariff rate. Net balances are either carried forward between billing periods or retired under consecutive bills. A two-way is meter used to measure and monitor net energy exchanges. Figure 4 shows an example of applying a net-metering compensation scheme to the Timor-Leste context.

[2] Source: Study on Technical Issues and Financial Viability of Net-Metering Mechanisms Perspective of Distribution Utilities. SAARC Energy Centre 2021

Figure 4 Net-Metering Compensation Scheme example for Timor-Leste



Hawaii's NEM program first adopted in 2001 but did not significantly expand until 2014, where RTS adoption expanded from 0.5% to 9-12% on some islands. This was due to a new NEM policy based on retail tariff compensation, where exported energy was credited at excessively high rates. The net metering compensation program was ended in 2015

Texas has a fully deregulated electricity market which offers RTS customers a range of net-metering compensation options. One of the most prevailing types offered by energy retailers is net-metering based credit schemes, where exported PV is credited at retail rates per kWh offered and subtracted from power bill. Credits can roll-over month-by-month but can only remain as a credit and cannot be cashed out by consumers.

Singapore's net-metering approach for RTS consumers utilizes a Simplified Credit Treatment (SCT) Scheme, where any excess electricity is used as a credit to offset utility bills at the end of each month. The credit is calculated by considering the prevailing retail tariff rate and deducting "grid charges", which represent associated network costs, typically amounting to 20-25% of the tariff.

2.3.2 Net-Billing Compensation Schemes

Net-billing compensation schemes involves exported electricity to the grid is paid in cash and valued at a fixed benchmark price. There are several schemes and mechanisms used to benchmark an appropriate price. Some primary examples include:

- Feed-in-Tariff: Flat and standard rate set for exporting each kWh to the grid.
- Retail Tariffs: Compensation for exports are equivalent to retail tariffs.
- Auction Prices: Prices for exports are discovered at auction
- Avoided Utility Cost: Considers the cost of additional generation and transmission / distribution that was avoided by the utility.

- Value of Distributed Energy Resource: Takes a systematic approach using various power system and economic factors to calculate the added value of additional energy injected into the grid.

Figure 5 Net-Billing Compensation Scheme example for Timor-Leste

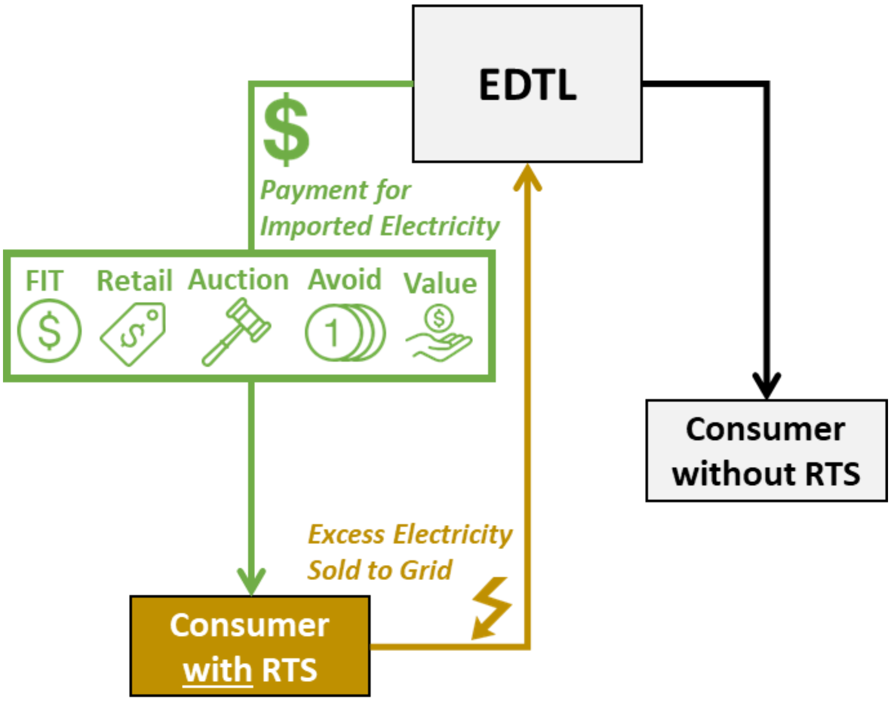


Figure 5 shows an example of applying a net-billing compensation scheme to the Timor-Leste context.

Indonesia's introduced a net-billing scheme in 2018 that offered monetary compensation for excess electricity injected into the grid at either 85% or 100% of the local generation cost. This was dependent on if the average national generation cost was higher than the local generation cost. In 2024, Indonesia ended its net-metering with net billing compensation scheme, due to financial inefficiencies in the mechanism.

Italy's net billing compensation scheme became operational in 2009, and prices electricity exported to the grid at the wholescale price of electricity. Consumers have the flexibility to either receive payment as cash or be provided with credits (net metering) on the next billing period.

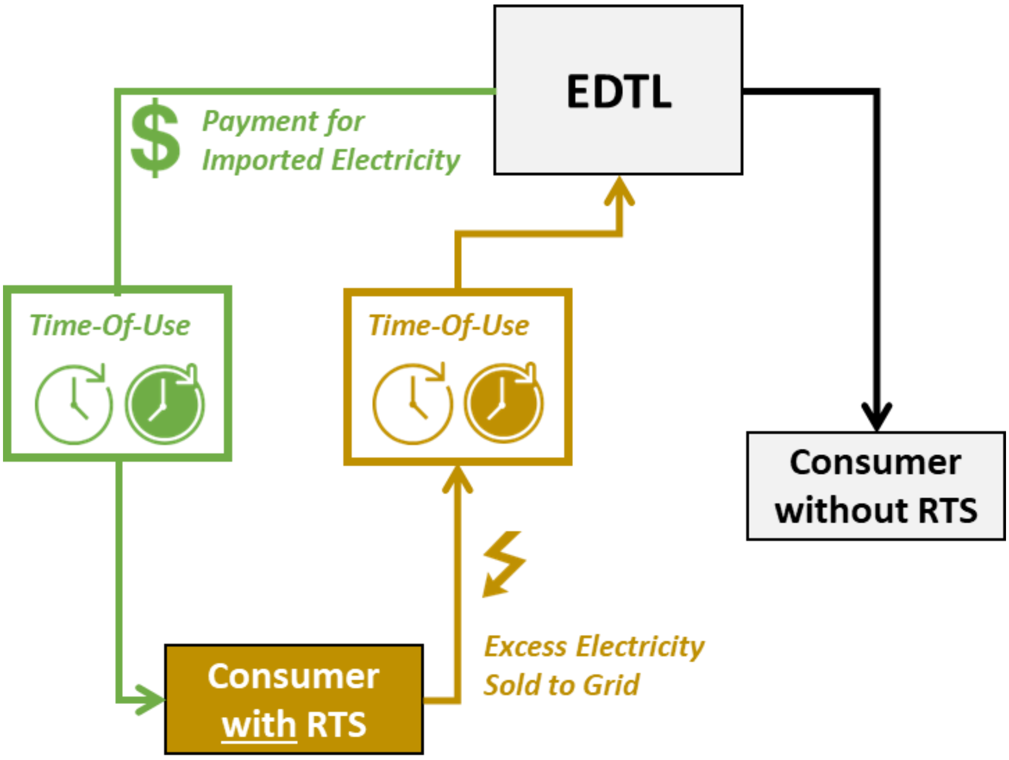
New York reformed its net-billing scheme in 2017 to reflect a Value of Distributed Energy Resource approach. Excess electricity injected into the grid considers the energy value based on day ahead hourly zonal lactational based marginal price (LBMP), a capacity value based on retail capacity rate performance during peak hour of previous year, an environmental value based on the higher value between tier 1 REC price or social cost of carbon (SCC), and a demand Reduction Value based on de-averaging of utility marginal cost of service studies.

2.3.3 Time-Of-Use Compensation Schemes

Net exports from the RTS consumer are priced based on the time of day and/or season. This system encourages RTS users to export during peak hours and consume energy during off-peak. Time-Of-

Use prices either follow a set structure or can be dynamic and real-time within an energy market system. Compensation scheme can be combined with either net-metering or net-billing approaches. Figure 6 below shows an example of applying a Time-Of-Use compensation scheme to the Timor-Leste context.

Figure 6 Time-Of-Use Compensation Scheme example for Timor-Leste



The Philippines net-metering program was first introduced in 2008 and in 2013 expanded to include Time-Of-Use elements in its compensation scheme. Consumers are encouraged to lower consumption and sell electricity during the day when prices are high, and in-turn consume more electricity from the grid at night when prices are low. Credits are provided to customers' bills in accordance with the time-value of electricity exported.

California's Net Energy Metering program 2.0 was implemented in 2016 and required RTS consumers to switch over to a Time-Of-Use retail pricing rate. In turn, they receive bill credits for each kWh injected into the system at the same retail time-of-use rate they are charged. However, customers under this scheme now must pay non-bypassable charges for each kWh of grid consumption, covering associated network related fees.

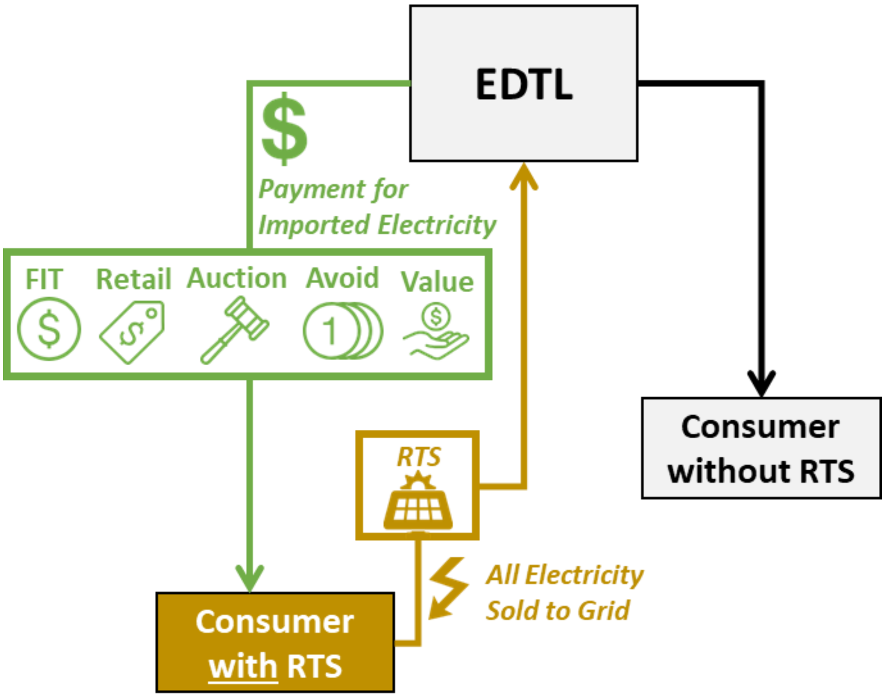
Spain's net-metering reforms were implemented in 2019 and feature a net-billing compensation scheme that allows RTS consumers to sell surplus electricity through a specialized agent. The pricing of energy sold is considered at retailed time-of-use rates through the market, and consumers receive corresponding benefits in cash at the end of the monthly billing period.

2.3.4 All-Buy & All-Sell Compensation Schemes

'All-Sell' scheme refers to when all consumption from the user must be purchased from the grid and priced on existing tariff rates. By contrast, the *'All-Buy'* – All generation from the RTS consumer must

be sold to the grid and paid on agreed benchmark prices. Benchmarks for exporting based on typical schemes used in net-billing. Retailers and utilities tend to have preference for this system, as they can purchase electricity as needed and expected by a normal generator. This approach does not capture consumer motivations for investing in RTS. Figure 7 below shows an example of applying a Time-Of-Use compensation scheme to the Timor-Leste context.

Figure 7 All-Buy & All-Sell Compensation Schemes example for Timor-Leste



Hawaii's NEM program was replaced in 2015 giving consumers the choice between the Customer Self Supply (all solar energy must be self-consumed) or the Customer Grid Supply (all solar energy must be exported to the grid and compensated at lower than retail prices). This scheme has been criticized of disincentivizing new RTS investment, and in 2022 there began a push for a reformed NEM program to be introduced.

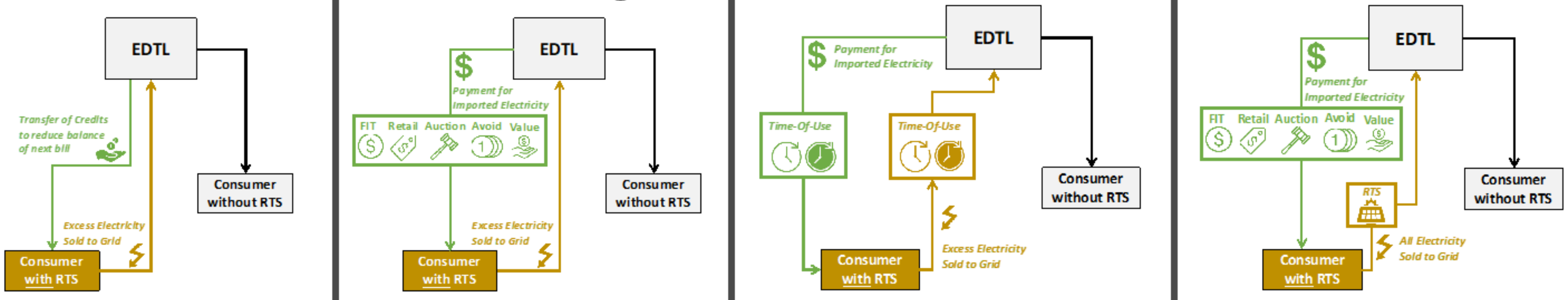
France's net metering system offers RTS consumers the choice to sell electricity to the grid via the Tarif d'Achat program, where consumers install Solar panels with the sole purpose of exporting power produced to the grid. In turn, consumers purchase all their power directly from the grid at retail tariff rates.

Vietnam's net-metering policy was reformed in 2019, changing from a net-metering credit scheme to an all-buy all-sell approach where exporting to the grid required consumers to sign a long-term feed-in-tariff agreement at predetermined rate. This approach resulted in a remarkable uncontrolled development of RTS solar PV in the country, due to favourable FIT rates offered, and has since been discontinued.

2.3.5 Summary of NEM Compensation Schemes

Figure 8 below summarizes the four NEM compensation schemes for Timor-Leste analysed in this report, providing key elements and design mechanisms in relation to EDTL and NEM consumers, and detailing evolving approaches to implementing NEM policies.

Figure 8 **Summary of NEM Compensation Schemes example for Timor-Leste**



Net-Metering

- Basic mechanism countries typically start with.
- Exported electricity to the grid is credited on utility bills.
- Challenges to set reasonable prices.

Net-Billing

- Exported electricity to the grid is paid directly to consumers.
- Range of potential pricing mechanisms offered.
- Greater flexibility for price setting.

Time-Of-Use

- Exported electricity to the grid is priced according to the time-value.
- RTS consumers encouraged to export during high pricing and consume more energy during off-peak, or low-pricing times.

All-Buy / All-Sell

- RTS consumers are required to export all electricity generated directly to the grid.
- In-turn all electricity consumed must be purchased through the grid.
- Does not capture consumer motivations for RTS.

3 International Experience in Net-Metering (Island Context)

This section provides a review of approach taken by island states to implementing net-metering policy within an island context, including Hawaii, the Philippines, Indonesia, Singapore, and New Zealand. It then provides a summary on lessons learned for Timor-Leste featuring key areas of: policy, regulatory and legal frameworks, compensation mechanisms, and current state of implementation.

3.1 Hawaii

3.1.1 Summary of Net-Metering Experience

Hawaii first adopted a NEM program in 2001 but only started rapidly expanding in 2014, where RTS adoption grew from 0.5% to 9-16% on some islands[3]. This was due to a new NEM policy based on retail tariff compensation, where exported energy was credited at excessively high rates ($0.30-$0.45 USD/kWh). The net metering compensation program was ended in 2015, allowing for only a limited share of existing consumers to continue. Hawaii's NEM program was replaced in 2015 giving consumers the choice between:

- Customer Self Supply (all solar energy must be self-consumed) or
- Customer Grid Supply (all solar energy must be exported to the grid and compensated at lower than retail prices).

Export credit rates under the grid supply option were significantly lower than under NEM and vary by island ($0.10-$0.17 USD/kWh). This scheme has been criticized of disincentivizing new RTS investment, and in 2022 there began a push for a reformed NEM program to be introduced. In addition to receiving lower compensation rates, consumers must choose between either full self-consumption or full grid export. The growth of RTS in Hawaii has since been limited to reach 26% of consumers by 2025[4].

3.1.2 Policy, Regulatory and Legal Framework

Hawaii's NEM program was first adopted in 2001 through the Net Metering Law (Act 296), which stipulated that consumers with grid connected solar PV systems up to 100 kW in size can receive credit on their utility bills for electricity exported back to the grid. It also limited the total amount of system penetration depending on the jurisdiction within Hawaii, with caps ranging from 0.2% to 20% of peak demand[5].

There were several minor amendments until 2008, where the system-wide cap for NEM was eliminated and raised the size of individual system limit to reflect load of consumers. In 2015 Hawaii's NEM program was replaced with full self-supply or full grid-supply options, due to technical concerns associated with a significant uptake in rooftop PV integration.

[3] Hawaiian Electric 2025, Net Energy Metering
[4] Hawaiian Electric 2025, Hawaiian Electric sees steady growth in solar installations
[5] National Renewable Energy Laboratory 2025, Status of Net Metering: Assessing the Potential to Reach Program Caps

3.1.3 Compensation Mechanism

Hawaii's initial NEM programme offered retail compensation mechanism, where exported energy was credited at excessively high rates ($0.30-$0.45 USD/kWh). Hawaii's NEM program was replaced in 2015 to a 'All-buy' & All-sell' giving consumers the choice between:

- Customer Self Supply (all solar energy must be self-consumed) or
- Customer Grid Supply (all solar energy must be exported to the grid and compensated at lower than retail prices).

Export credit rates under the grid supply option are significantly lower than under NEM and vary by island ($0.10-$0.17 USD/kWh).

3.1.4 Status of Implementation

There was an immediate decline in uptake following the 2015 revisions to the compensation mechanism, due to changes and uncertainty related to the new structure and reduced rates offered. However, from 2020 onwards, there began a significant surge of new rooftop PV systems across the country, utilizing both self-supply and grid-supply options, and most new installations are coupled with battery energy storage systems[6]. By 2024 there was 113,999 grid-connected solar PV systems totalling up to 1,410 MW of capacity.

3.1.5 Key Lessons Learnt

The NEM experience in Hawaii demonstrates that starting with a simple net-metering program that provides credits on customers' bills is most appropriate for initial stages of implementation. However, setting appropriate export credit rates is critical for the long-term success and sustainability of the NEM programme. There should initially be limitations on the sizes of both individual PV systems and system-wide deployment that should be gradually lifted as the programme / policy progresses over time, and as the local distribution utilities become adept at managing higher integration levels of behind-the-meter Solar PV.

3.2 The Philippines[7]

3.2.1 Summary of Net-Metering Experience

The net-metering program in the Philippines, established under ERC Resolution 09 in 2013 and authorized by the Renewable Energy Act of 2008, allows qualified end-users to install renewable energy (RE) systems with a capacity of up to 100 kW. This program enables users to consume self-generated electricity and export surplus energy to the grid, earning credits equivalent to the generation cost, which are applied to their electric bills. Additionally, a Peak/Off-Peak (POP) pricing scheme incentivizes users to shift consumption to off-peak hours and earn higher credits by exporting energy during peak demand periods. From 2015 to 2019, the program saw consistent growth in participants and capacity, though 2020 experienced a decline due to the COVID-19 pandemic.

The application process involves multiple stages, including submitting documents to the Distribution Utility (DU) and Local Government Units (LGUs), undergoing technical evaluations, and completing

[6] Hawaiian Electric 2021, Rooftop solar installations up 55% despite pandemic, boosting industry and Hawaii economy
[7] Guidebook on Net Metering in the Philippines. Available at " https://doe.gov.ph/renewable-energy/guidebook-net-metering-philippines "

inspections before energization. While the program offers significant benefits, such as promoting renewable energy adoption and reducing electricity costs, it also requires compliance with technical standards and permits, as outlined in the Net-Metering Guidebook by the Department of Energy (DOE).

3.2.2 Background

The Energy Regulatory Commission enacted the ERC Resolution 09, Series of 2013 on 27th of May 2013 which established the rules enabling the Net-Metering program for renewable energy (RE) in the Philippines. The ERC's authority to approve a net-metering program for renewable energy (RE) in the Philippines is based on Section 10 of the Renewable Energy Act of 2008 (Republic Act No. 9513). This section states that, "Subject to technical considerations and without discrimination and upon request by distribution end-users, the distribution utilities shall enter into net-metering agreements with qualified end-users who will be installing the RE system."[8]

This program enables end-users to install on-site renewable energy (RE) systems with a maximum capacity of 100 kilowatts (kW) which allows them to generate electricity for their own consumption, while any surplus electricity is automatically exported to the distribution system or grid.

3.2.3 Policy, Regulatory and Legal Framework

Renewable Energy Act of 2008 (RA 9513) acted as a policy foundation for net-metering in the Philippines. The primary objective of the Renewable Energy (RE) Act is to expedite the exploration and development of renewable energy resources, promote their efficient and cost-effective commercial applications, and foster their use to balance economic growth with environmental and health protection. To support the commercial advancement of RE projects, the RE Act introduced various market development policies aimed at enhancing competitiveness and expanding the adoption of renewable energy. One such policy mechanism is the Net Metering Program for Renewable Energy.

Section 10 of the Act states that, "Subject to technical considerations and without discrimination and upon request by distribution end-users, the distribution utilities shall enter into net-metering agreements with qualified end-users who will be installing the RE system." This mandates distribution utilities (DUs) to enter into net-metering agreements with qualified end-users upon request, ensuring non-discriminatory access to the program.

The Net Metering Program is established based on the following resolutions and circulars issued by both the Department of Energy (DOE) and the Energy Regulatory Commission (ERC)[9]:

- <u>Resolution No. 09 Series of 2013 Rules Enabling the Net-Metering Program</u>: This resolution applies to on-grid systems where qualified end-users (QEs) can use renewable energy (RE) resources and sell excess power at the host DU's blended generation rate. The DU will install meters to track electricity import, export, and RE generation, earning Renewable Energy Certificates for the energy produced from RE sources.
- <u>Resolution No. 06 Series of 2019 Amended Net-Metering Rules:</u> This amended Net-Metering Rules set a 20-working day processing timeline for DUs to complete interconnection, provided all permits are in place. It expands eligible RE technologies to include wind, solar, hydro, and

[8] Ibid
[9] Ibid.

biomass, removes the DIS fee and net-metering charge, and maintains the DU's blended generation cost for pricing, while also rationalizing the lifeline rate subsidy distribution.

- Resolution No. 05 Series of 2020 Amendments to the Rules Enabling Net Metering Program: The resolution clarifies provisions from Resolution No. 09 Series of 2019, amending definitions and responsibilities: (i) good credit standing now includes new customers with no outstanding obligations, (ii) DUs cover meter costs, except for new RE system installations where the end-user pays the difference, (iii) DUs cover the REC meter cost, while QEs pay wiring, and (iv) REC meters must be near the connection point. It also states that DUs will replace two uni-directional meters with one bi-directional meter at no cost to existing customers.
- Department Circular No. 2020-10-0022 Policies on Net-Metering Program: This amendment on Net-Metering rules addresses economic and technical barriers, but the DOE aims to further enhance policies to boost RE use. The circular clarifies that QEs must not be net generators at year-end, with excess credits forfeited, and expands the program to off-grid areas, with the NEA assisting electric cooperatives in promoting the program and providing technical support.
- Joint Memorandum Circular No. 2020-01 LGU Energy Code: The DOE and DILG issued a Joint Memorandum Circular directing LGUs to track and include energy project benefits in their development plans. LGUs are also required to streamline permit processes for energy projects under the EVOSS Act and ensure stakeholders are trained on energy safety, efficiency, conservation, resiliency, and planning.

3.2.4 Compensation Mechanism

For the surplus capacity exported by the customer, the DU provides a monetary / peso credit which is equivalent to the DU's generation cost (excluding other generation adjustments) and deducts these credits from the customer's electric bill. Electricity generation costs typically constitute a portion of the total cost of electricity, which also includes transmission, distribution, and supply costs. In general, generation costs account for approximately 50% - 70% of the overall electricity cost or the retail price.

The net amount creditable to the customer is determined by subtracting the following from the subtotal amount for export energy:

- the subtotal peso amount for export energy (= export energy in kWh x generation cost in Pho/kWh), and
- the peso amount credited in the previous month, if applicable.

If the resulting amount is positive, the customer is required to pay the corresponding peso amount to the DU. Conversely, if the resulting amount is negative, the DU will credit the negative peso amount to the customer's electric bill in the next billing cycle.

Illustration of net energy metering by Marinduque Electric Cooperative (MERALCO), largest private sector electric DU in the Philippines is shown in, and the mechanism is described as: "The RE facility harnesses solar energy that is used to generate electricity. Any excess power that is not utilized by the household will be exported and converted to bill credits, which will be deducted from the monthly electricity bill. Any deficit on the customer's end will be imported from Meralco and charged accordingly."[10]

[10] https://www.meralco.com.ph/residential/electric-service/solar-net-metering

Time of use

In the Philippines, an alternative pricing scheme exists that incorporates distinct generation charges for peak and off-peak periods.

For instance, MARELCO implements a Peak/Off-Peak (POP) scheme to incentivize customers to shift a significant portion of their electricity consumption to off-peak hours when generation charges are considerably lower due to reduced demand. This arrangement also benefits customers with rooftop solar (RTS) systems with net-metering, allowing them to earn higher credits by exporting electricity during peak hours, typically in the morning and afternoon when solar generation is most productive.

Comparison between the POP and Non-POP schemes, as defined by MARELCO are shown in Table 1. The peak generation charges are Php2.14 higher than the off-peak generation charges. The generation rates shown are subject to change as per the Generation Charge Adjustment (GCA) which varies monthly.

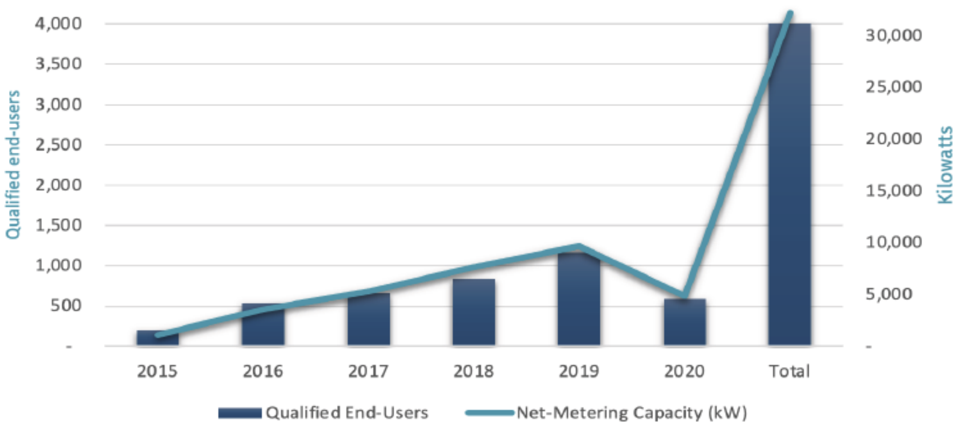
Table 1 Comparison between POP and Non-POP

Season	POP / Non-POP	Peak (Php/kWh) *Monday to Saturday: 8am to 9pm (13 hours) Sunday: 6pm to 8pm (2 hours)*	Off Peak (Php/kWh) *Monday to Saturday: 9pm to 8am (11 hours) Sunday: 12am to 6pm (18 hours) and 8pm to 12am (4 hours)*
Dry Season (Jan-Jun)	POP	7.48	3.55
	Non-POP	5.69	5.69
Wet Season (Jul-Dec)	POP	7.28	3.55
	Non-POP	5.69	5.69

Source: https://www.meralco.com.ph/residential/electric-service/peakoff-peak

3.2.5 Status of Implementation

Figure 9 Number of Qualified End Users (QEs) and Capacity Additions (2015-2020)



Source: Guidebook on Net Metering in the Philippines. Available at " https://doe.gov.ph/renewable-energy/guidebook-net-metering-philippines ". Based on data from ERC.

Status of the Net-Metering from 2015 to 2020 in the Philippines is shown in Figure 9. It is observed that there is a consistent increase in number of QEs / capacity additions from 2015 to 2019 and dropped in 2020 due to the COVID-19 pandemic.

3.2.6 Key Lessons Learnt

Key lessons from the Philippines' net-metering experience highlight the importance of a strong regulatory framework and clear implementation guidelines. The success of the program is rooted in legislation like the Renewable Energy Act, which mandates utilities to engage with qualified end-users, ensuring inclusivity and technical feasibility. Establishing transparent pricing mechanisms, such as crediting surplus energy at generation cost, is crucial for maintaining fairness while incentivizing participation. Additionally, tiered pricing schemes like Peak/Off-Peak (POP) can enhance program appeal by allowing customers to maximize credits during high-demand periods.

3.3 Indonesia

3.3.1 Summary of Net-Metering Experience

Indonesia's solar energy policy evolved from net metering in 2013 to net billing in 2018, where excess electricity was credited at a 65% multiplier. In January 2024, the government repealed both systems due to concerns about PLN's capacity to manage excess energy. However, existing rooftop solar users will continue under the previous regulations for 10 years. This change highlights challenges in integrating decentralized renewable energy into Indonesia's grid.

3.3.2 Background

Indonesia's approach to developing its solar energy sector has undergone significant changes over the past decade. The journey began in 2013 with the introduction of a net metering policy under PLN Regulation No. 0733/2013. This policy was later transitioned to a net billing system with the enactment of MEMR Regulation No. 49/2018.[11]

However, on January 30, 2024, the Indonesian government officially abolished the net metering scheme through MEMR Regulation No. 2/2024. This decision was driven by concerns over PLN [12](Perusahaan Listrik Negara)'s capacity to absorb excess electricity generated by RTS systems and effectively provide credits for it. The change reflects the challenges of integrating distributed renewable energy sources into Indonesia's power grid.[13]

3.3.3 Policy, Regulatory and Legal Framework

The Indonesian government began formulating policies to facilitate the rapid and sustainable development of the solar energy sector. In response to growing public and commercial interest in solar energy, the government set a target to increase the share of renewable energy and introduced new policies. These policies are enforced through several regulations, including MEMR Regulation No. 17/2013, MEMR Regulation No. 79/2014, which aim to raise the renewable energy share to at

[11] Investigating policies on improving household rooftop photovoltaics adoption in Indonesia. Available at: https://www.sciencedirect.com/science/article/pii/S0960148120306388

[12] PLN is an Indonesian government-owned corporation with a monopoly on electric power distribution in Indonesia and also generates the majority of the country's electricity.

[13] https://www.pv-magazine.com/2024/02/28/indonesian-government-abolishes-net-metering

least 23% by 2025[14], as well as MEMR Regulations No. 19/2016, No. 50/2017, No. 0733/2013 (Net-Metering) and No. 49/2018(Net-Billing).

3.3.4 Compensation Mechanism History in Indonesia

3.3.4.1 Net Metering (PLN Regulation No. 0733/2013)

According to this regulation, the energy exported to PLN from customers' RTS systems will be offset by the electricity supplied by PLN to the customers. If the electricity received by PLN exceeds the energy provided by PLN, the difference is recorded as a kWh deposit, which will be carried over and applied in subsequent months. It is important to note that customers were still subject to a minimum monthly charge by PLN, regardless of their energy consumption or export.[15]

Under this mechanism, the amount of electricity exported by customers was not subject to a multiplier. Consequently, the energy received by PLN was regarded as identical to the energy exported by the customers. As a result, for each kWh of electricity sent to the PLN grid, customers received credits corresponding to the standard customer tariff.

3.3.4.2 Net Billing (MEMR Regulation No. 49/2018)

MEMR Regulation No. 49/2018 was introduced by the Ministry of Energy and Mineral Resources (MEMR) to support the development of solar energy. It established an export-import mechanism, distinct from the previous net metering system from 2013. Under this regulation, excess electricity generated by the owner is converted into credits that offset the owner’s electricity consumption from PLN. The exported electricity is calculated monthly and converted into credits, which expire after three months. Additionally, the exported electricity is subject to a 65% multiplier, meaning only 65% of the exported energy is credited, with the remaining 35% effectively discounted.[16]

3.3.4.3 MEMR Regulation No. 2/2024

On January 30, 2024, Indonesia formally repealed the Net Billing regulation introduced in 2018 (outlined in Section 3.3.4.2) and fully eliminated the net metering system. However, this policy revision guarantees that customers with existing RTS installations as of January will continue to be governed by the previous regulation for a period of 10 years.

3.3.5 Status of Implementation[17]

According to data from the Ministry of Energy and Mineral Resources, as shown in the number of solar captive users in Indonesia rose from 351 in January 2018 to 1,580 by December 2019. This notable increase can be attributed to the clear economic benefits of solar energy, particularly in reducing electricity costs and decreasing reliance on the national grid.

By the end of 2019, Indonesia had an installed solar photovoltaic (PV) capacity of 152 MW, with 34 MW added during that year alone. Of the total installed capacity, 11% (16.6 MW) was derived from rooftop solar PV.

[14] https://www.sciencedirect.com/science/article/pii/S2214629624003888
[15] PLN Regulation No. 0733/2013. Available at: https://www.scribd.com/document/428743587/PERATURAN-DIREKSI-0773-K-DIR-2013-FOTOVOLTAIK-pdf
[16] Investigating policies on improving household rooftop photovoltaics adoption in Indonesia. Available at: https://www.sciencedirect.com/science/article/abs/pii/S0960148120306388
[17] https://www.fourthpartner.co/solar-scenario-in-indonesia.html

The recent discontinuation of net metering, as per MEMR Regulation No. 2/2024, may impact the adoption rates of rooftop solar systems among residential users.

Figure 10 Number of customers installing rooftop PV in Indonesia

Source: https://www.fourthpartner.co/solar-scenario-in-indonesia.html

3.3.6 Key Lessons Learnt

A key lesson from Indonesia' experience is that there is need for careful assessment of grid capacity and the utility's ability to manage distributed renewable energy. Indonesia's experience shows that without proper infrastructure, excess energy can overwhelm the grid, highlighting the importance of grid upgrades before implementing net metering.

3.4 Singapore

3.4.1 Summary of Net-Metering Experience

Singapore's NEM policy was implemented in 2014 and allowed Solar PV consumers to export excess electricity to the wholesale market without becoming an official participant, limited to 10 MW. The compensation mechanism involved net metering where energy sold is credited at the prevailing half-hourly wholesale electricity price. Overall installations have doubled between 2021 and 2025 reaching 527 MWp across 9,273 installations by Q1 of 2025, supported by the government's Singapore Green Plan 2030 policy.

3.4.2 Policy, Regulatory and Legal Framework

In 2014, the EMA removed a hard cap of 600 MWp of Solar PV connected to Singapore's grid, allowing for a new dynamic approach to PV integration. In the same year, Singapore's NEM policy was then introduced in under the Enhanced Central Intermediary Scheme (ECIS) allowing consumers with behind-the-meter Solar to sell electricity on the wholesale market. It allowed these consumers to effectively participate in the wholesale electricity market without requiring registration and other processes to become a market participant, limited to PV system sizes of 10 MW[18]. Consumers with

[18] Energy Market Authority 2025 Solar Payment Schemes

systems larger than 10 MW must register as generation facility market participant to export excess energy.

The overarching framework supporting the development of Solar PV is the Singapore Green Plan 2030, which launched in 2021 and set a target to reach 1.5 GWp of deployment by 2025 and 2 GWp by 2030.

3.4.3 Compensation Mechanism

For those PV consumers under the ECIS, exported energy is credited at the prevailing half-hourly wholesale electricity price (Uniform Singapore Energy Price)[19]. Customers then receive credits under a net-metering compensation mechanism on their monthly utility bill, reducing overall payments for electricity.

3.4.4 Status of Implementation

Solar development from the implementation of the ECIS lagged between 2014 to 2020, however, from 2021 onwards under the adoption of the Singapore Green Plan policy began significantly growing, with small residential and public buildings rising from 211 MWp across 4,029 installations in 2021 up to 527 MWp across 9,273 installations by Q1 of 2025[20].

3.4.5 Key Lessons Learnt

The approach to designing NEM policy in Singapore under the ECIS was focused on ease of implementation to attract new consumers. Exporting through net metering offers more competitive rates during hours of PV generation when there is low rates of utility-scale Solar PV deployment at the system level. Government policies that set deployment targets along with direct NEM support programs for customers is critical for long-term success.

3.5 New Zealand

3.5.1 Summary of Net-Metering experience

New Zealand's Net-Metering experience began in 2010 with the implementation of the legislative and regulatory framework for NEM. The compensation mechanism has been market-based driven, where once requirements for interconnection are met, consumers are provided with credits on excess solar energy they export, based on buy back rates offered by their utility. There has been a recent surge in deployment of distributed PV systems from 2020 onwards.

3.5.2 Policy, Regulatory and Legal Framework

Part 10 of The Electricity Industry Participation Code of 2010 features technical requirements for consumers to participate in the net metering program in New Zealand. Once these are met, consumers with PV systems must enter buy back rate agreements with respective electricity retailers that offer different rates.

[19] Energy Market Authority 2025 Solar Payment Schemes
[20] Energy Market Authority 2025 Singapore Solar Photovoltaic Report Q1 2025

3.5.3 Compensation Mechanism[21]

In New Zealand, the solar buyback system operates through a net metering mechanism facilitated by a bi-directional meter. This meter records both the electricity exported to the grid and the electricity imported from it. Customers are credited for the electricity they export to the grid, with these credits accumulated for surplus energy and subsequently deducted from their electricity bills.

Electricity retailers compensate customers for the surplus electricity at agreed-upon buyback rates. These rates vary between retailers and are consistently lower than the retail tariff price of electricity.

Buy back rates from some of the retailers in New Zealand are shown in Table 2

Table 2 Buy-back rates offered by retailers

Retailer	Buy-Back Rate (in NZD cents/kWh)
Electric Kiwi	8 to 12.5
Megatel	7.4
Genesis Energy	12
Contact Energy	8
Nova Energy	10
Ecotricity	12 to 16
Powershop	13
Frank Energy	11
Flick Electric	13.2
Meridian Energy	12 to 17
Mercury Energy	8.5
Octopus Energy	17
Toast Electric	10

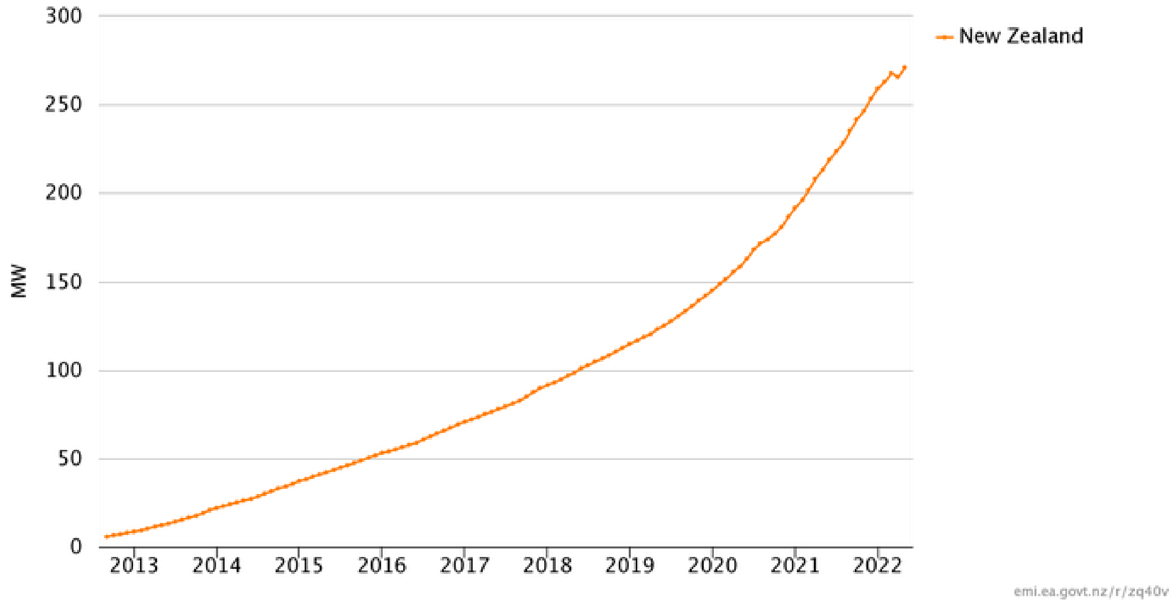
Source: https://www.powercompare.co.nz/p/nz-solar-energy-buy-back-rates

3.5.4 Status of Implementation

Distributed Solar PV has experienced rapid growth in New Zealand from 2020 onwards, increasing from 150 MW to 270 MW by 2023. Transpower forecasts that installations will continue to grow to reach 535 MW by 2030.

[21] https://www.powercompare.co.nz/p/solar-buy-back

Figure 11 Growth of Installed Distributed Solar PV capacity in New Zealand



Source: https://www.ea.govt.nz/news/eye-on-electricity/solar-generation-now-and-in-the-future/

3.5.5 Lessons Learnt

The case of New Zealand shows an approach that's entirely market driven, by first setting the legislative / regulatory framework for NEM, establishing a basic net metering compensation mechanism, and then allowing for electricity retailers to offer competitive buy-back rates to consumers with PV.

3.6 Summary of Net-Metering International Experience (Island Context)

Table 3 below sets out a summary of net-metering international experience, featuring key areas of policy, regulatory and legal frameworks, compensation mechanisms, status of implementation, and key lessons learned for Timor-Leste policy makers.

Table 3 Summary of Net-Metering International Experience (Island Context)

	Hawaii	The Philippines	Indonesia	Singapore	New Zealand
Policy, Regulatory and Legal Framework	Hawaii's NEM program was first adopted in 2001 through the Net Metering Law (Act 296). It has since undergone major amendments in 2008 and again in 2015, reflecting changes in connection requirements and compensation mechanisms.	The Renewable Energy Act of 2008 (RA 9513) underpins the Philippines' Net Metering Program, promoting renewable energy development through streamlined policies, expanded eligibility, and support mechanisms.	2013 with the introduction of a net metering policy under PLN Regulation No. 0733/2013. Enactment of MEMR Regulation No. 49/2018 made an amendment to the compensation mechanism. 2024 abolished the net metering scheme through MEMR Regulation No. 2/2024.	In 2015, Singapore's NEM policy was introduced under the Enhanced Central Intermediary Scheme (ECIS) allowing consumers with behind-the-meter Solar to sell electricity on the wholesale market.	Part 10 of The Electricity Industry Participation Code of 2010 features technical requirements for consumers to participate in the net metering program in New Zealand.
Compensation mechanism	Initially Net-Metering, change to 'All-Buy & All-Sell' mechanism in 2015.	Net-Metering and Time of Use mechanisms	Discontinued Net-billing in 2024.	Net-Metering that is credited at the prevailing half-hour USEP wholesale price.	Net-Metering according to buy-back rates offered by retailers.
Status of Implementation	Immediate decline following 2015 revisions, however, significant surge from 2020 onwards.	Consistent increase in number of net-metering users / capacity additions from 2015 to 2019 and dropped in 2020 due	According to data from the Ministry of Energy and Mineral Resources, as shown in the number of solar captive users in Indonesia rose from	Significant growth from 2021 onwards with the adoption of the Singapore Green Plan policy, reaching up to 527 MWp across	Rapid growth from 2020 onwards reaching 270 MW by 2023. Projected to reach 535 MW by 2030.

	Hawaii	The Philippines	Indonesia	Singapore	New Zealand
		to the COVID-19 pandemic.	351 in January 2018 to 1,580 by December 2019. Discontinued in 2024.	9,273 installations by Q1 2025.	
Key Lessons learnt for Timor-Leste	Simple net-metering with credits on customers bill most appropriate for initial stages. Setting appropriate export credits rates critical for long-term sustainability. Place limitations on sizes of individual PV and system-wide adoption that are gradually lifted as more experience is gained for integration.	A robust legal foundation, like the Renewable Energy Act, ensures utilities engage with qualified end-users inclusively and feasibly. Detailed rules help streamline program execution and participation. Options like Peak/Off-Peak (POP) enhance appeal by enabling customers to maximize credits during high-demand periods.	Evaluate the grid's capacity to handle distributed renewable energy. Ensure utilities are equipped to manage excess energy from distributed sources. Prioritize grid enhancements to prevent system overload before implementing net metering.	Ease of set-up and interconnection is critical for attracting new customers. Set competitive rates that gradually reflect the short-run marginal system cost during periods of Solar PV exports. Government policies that set deployment targets along with direct NEM support programs is critical for long-term success.	Clear legislative and regulatory framework and reflection in grid-code is essential for behind the meter PV development. Buy-back rates overtime should vary according to utility distribution zone, reflecting the cost of delivering energy.

4 NEM Payback Scenario Assumptions for Timor-Leste

This section details key assumptions considered for simulating different payback scenarios in Timor-Leste, including Rooftop Solar PV costs, the Net Metering Model composition, exporting potential considered, and load profiles by consumer classification.

4.1 Net Metering Model

The net-metering model developed for this simulation is excel based and considers a range of assumptions and inputs detailed within this section. Based on varying consumer classes, daily demand and solar PV production curves are first developed, as in the example shown for residential sector in Figure 12 below. In turn, this yield estimates on daily own consumption of Solar PV (Figure 13), daily remaining energy purchased from EDTL (Figure 14), as well as daily excess export values to EDTL (Figure 15). The assumptions are summarized in Table 5, which then provide an annual kWh volume for each curve.

Figure 12 Daily Demand and Solar PV Production (Residential Example)

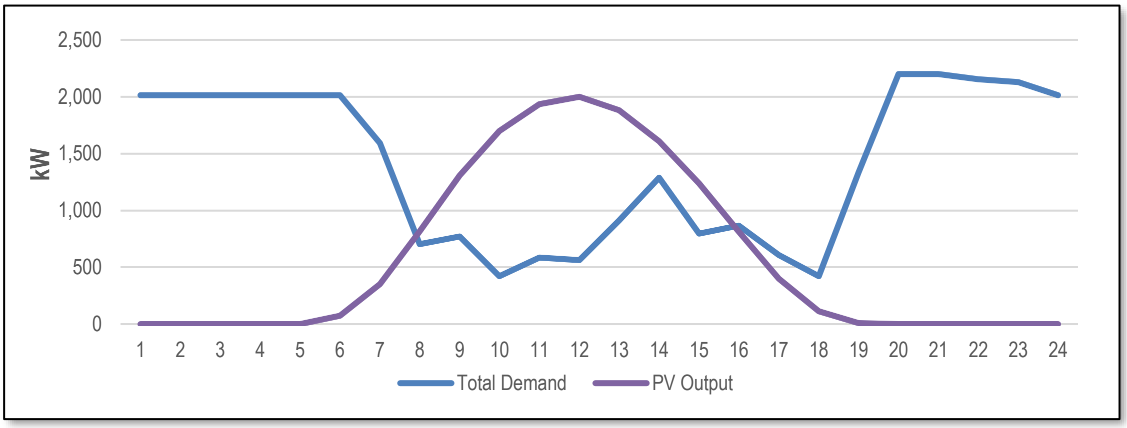


Figure 13 Daily Own-Use of Solar PV (Residential Example)

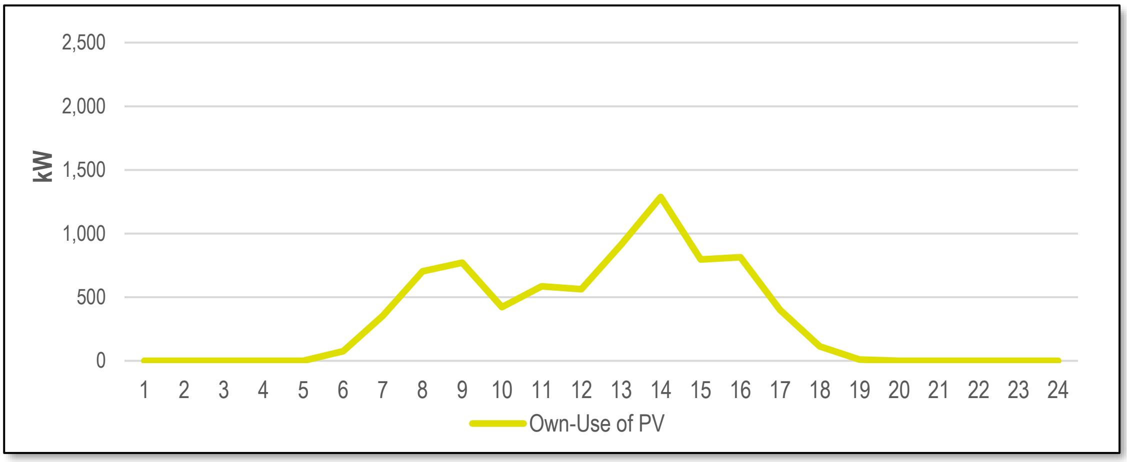


Figure 14 Daily Purchase from EDTL (Residential Example)

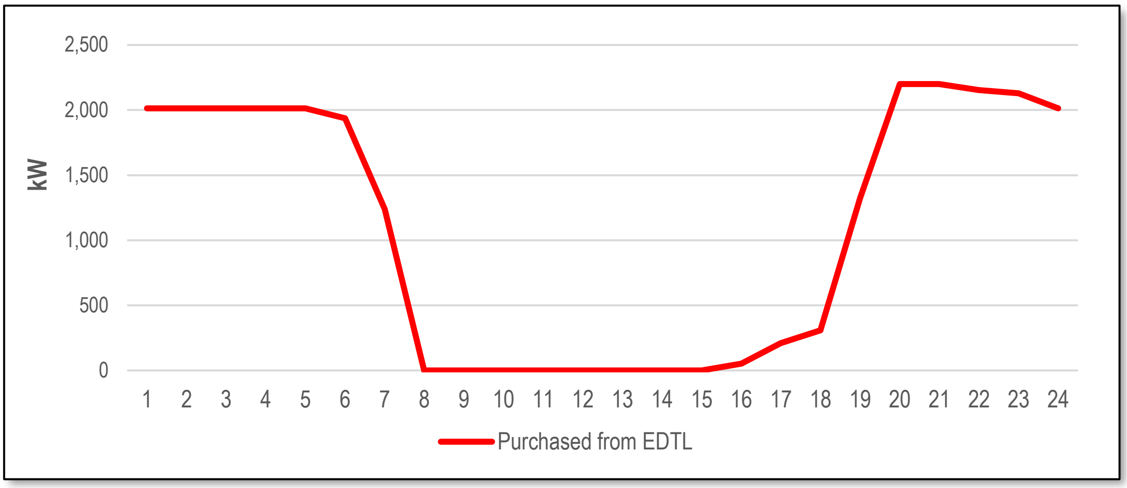


Figure 15 Daily Export to EDTL (Residential Example)

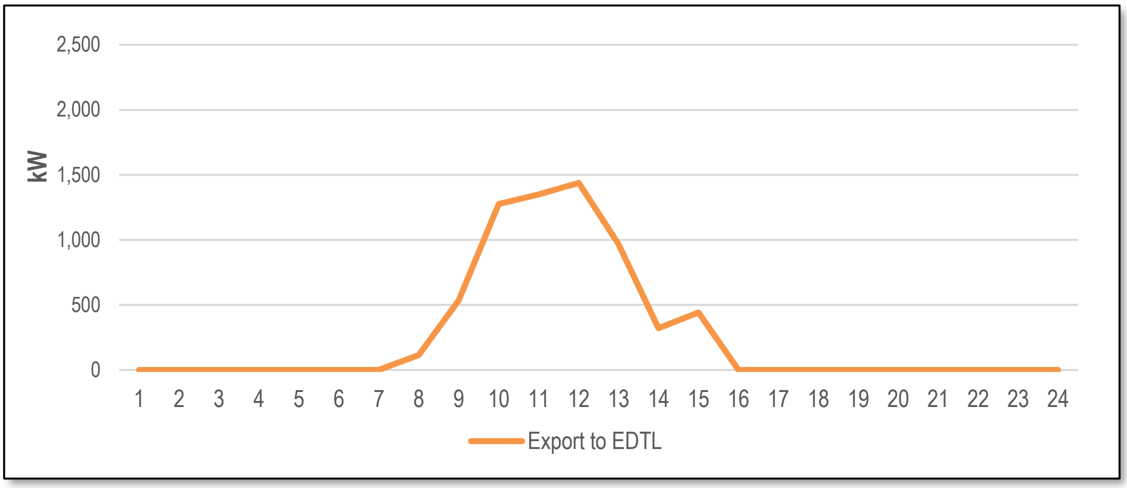


Table 4 Net Metering Model Assumptions (Residential Example)

2 kWp Solar PV System	Wh/day	kWh p.a.
Demand (Average)	33,632	12,276
Total PV Out	14,244	5,199
Own-Use of PV	7,801	2,847
Energy exported to EDTL	6,443	2,352
Total purchased from EDTL	25,831	9,428

The resulting outputs from the net metering model are shown below in Table 5, where first key metrics on energy consumption are provided, followed by a corresponding calculation of monthly EDTL bills are shown, depending on different export tariff options (50%, 100%, 200%), resulting in different simple buy-back periods. The table shows an example output for the residential sector; however, outputs will be calculated for each consumer class.

Table 5 Net Metering Model Outputs (Residential Example)

Residential Rooftop PV NEM Low Day	**PV Wpk**	**2,000**	**2,000**	**2,000**
	Connection	2200VA	2200VA	2200VA
Own Demand	Wh/day	33,632	33,632	33,632
Total PV output	Wh/day	14,244	14,244	14,244
Total own-use solar energy	Wh/day	7,801	7,801	7,801
Total potential energy export	Wh/day	6,443	6,443	6,443
Export Valued at	**% of tariff**	**50%**	**100%**	**200%**
	Wh/day	**3,222**	**6,443**	**12,887**
Total energy purchased from EDTL	Wh/day	25,831	25,831	25,831
CALCULATION FOR EDTL BILLS				
Net energy monthly purchase from EDTL	kWh/month	678	582	388
Electricity purchased from EDTL	USD/month	81	70	47
Minimum charge (USD / kWh)*	USD/month	9	9	9
EDTL bill (with solar PV)	USD/month	81	70	47
EDTL bill (without solar PV)	USD/month	121	121	121
Export Earnings	USD/month	0	0	0
Solar PV cost savings	USD/month	40	51	74
CAPEX@USD 2.0/Wp	USD	3,000	3,000	3,000
Simple Payback Period	**Years**	**6.30**	**4.88**	**3.36**
Simple 15 yr earnings ratio (post payback)		**2.4**	**3.1**	**4.5**
* The minimum charge is incurred if the monthly bill is less than a specified amount				

4.2 Export Potential

The export potential of a rooftop solar PV system is simply determined as the difference between the maximum PV production of the installed PV system and the self-consumption of the consumer. The maximum PV production will rarely be the same as the maximum technical potential of solar PV for a given prosumer, because economics is a factor when selecting an optimal rooftop PV size. Net metering analyses determine what capacity of PV system is financially advantageous for a consumer as the buyback rate (or Feed-In-Tariff) is varied relative to the prevailing electricity tariff.

4.3 Rooftop Solar PV Costs

Table 6 below sets out the assumptions considered for Rooftop Solar PV in Timor-Leste, ranging from a 2-kW system to a 50-kW system. As shown, the $/Watt installed scales down with the installation of a larger system.

Table 6 Rooftop Solar PV $ per Watt Installed

Solar Panel System Size	Number of Solar Panels Required	Panel Area	$ / Watt installed
2 kW	6	12 m2	1.5
3 kW	9	17 m2	1.4
4 kW	12	23 m2	1.4
5 kW	15	28 m2	1.3
6.6 kW	20	38 m2	1.3
8 kW	24	45 m2	1.2
10 kW	30	55 m2	1.1
15 kW	45	85 m2	1.1
30 kW	90	165 m2	1
50 kW	150	275 m2	0.9

4.4 Load Profiles by Consumer Classification

The estimation of load profiles requires a knowledge of the ‘end-use’ of electricity of consumers. Such end-use varies considerably between consumer classes. In the case of developing countries, it is usual for demand profiles to be constructed using benchmark references as load research has not been conducted This is the case for Timor Leste.

In Timor Leste, the consumer classes of interest are:

- Residential,
- Schools,
- Commercial / Public / Government,
- Hospitals,
- Hotels, and
- Universities.

4.4.1 Residential Sector Load

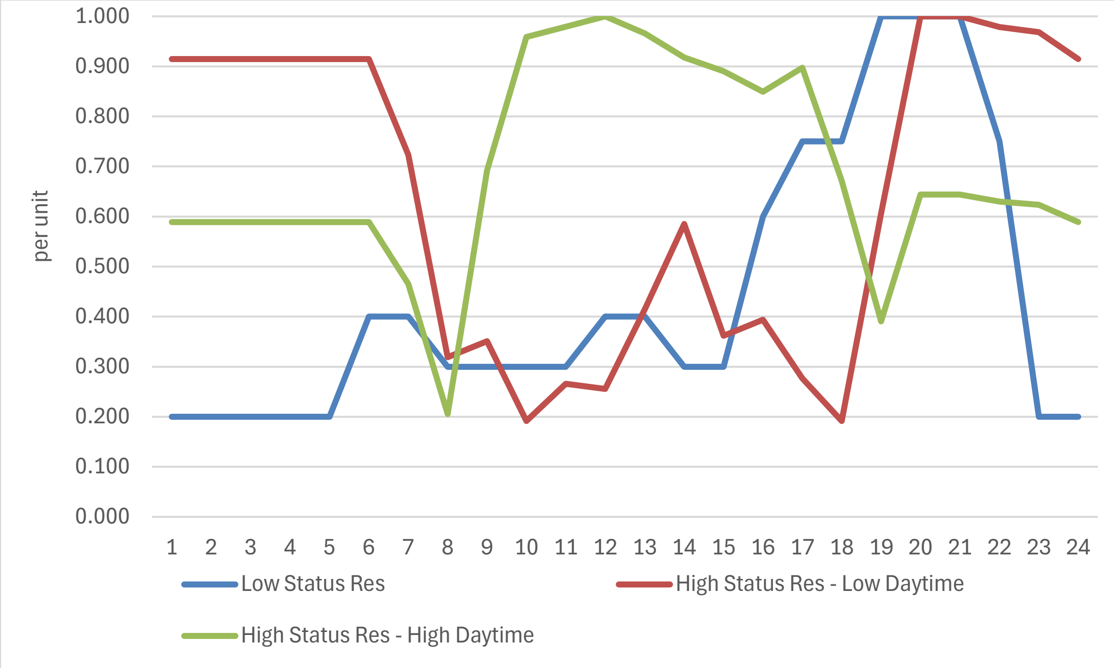
In the case of the residential sector in Timor Leste, three electricity demand profiles have been considered as shown in Figure 16 below.

- A ‘low status’ residential consumer,
- A ‘high status’ consumer with a high daytime consumption, and
- A ‘high status’ consumer with a low day time consumption.

In practice, the ‘low status’ residential consumer profile is typical for consumers in rural areas. It is a poor fit with rooftop PV production and has been set aside as a non-viable case.

The ‘high status’ consumer with a low day time consumption profile is also a poor fit but is included because a high-status consumer may have the capacity to afford to install rooftop PV if excess power can be sold back to the grid.

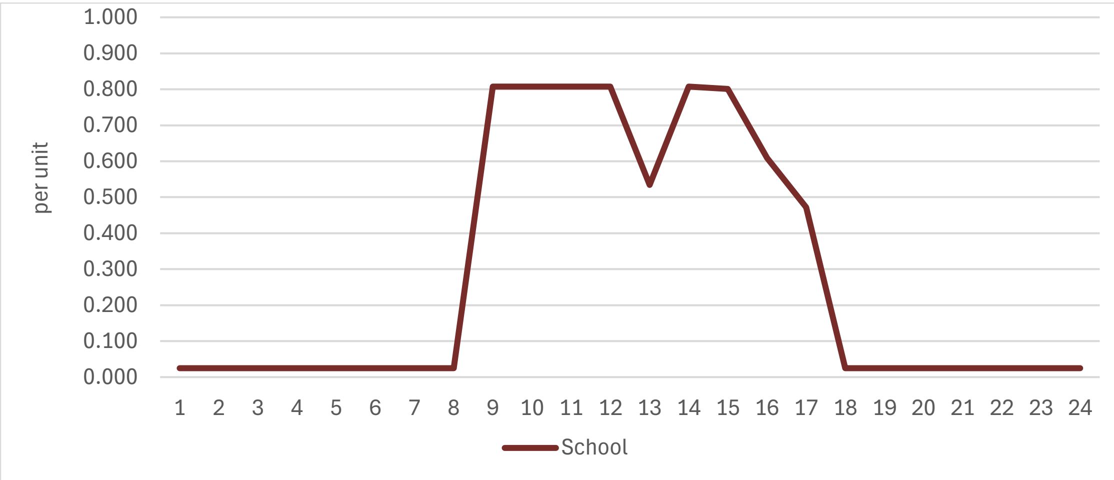
Figure 16 Residential Electricity Demand Profiles



4.4.2 Schools Load

Schools use electricity for lighting, for computers and to power kitchen equipment. Load profiles for schools tend to be similar around the world, with the peak demand driven by the size of classrooms (pupils). The peak demand for schools in Timor Leste is assumed to average 2kW. A typical load profile follows below in Figure 17.

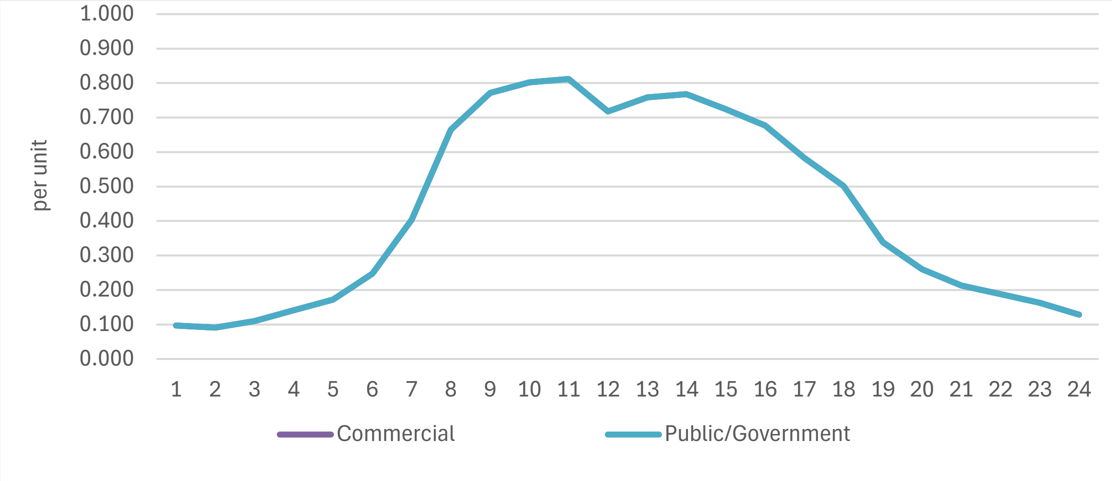
Figure 17 School Electricity Demand Profile



4.4.3 Commercial / Public / Government Load

These consumers use electricity for lighting, for computers and to power kitchen equipment. The peak demand is driven by the building footprint (size). In the case of commercial buildings, the building footprint is determined by stock holding and display practices. In the case of public buildings and government offices the building footprint is related to the number of occupants. The peak demand for these buildings is assumed to average 35kW. A typical load profile follows below in Figure 18.

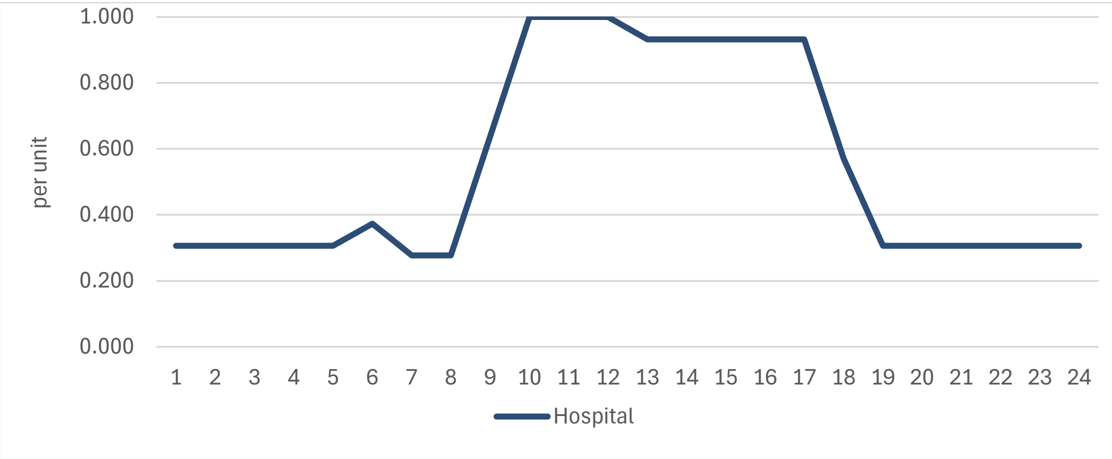
Figure 18 Commercial / Public / Government Electricity Demand Profile



4.4.4 Hospitals Load

Hospitals use electricity for lighting, for computers and to power kitchen equipment. The peak demand is driven by the building footprint (size) which is in turn driven by the number of beds. Clinics are a special case where the building footprint depends on the size of the waiting room and number of staff. The peak demand for hospitals is assumed to average 110kW. A typical load profile follows below in Figure 19.

Figure 19 Hospital Electricity Demand Profile



4.4.5 Hotels Load

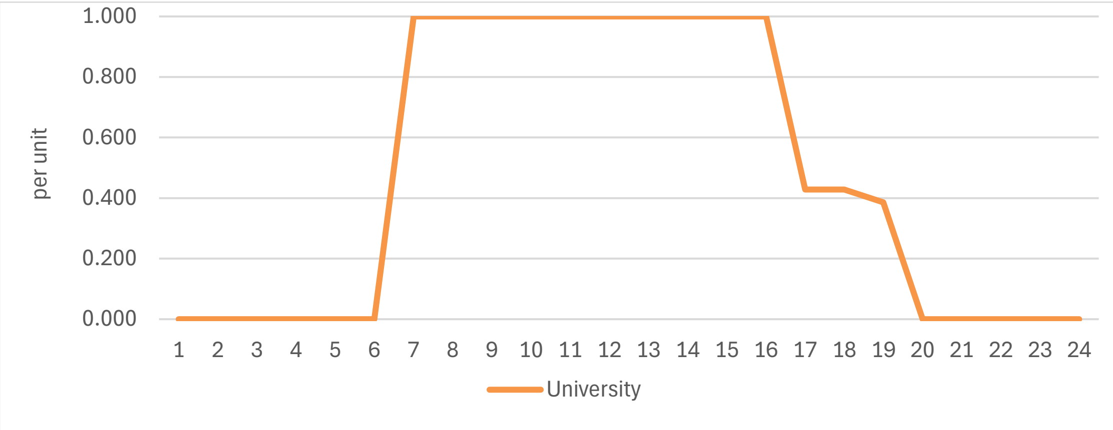
Hotels use electricity for lighting and to power kitchen equipment. Guests use electricity for charging mobile phones and other electronic devices. Air-conditioning load can be significant. The peak demand is driven by the number of beds. The peak demand tends to occur at mealtimes, particularly in the early evening when guests return to the hotel. The peak demand for hotels is assumed to average 188kW. A typical load profile follows in Figure 20.

Figure 20 Hotel Electricity Demand Profile

4.4.6 Universities Load

Universities typically comprise a set of large buildings. Electricity is used for lighting and to power electronic and kitchen equipment. Air-conditioning load can be significant. The peak demand is driven by the number of students. The peak demand occurs during the day when classrooms are in use. The peak demand for a university is assumed to average 770kW. A typical load profile follows below in Figure 21.

Figure 21 University Electricity Demand Profile



4.4.7 Summary of Load Profiles

The estimation of self-consumption of a large and varied population of consumers, requires not only daily load profiles for each consumer class, but also a knowledge of which variable(s) drives peak demand. With the appropriate driver information, load profiles can be scaled for each consumer and the accuracy of the total estimate of self-consumption will be higher.

As driver information is rarely available, proxy measures are needed. As an example, the peak demand of a retail outlet is driven by the number of lighting fixtures. However, as lighting needs correlate with retail floor area, the building floor area can also be used as a proxy measure for lighting fixtures. The advantage of this method is that floor area is often available or can be estimated.

Fortunately, building floor area can be used as a proxy measure for all but the industry sector class of buildings. With a knowledge of specific consumption rates (Watts / m2) for different consumer classes, and floor area, peak demand can be estimated. Ideally specific consumption rates should be determined by load research, but this work has not been done in Timor Leste. This means resorting to international benchmark rates. In this regard, for households, reference has been made to Indonesian studies conducted in areas outside of Java-Bali. For schools, a JICA survey of energy use in schools was conducted for Timor Leste in 2010, and a specific consumption rate has been determined from the study. For other classes of consumer, rates have been struck by reference to a Cambodian study.

Table 7 below gives the load profiles on hourly basis in per unit values, where the denominator of the per unit value is the peak demand of each consumer class.

Table 7 Load Profile Summary for different consumer classes with reference sources

Hour of Day	Low Status Residential HH (p.u. base:10W)	High Status Residential - Low Daytime (p.u. base: 2kW)	High Status Residential - High Daytime (p.u. base: 2kW)	Commercial (p.u. base: 35kW)	Public / Government (p.u. base: 35kW)	University (p.u. base: 770kW)	Hospital (p.u. base: 110kW)	Hotel (p.u. base: 188kW)	School (p.u. base: 2kW)
1	0.200	0.915	0.589	0.097	0.097	0.000	0.306	0.848	0.025
2	0.200	0.915	0.589	0.091	0.091	0.000	0.306	0.851	0.025
3	0.200	0.915	0.589	0.110	0.110	0.000	0.306	0.855	0.025
4	0.200	0.915	0.589	0.141	0.141	0.000	0.306	0.870	0.025
5	0.200	0.915	0.589	0.172	0.172	0.000	0.306	0.924	0.025
6	0.400	0.915	0.589	0.248	0.248	0.000	0.373	0.971	0.025
7	0.400	0.723	0.466	0.404	0.404	1.000	0.277	1.000	0.025
8	0.300	0.319	0.205	0.665	0.665	1.000	0.277	0.967	0.025
9	0.300	0.351	0.692	0.771	0.771	1.000	0.639	0.938	0.807
10	0.300	0.191	0.959	0.803	0.803	1.000	1.000	0.909	0.807
11	0.300	0.266	0.979	0.812	0.812	1.000	1.000	0.862	0.807
12	0.400	0.255	1.000	0.718	0.718	1.000	1.000	0.844	0.807
13	0.400	0.415	0.966	0.759	0.759	1.000	0.933	0.833	0.534
14	0.300	0.585	0.918	0.768	0.768	1.000	0.933	0.801	0.807
15	0.300	0.362	0.890	0.724	0.724	1.000	0.933	0.804	0.801
16	0.600	0.394	0.849	0.677	0.677	1.000	0.933	0.837	0.609
17	0.750	0.277	0.897	0.583	0.583	0.428	0.933	0.884	0.472
18	0.750	0.191	0.671	0.502	0.502	0.428	0.571	0.899	0.025
19	1.000	0.606	0.390	0.339	0.339	0.386	0.306	0.909	0.025

Hour of Day	Low Status Residential HH (p.u. base:10W)	High Status Residential - Low Daytime (p.u. base: 2kW)	High Status Residential - High Daytime (p.u. base: 2kW)	Commercial (p.u. base: 35kW)	Public / Government (p.u. base: 35kW)	University (p.u. base: 770kW)	Hospital (p.u. base: 110kW)	Hotel (p.u. base: 188kW)	School (p.u. base: 2kW)	
20	1.000	1.000	0.644	0.260	0.260	0.000	0.306	0.909	0.025	
21	1.000	1.000	0.644	0.213	0.213	0.000	0.306	0.920	0.025	
22	0.750	0.979	0.630	0.188	0.188	0.000	0.306	0.913	0.025	
23	0.200	0.968	0.623	0.163	0.163	0.000	0.306	0.877	0.025	
24	0.200	0.915	0.589	0.129	0.129	0.000	0.306	0.855	0.025	
Reference Cases										
Building Footprint (sq. metres)	45	180	180	436	780	2000	550	664	500	
Per unit base W	10	2000	2000	35000	35000	155000	110000	188000	2000	
Watts per bldg sq m (benchmark)	0.22	11.1	11.1	80.3	44.9	77.5	200.0	283.1	4.0	
Load factor	0.444	0.637	0.689	0.530	0.530	0.468	0.549	0.887	0.352	
Total Self-Consumption (kWh p.a.)	39	11,160	12,080	162,622	162,622	635,989	528,626	1,460,413	6,171	
Portion sun light hours	52%	34%	61%	82%	82%	97%	74%	54%	96%	
Own-Use sunlight hours (kWh p.a.)	20	3,829	7,360	132,682	132,682	614,174	393,470	792,611	5,924	
Net-Use (p.a.)	19	7,331	4,720	29,940	29,940	21,815	135,156	667,802	247	
	Sources	Indonesia	Indonesia	Indonesia	Cambodia	Cambodia	Cambodia	Cambodia	Cambodia	JICA

Source: Consultant

5 NEM Payback Scenario Calculations for Timor-Leste

This section features the results of the NEM Payback Scenario Calculations across different types of consumers in Timor-Leste, including Residential, Schools, Commercial/Public/Government, Hospitals, Hotels, and Universities. It provides a summary table and analysis on the results at the end of this section.

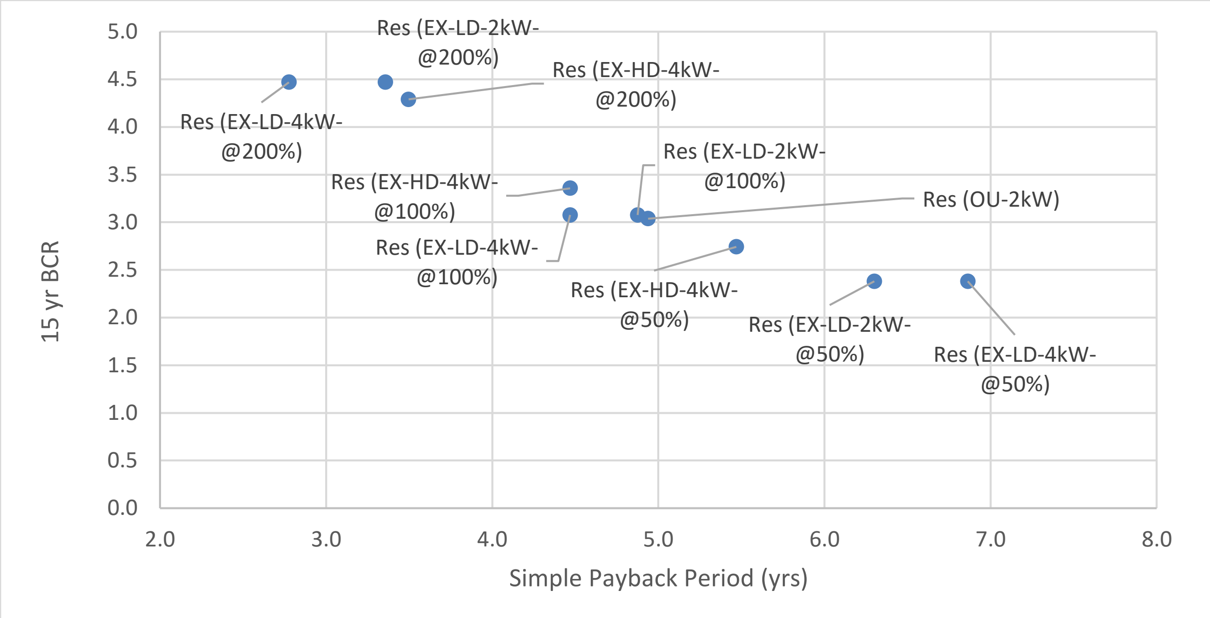
5.1 Residential

Table 8 shows the NEM Payback scenario results for the residential sector under varying demand profiles, export tariff buy-back rates (under a 12 cents / kWh assumption), and nominal system size.

Table 8 Residential Cost-Benefit Analysis (without Capital Cost subsidy)

2200W Demand	Residential Profile	Export on retail tariff buyback rate	Nominal PV Size (kW)	Code	Payback Period (yrs)	15 yr BCR	Capex $k
Export	Low Day	@50%	2kW	Res (EX-LD-2kW-@50%)	**6.3**	**2.4**	3
Export	Low Day	@100%	2kW	Res (EX-LD-2kW-@100%)	**4.9**	**3.1**	3
Export	Low Day	@200%	2kW	Res (EX-LD-2kW-@200%)	**3.4**	**4.5**	3
Export	Low Day	@50%	4kW	Res (EX-LD-4kW-@50%)	**6.9**	**2.4**	5.5
Export	Low Day	@100%	4kW	Res (EX-LD-4kW-@100%)	**4.5**	**3.1**	5.5
Export	Low Day	@200%	4kW	Res (EX-LD-4kW-@200%)	**2.8**	**4.5**	5.5
Own Use	High Day		2kW	Res (OU-2kW)	**4.9**	**3.0**	3
Export	High Day	@50%	4kW	Res (EX-HD-4kW-@50%)	**5.5**	**2.7**	5.5
Export	High Day	@100%	4kW	Res (EX-HD-4kW-@100%)	**4.5**	**3.4**	5.5
Export	High Day	@200%	4kW	Res (EX-HD-4kW-@200%)	**3.5**	**4.3**	**5.5**

Figure 22 Residential 15-yr Benefit Cost Ratio vs. Simple Payback Period



Shown above in Figure 22, the simple payback period and BCR range from 2.8 years and 4.5 BCR under a low-demand day assumption with 200% buy-back rate and a 4kW system size to 6.9 years and 2.4 BCR for the same assumptions with a 50% buy-back rate.

Table 9 Residential Cost-Benefit Analysis (with 50% Capital Cost subsidy)

50% Capital Cost Subsidy - Retail Tariff 12 cents per kWh							
2200W Demand	Residential Profile	Export on retail tariff buyback rate	Nominal PV Size (kW)	Code	Payback Period (yrs)	15 yr BCR	Capex $k
Export	Low Day	@50%	2kW	Res (EX-LD-2kW-@50%)	3.2	4.8	1.5
Export	Low Day	@100%	2kW	Res (EX-LD-2kW-@100%)	2.4	6.2	1.5
Export	Low Day	@200%	2kW	Res (EX-LD-2kW-@200%)	1.7	8.9	1.5
Export	Low Day	@50%	4kW	Res (EX-LD-4kW-@50%)	3.6	4.8	2.9
Export	Low Day	@100%	4kW	Res (EX-LD-4kW-@100%)	2.3	6.2	2.9
Export	Low Day	@200%	4kW	Res (EX-LD-4kW-@200%)	1.5	8.9	2.9
Own Use	High Day		2kW	Res (OU-2kW)	2.5	6.1	1.5
Export	High Day	@50%	4kW	Res (EX-HD-4kW-@50%)	2.9	5.2	2.9
Export	High Day	@100%	4kW	Res (EX-HD-4kW-@100%)	2.3	6.4	2.9
Export	High Day	@200%	4kW	Res (EX-HD-4kW-@200%)	1.8	8.2	2.9

Figure 23 Residential 15-yr Benefit Cost Ratio vs. Simple Payback Period (50% Capital Cost subsidy)

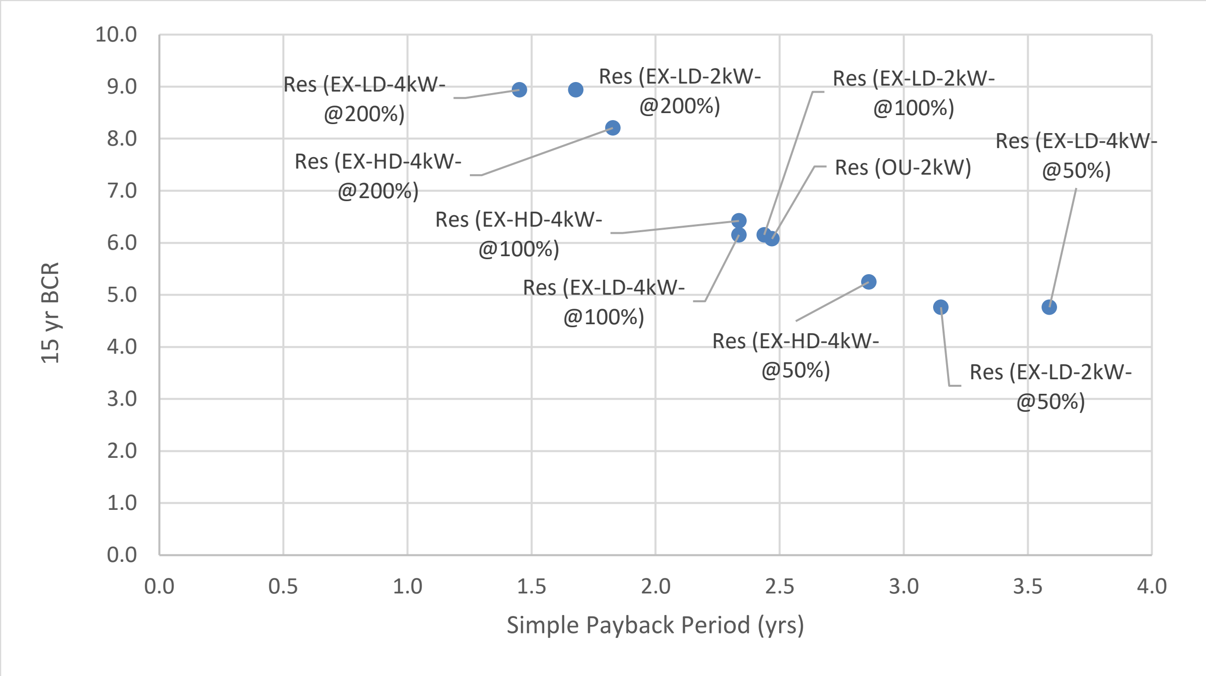


Table 9 and Figure 23 show the same simulation for the residential sector when considering a 50% capital cost subsidy. The range in payback periods declines significantly to as low as 1.5 years while yielding an 8.9 BCR under a low-demand day assumption with 200% buy-back rate and a 4kW system size.

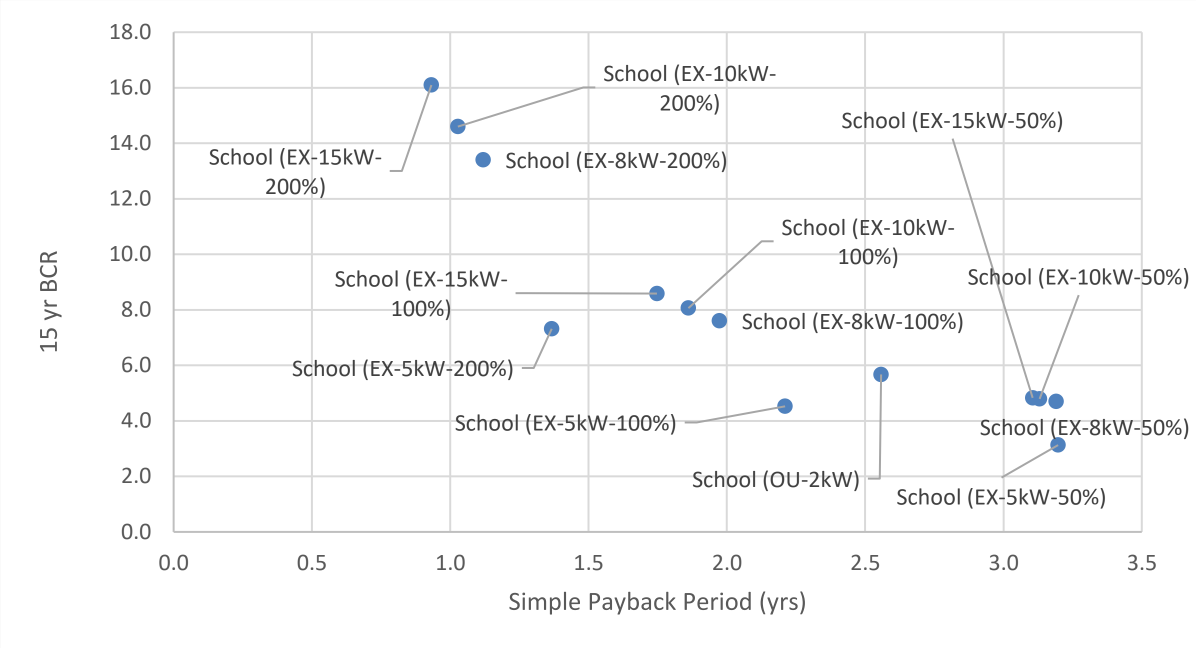
5.2 Schools

Table 10 shows the NEM Payback scenario results for schools under varying demand uses, export tariff buy-back rates (under a 24 cents / kWh assumption), and nominal system size.

Table 10 School Cost-Benefit Analysis

2kW Demand	Code	Nominal PV Size (kW)	Payback Period (yrs)	15 yr BCR	Capex $k
Own-Use	School (OU-2kW)	2kW	2.6	5.7	3
Export	School (EX-5kW-50%)	5kW	3.2	3.1	7
Export	School (EX-5kW-100%)	5kW	2.2	4.5	7
Export	School (EX-5kW-200%)	5kW	1.4	7.3	7
Export	School (EX-8kW-50%)	8kW	3.2	4.7	10
Export	School (EX-8kW-100%)	8kW	2.0	7.6	10
Export	School (EX-8kW-200%)	8kW	1.1	13.4	10
Export	School (EX-10kW-50%)	10kW	3.1	4.8	11
Export	School (EX-10kW-100%)	10kW	1.9	8.1	11
Export	School (EX-10kW-200%)	10kW	1.0	14.6	11
Export	School (EX-15kW-50%)	15kW	3.1	4.8	16
Export	School (EX-15kW-100%)	15kW	1.7	8.6	16
Export	School (EX-15kW-200%)	15kW	0.9	16.1	16

Figure 24 School 15-yr Benefit Cost Ratio vs. Simple Payback Period



For schools, the payback period was modelled to be as low as 0.9 years with a BCR of 16.1 when considering a 15-kW system exporting at 200% tariff, to as high as 3.1 years with BCR of 4.7 when exporting at a 50% tariff. Figure 24 charts the BCR and simple payback period across different PV configurations for schools.

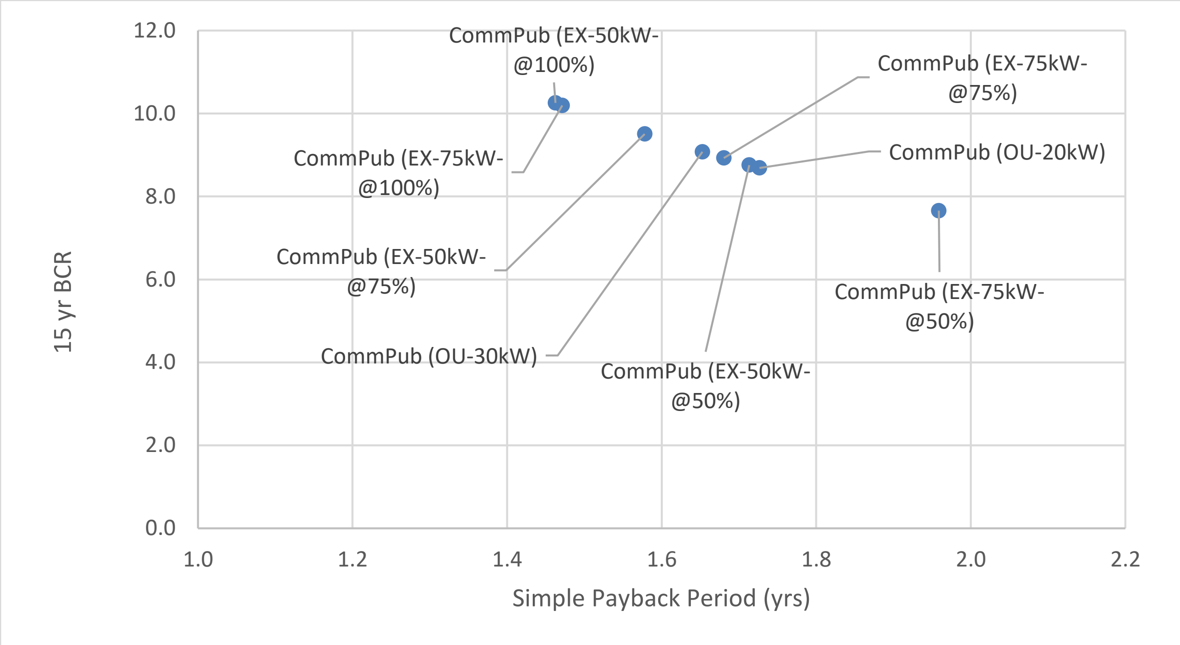
5.3 Commercial / Public / Government

Table 11 shows the NEM Payback scenario results for the Commercial/Public/Government sector under varying demand uses, export tariff buy-back rates (under a 24 cents / kWh assumption), and nominal system size.

Table 11 Commercial / Public / Govt Cost-Benefit Analysis

35kW Demand	Export on retail tariff buyback rate	Code	Payback Period (yrs)	15 yr BCR	Capex $k
Own-Use		CommPub (OU-20kW)	1.7	8.7	21
Own-Use		CommPub (OU-30kW)	1.7	9.1	30
Export	@50%	CommPub (EX-50kW-@50%)	1.7	8.8	45
Export	@75%	CommPub (EX-50kW-@75%)	1.6	9.5	45
Export	@100%	CommPub (EX-50kW-@100%)	1.5	10.3	45
Export	@50%	CommPub (EX-75kW-@50%)	2.0	7.7	68
Export	@75%	CommPub (EX-75kW-@75%)	1.7	8.9	68
Export	@100%	CommPub (EX-75kW-@100%)	1.5	10.2	68

Figure 25 Commercial / Pub / Govt 15-yr Benefit Cost Ratio vs. Simple Payback Period



For the commercial sector, payback periods ranged from 1.5 years with a BCR of 10.3 to 2 years with a BCR of 7.7, depending on the level of buy-back rates (50%-100%) considered. Figure 25 charts the BCR and simple payback period across different PV configurations for the commercial / public / government buildings sector.

5.4 Hospitals

Table 12 shows the NEM Payback scenario results for hospitals under varying demand uses, export tariff buy-back rates (under a 24 cents / kWh assumption), and nominal system size.

Table 12 Hospital Cost-Benefit Analysis

110kW Demand	Export on retail tariff buyback rate	Nominal PV Size (kW)	Payback Period (yrs)	15 yr BCR	Capex $k
Own-Use		Hospital (OU-80kW)	1.5	10.2	72
Own-Use		Hospital (OU-100kW)	1.5	10.2	90
Export	@50%	Hospital (EX-150kW-@50%)	1.6	9.3	135
Export	@75%	Hospital (EX-150kW-@75%)	1.5	9.8	135
Export	@100%	Hospital (EX-150kW-@100%)	1.5	10.3	135
Export	@50%	Hospital (EX-250kW-@50%)	1.9	7.8	225
Export	@75%	Hospital (EX-250kW-@75%)	1.7	9.0	225
Export	@100%	Hospital (EX-250kW-@100%)	1.5	10.2	225

Figure 26 Hospital 15-yr Benefit Cost Ratio vs. Simple Payback Period

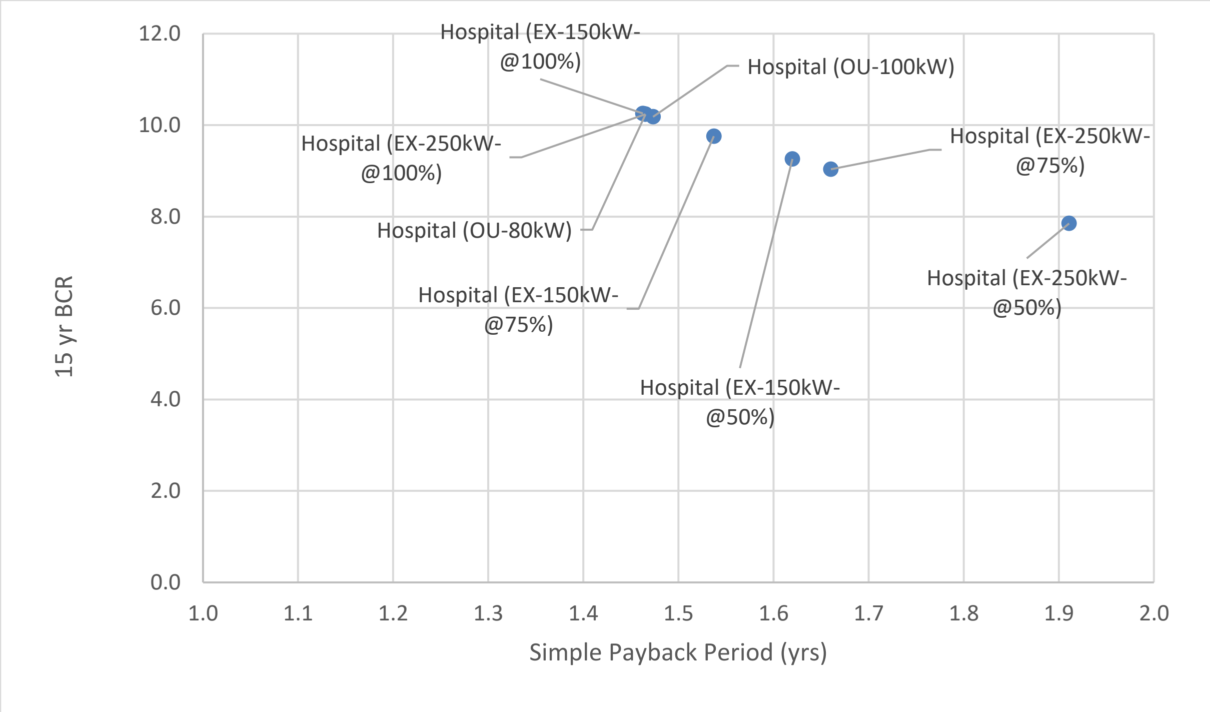


Figure 26 charts the results of the simulation for hospitals showing simple payback periods ranging from 1.5 years and 10.2 BCR to 1.9 years and 7.8 BCR, varying by different export retail buyback rates (50%-100%). Table 12

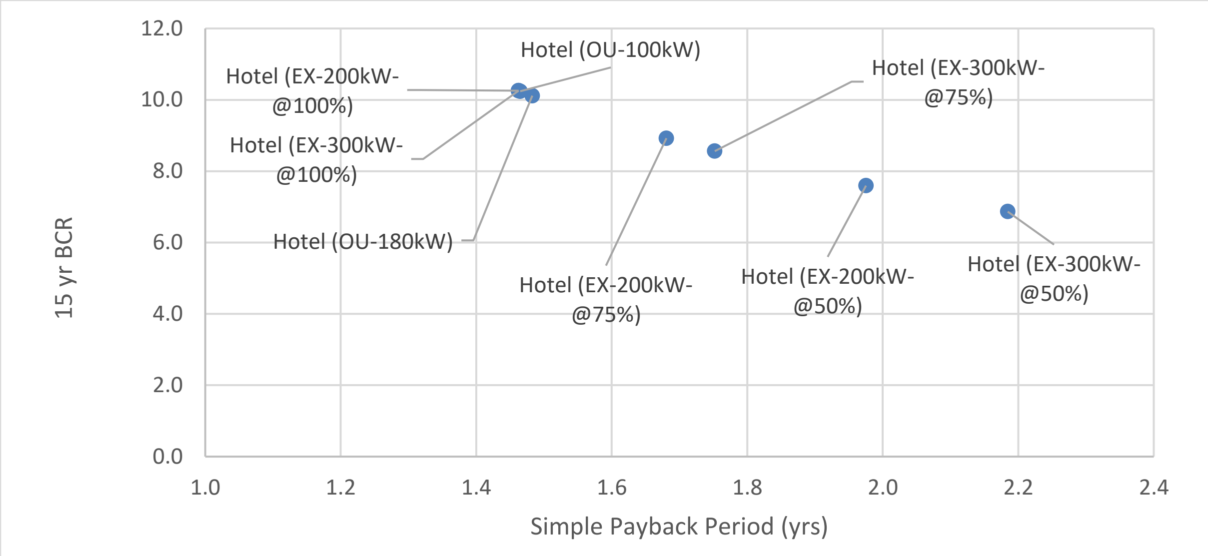
5.5 Hotels

Table 13 shows the NEM Payback scenario results for hotel sector under varying demand uses, export tariff buy-back rates (under a 24 cents / kWh assumption), and nominal system size. Figure 27 charts the modelling outputs for the hotel sector, showing the simple payback period ranging from 1.5 years and 10.3 BCR at a 100% tariff buyback rate, to 2.2 years and 6.9 BCR rate.

Table 13 Hotel Cost-Benefit Analysis

188kW Demand	Export on retail tariff buyback rate	Nominal PV Size (kW)	Payback Period (yrs)	15 yr BCR	Capex $k
Own-Use		Hotel (OU-100kW)	1.5	10.2	90
Own-Use		Hotel (OU-180kW)	1.5	10.1	162
Export	@50%	Hotel (EX-200kW-@50%)	2.0	7.6	180
Export	@75%	Hotel (EX-200kW-@75%)	1.7	8.9	180
Export	@100%	Hotel (EX-200kW-@100%)	1.5	10.3	180
Export	@50%	Hotel (EX-300kW-@50%)	2.2	6.9	270
Export	@75%	Hotel (EX-300kW-@75%)	1.8	8.6	270
Export	@100%	Hotel (EX-300kW-@100%)	1.5	10.3	270

Figure 27 Hotel 15-yr Benefit Cost Ratio vs. Simple Payback Period



5.6 Universities

Table 14 shows the NEM Payback scenario results for universities under varying demand uses, export tariff buy-back rates (under a 24 cents / kWh assumption), and nominal system size.

Table 14 University Cost-Benefit Analysis

Export on retail tariff buyback rate	Nominal PV Size (kW)	Payback Period (yrs)	15 yr BCR	Capex $k
	Univ's (OU-500kW)	1.5	10.2	450
	Univ's (OU-750kW)	1.5	10.2	675
@50%	Univ's (EX-1000kW-@50%)	1.5	9.7	900
@75%	Univ's (EX-1000kW-@75%)	1.5	10.0	900
@100%	Univ's (EX-1000kW-@100%)	1.5	10.3	900
@50%	Univ's (EX-1200kW-@50%)	1.6	9.2	1,080
@75%	Univ's (EX-1200kW-@75%)	1.5	9.8	1,080
@100%	Univ's (EX-1200kW-@100%)	1.5	10.3	1,080

Figure 28 University 15-yr Benefit Cost Ratio vs. Simple Payback Period

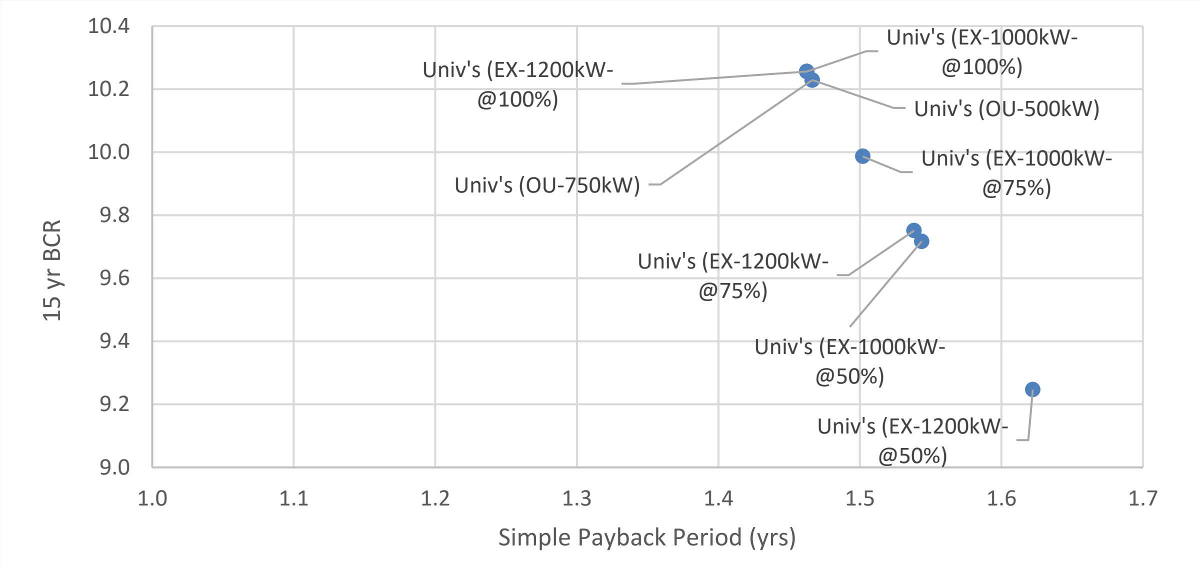


Figure 28 charts the modelling outputs for the universities, showing the payback period at around 1.5 years across all configurations, with the corresponding BCR dependent on the tariff buy-back rate (50%-100%).

5.7 Summary of NEM Payback Scenario Calculations

The results of the NEM Payback Scenario Calculations were shown across different types of consumers in Timor-Leste, including Residential, Schools, Commercial/Public/Government, Hospitals, Hotels, and Universities. Figure 29 below charts all simulation results across different consumer categories, each showing a different colour. All consumer classes except for residential have simple pay-back periods that are below 2.5 years with 15-year BCRs over 6.

Figure 30 that follows charts the simulation results across different buy-back rates, when compared with Figure 29 above it we can see that while some consumer classes are more sensitive than others to the impact of buy-back rates, the simple pay-back period for most cases stays within the 2.5-year range. This trend is shown more clearly on the next page in Figure 31, where commercial, hospital, hotel, and university sectors overall have simple pay-back periods between 1.5 and 2.2 years.

For schools, the minimum payback period was as low as 0.9 years and up to 3.2 years, indicating greater sensitivity to the buy-back rate offered (200% for 0.9 years and 50% for 3.2 years). The results for residential consumers were sensitive to buy-back rate, system size, and low/high demand. Figure 32 charts the corresponding BCR by consumer class. While residential consumers were less sensitive to changes from a BCR perspective, the school category had the greatest BCR range, from as low as 3.1 to as high as 16.1, indicating significant sensitivity to the buy-back rate offered.

Table 15 provides a summary of modelling results outputs by consumer class and export configuration. Overall, these results indicate that all consumer classes except for residential will yield low pay-back periods of under 3 years and BCR over 7 when provided with a 50% buy-back rate for net energy exports from their Solar PV systems under these assumptions. The residential sector will require a 100% buy-back rate to achieve a pay-back period below 5 years, without any capital subsidy, which is an alternative option for keeping a 50% buy-back rate while still encouraging adoption.

Figure 29 Summary of Pay-Back Period and BCR across different consumer classes

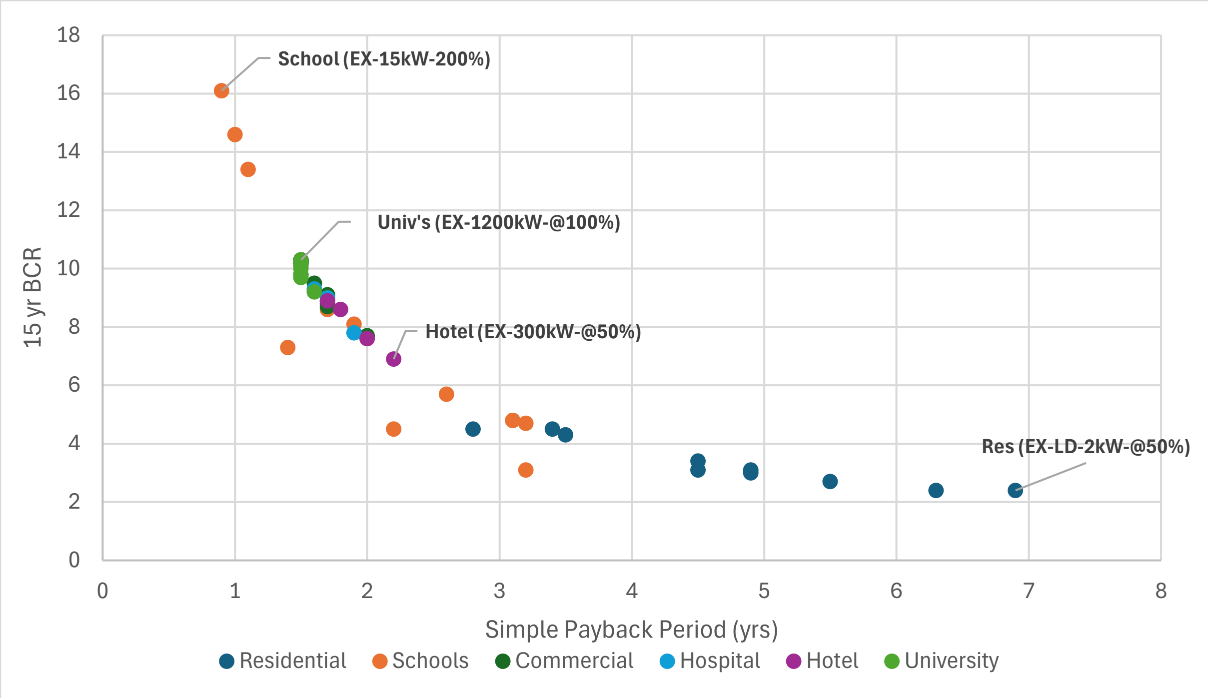


Figure 30 Summary of Pay-Back Period and BCR across different buy-back rates

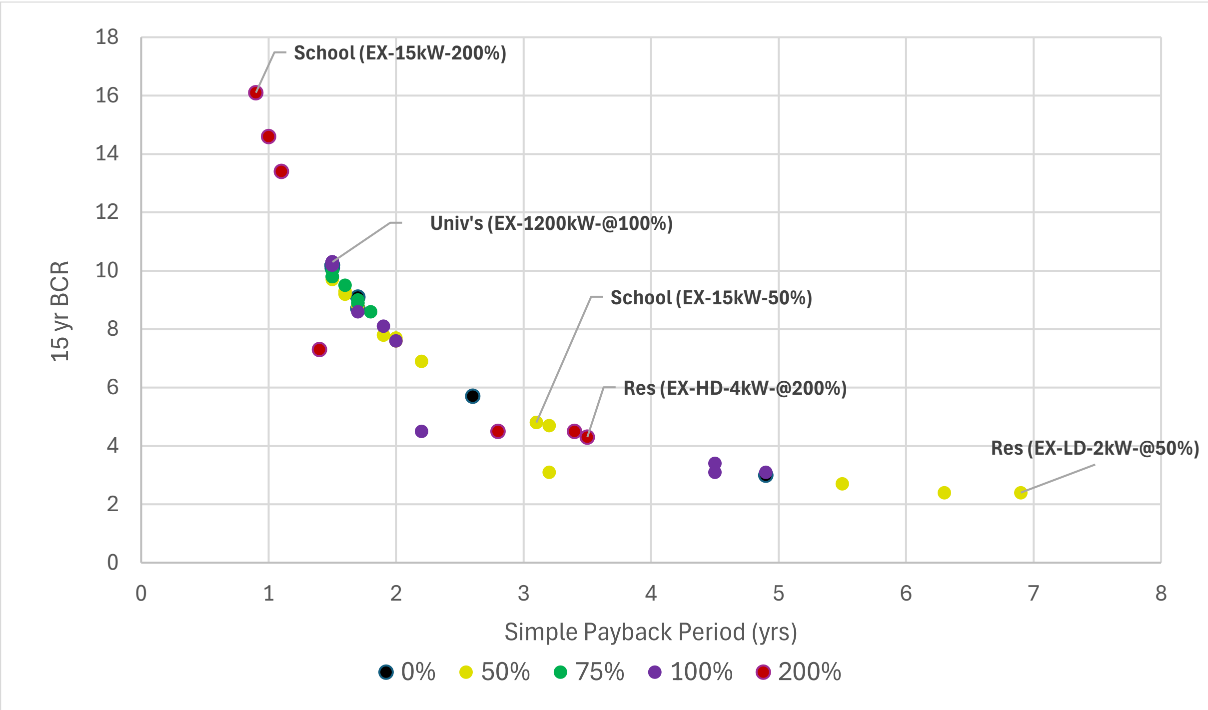


Figure 31 Summary of Pay-Back Period across different consumer classes

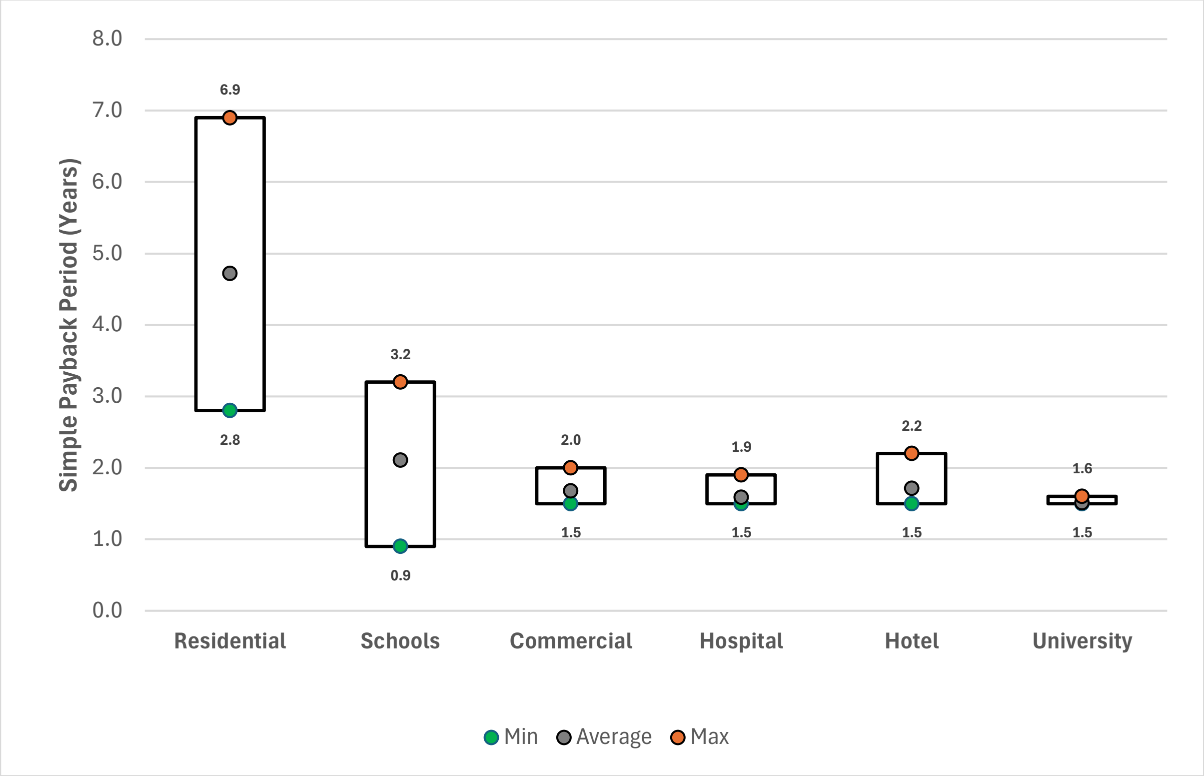


Figure 32 Summary of 15 Year BCR across different consumer classes

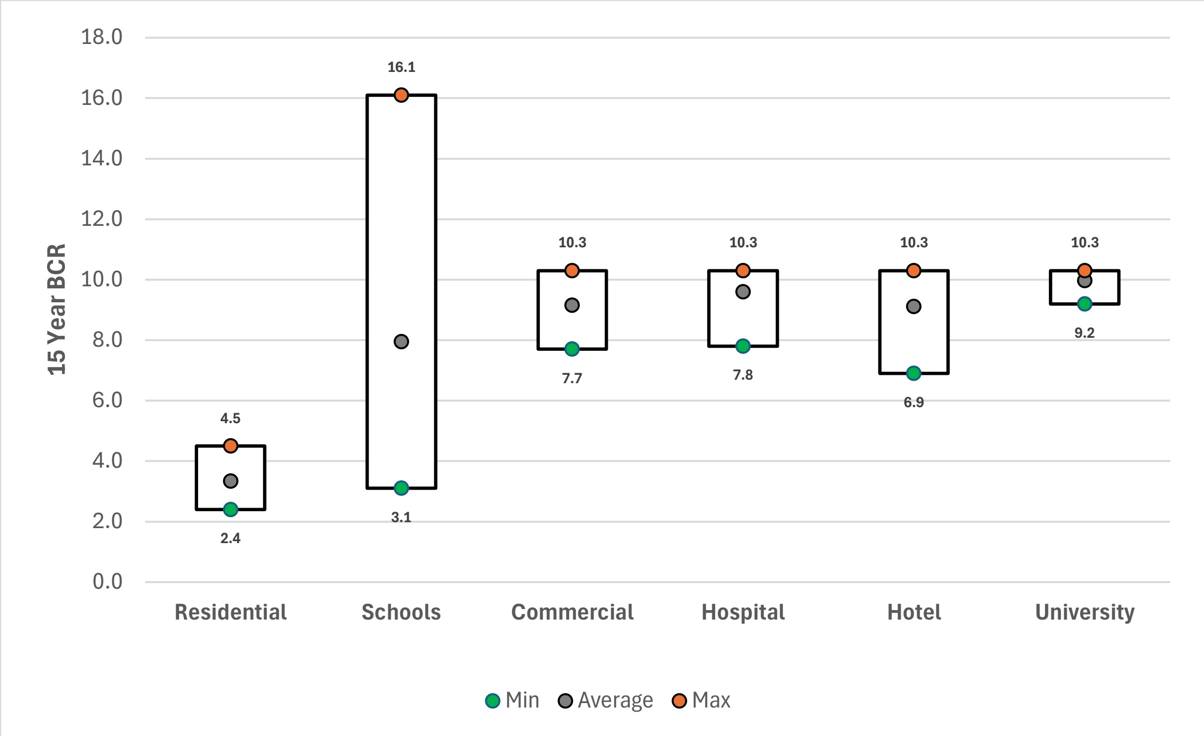


Table 15 Summary Table of Pay-Back Period and BCR across different consumer classes

Code	Own use / Export	Nominal PV Size (kW)	Export on retail tariff buyback rate	Capex $k	Payback Period (yrs)	15 yr BCR
Res (EX-LD-2kW-@50%)	Export	2kW	@50%	3	6.3	2.4
Res (EX-LD-2kW-@100%)	Export	2kW	@100%	3	4.9	3.1
Res (EX-LD-2kW-@200%)	Export	2kW	@200%	3	3.4	4.5
Res (EX-LD-4kW-@50%)	Export	4kW	@50%	5.5	6.9	2.4
Res (EX-LD-4kW-@100%)	Export	4kW	@100%	5.5	4.5	3.1
Res (EX-LD-4kW-@200%)	Export	4kW	@200%	5.5	2.8	4.5
Res (OU-2kW)	Own-Use	2kW		3	4.9	3
Res (EX-HD-4kW-@50%)	Export	4kW	@50%	5.5	5.5	2.7
Res (EX-HD-4kW-@100%)	Export	4kW	@100%	5.5	4.5	3.4
Res (EX-HD-4kW-@200%)	Export	4kW	@200%	**5.5**	3.5	4.3
School (OU-2kW)	Own-Use	2kW		3	2.6	5.7
School (EX-5kW-50%)	Export	5kW	@50%	7	3.2	3.1
School (EX-5kW-100%)	Export	5kW	@100%	7	2.2	4.5
School (EX-5kW-200%)	Export	5kW	@200%	7	1.4	7.3
School (EX-8kW-50%)	Export	8kW	@50%	10	3.2	4.7
School (EX-8kW-100%)	Export	8kW	@100%	10	2	7.6

Code	Own use / Export	Nominal PV Size (kW)	Export on retail tariff buyback rate	Capex $k	Payback Period (yrs)	15 yr BCR
School (EX-8kW-200%)	Export	8kW	@200%	10	1.1	13.4
School (EX-10kW-50%)	Export	10kW	@50%	11	3.1	4.8
School (EX-10kW-100%)	Export	10kW	@100%	11	1.9	8.1
School (EX-10kW-200%)	Export	10kW	@200%	11	1	14.6
School (EX-15kW-50%)	Export	15kW	@50%	16	3.1	4.8
School (EX-15kW-100%)	Export	15kW	@100%	16	1.7	8.6
School (EX-15kW-200%)	Export	15kW	@200%	16	0.9	16.1
CommPub (OU-20kW)	Own-Use	20kW		21	1.7	8.7
CommPub (OU-30kW)	Own-Use	30kW		30	1.7	9.1
CommPub (EX-50kW-@50%)	Export	50kW	@50%	45	1.7	8.8
CommPub (EX-50kW-@75%)	Export	50kW	@75%	45	1.6	9.5
CommPub (EX-50kW-@100%)	Export	50kW	@100%	45	1.5	10.3
CommPub (EX-75kW-@50%)	Export	75kW	@50%	68	2	7.7
CommPub (EX-75kW-@75%)	Export	75kW	@75%	68	1.7	8.9
CommPub (EX-75kW-@100%)	Export	75kW	@100%	68	1.5	10.2
Hospital (OU-80kW)	Own-Use	80kW		72	1.5	10.2
Hospital (OU-100kW)	Own-Use	100kW		90	1.5	10.2
Hospital (EX-150kW-@50%)	Export	150kW	@50%	135	1.6	9.3
Hospital (EX-150kW-@75%)	Export	150kW	@75%	135	1.5	9.8
Hospital (EX-150kW-@100%)	Export	150kW	@100%	135	1.5	10.3
Hospital (EX-250kW-@50%)	Export	250kW	@50%	225	1.9	7.8
Hospital (EX-250kW-@75%)	Export	250kW	@75%	225	1.7	9
Hospital (EX-250kW-@100%)	Export	250kW	@100%	225	1.5	10.2
Hotel (OU-100kW)	Own-Use	100kW		90	1.5	10.2
Hotel (OU-180kW)	Own-Use	180kW		162	1.5	10.1
Hotel (EX-200kW-@50%)	Export	200kW	@50%	180	2	7.6
Hotel (EX-200kW-@75%)	Export	200kW	@75%	180	1.7	8.9
Hotel (EX-200kW-@100%)	Export	200kW	@100%	180	1.5	10.3
Hotel (EX-300kW-@50%)	Export	300kW	@50%	270	2.2	6.9
Hotel (EX-300kW-@75%)	Export	300kW	@75%	270	1.8	8.6
Hotel (EX-300kW-@100%)	Export	300kW	@100%	270	1.5	10.3
Univ's (OU-500kW)	Own-Use	500kW		450	1.5	10.2
Univ's (OU-750kW)	Own-Use	750kW		675	1.5	10.2
Univ's (EX-1000kW-@50%)	Export	1000kW	@50%	900	1.5	9.7
Univ's (EX-1000kW-@75%)	Export	1000kW	@75%	900	1.5	10
Univ's (EX-1000kW-@100%)	Export	1000kW	@100%	900	1.5	10.3
Univ's (EX-1200kW-@50%)	Export	1200kW	@50%	1,080	1.6	9.2
Univ's (EX-1200kW-@75%)	Export	1200kW	@75%	1,080	1.5	9.8
Univ's (EX-1200kW-@100%)	Export	1200kW	@100%	1,080	1.5	10.3

6 NEM Policy Design for Timor-Leste

This section outlines the overall approach to developing a NEM Policy document for Timor-Leste, detailing the range of parameters that are required and provides guidance and recommendations to policy makers within the local context.

6.1 Approach to designing policy document

The overall approach to designing the policy document is to set out a series of parameters and definitions to form the initial legal, regulatory, and policy basis for developing a net-metering programme in Timor-Leste.

There are four key areas of parameters that are typically involved in implementing net metering for a power system:

- General Parameters
- Compensation Parameters
- Technical Parameters
- Administrative Parameters

In the sections that follow, we set out the typical requirements for each category of parameters while adding analysis rooted in the local context. These provisions are designed to provide government stakeholders guidance on the approach to developing a NEM policy document that can be adapted over time.

6.2 General Parameters

There are basic definitions and parameters that must be first outlined on the document to set provisions that can then be built upon and referenced in other sections. These include defining the basics around eligibility, technology types, system limits, program cap, other specifications:

- **Eligibility Criteria** – establishes what types of consumers are eligible for enrolling in the program. This may differ across regions, utilities, distribution areas, rural and urban, voltage levels, as well as class of consumer.
- **Technology Type** – here the acceptable types of renewable energy technologies are defined, which in the case of net-metering grid-connected is Solar PV. Recent trends have now added battery energy storage systems that are recommended or in some cases mandated to be installed alongside the Solar PV.
- **System Size Limit** – sets of the total PV system size limit that can be eligible to enrol in the net-metering program. In some cases, limits can be set for different types of consumer classes. Experience has shown that lower limits should be initially set and increased over time throughout NEM program implementation.
- **Program Cap** – defines the total system-wide cap for the NEM program adoption. This limit can also be set for different distribution areas or consumer classes, and it evolves over time as infrastructure and requirements of the power system changes.
- **Program Duration** (optional) – some NEM programs will set out a duration for the program that will allow new users to sign up and secure long-term agreements on offered conditions until a specified date. After that date, a new NEM program with

changes on conditions and / or compensation mechanisms would be offered for new consumers to enrol in.

6.3 Compensation Parameters

The policy document needs to include defining key parameters regarding the compensation mechanism, which includes provisions on how and when energy exports from enrolled NEM systems are compensated:

- **Tariff Structure** – what type of compensation scheme is being introduced. This should initially be defining a net-metering structure for Timor-Leste, where specifications for buy-back rates under different consumer classes are set out, detailing the $/kWh sold back to the grid.
- **Settlement Period** – here what is classified as exported generation from the PV system is established, with some rules around net-exporting are sometimes specified, ensuring consumption is first met (more relevant for tariff buy-back rates over 100%).
- **Excess Generation** – the horizon in which the net-energy exported being considered to receive compensation is defined here. This parameter typically would match the same period considered by the tariff structure.
- **Export Credit Expiry** – this sets out the rules surrounding the duration in which export credits must be used before they expire. For some consumers with low demand and large systems, a net export credit may sometimes result for that given settlement period. Credits can either expire for that period or can be rolled onto the following period.
- **Billing Mechanism** – defines how exported generation is processed as a credit on utility bills and sets out the approach taken to measure and track exports.

6.4 Technical Parameters

There are technical standards that must be defined, which are critical to implementing a NEM program. They typically involve provisions around grid interconnection, metering, and protections / safety requirements:

- **Interconnection Standards** – specify technical requirements for grid-connected PV systems, which typically follows standard grid-code procedures with additional provisions to reflect behind-the-meter conditions. These include provisions on power quality, voltage and frequency, and grid synchronization.
- **Metering Requirements** – to track exported energy, the installation of a bi-directional meter is required to measure both consumption and exports to the grid. Specifications on metering types and compatibility with utility requirements are also set out here.
- **Connection Approval Process** – this involves the requirements and process for approving new connection applications, which typically involves an on-site consultation with a local utility expert to carry out a connection impact assessment that ensures all requirements are met.
- **Protection & Safety Requirements** – these technical provisions outline necessary safety features for installation, grid synchronization, and operation, as well as protections against anti-islanding and overcurrent / over-under voltage.

6.5 Administrative Parameters

On the administrative size, key stipulations regarding the application process, monitoring and reporting requirements, as well as defining responsible organizations for regulatory oversight:

- **Application Process & Fees** – stipulates the process, requirements, and fees for applying to the NEM program. Here details are set out on the steps needed to first obtain and then submit an application, as well as scheduling of a connection impact assessment, and cost of and payment of associated fees.
- **Monitoring & Reporting** – sets out details on the performance requirements for NEM enrolled systems, including the monitoring of system stability and frequency and type of reporting required from consumers to the utility.
- **Regulatory Oversight** – defines the government organizations responsible for rule setting and leading regulatory oversight of the NEM program. This also typically involves annual reporting on the implementation for the program, detailing data on the number of consumers added and total program capacity.
- **Consumer Protection Provisions** – includes things like guarantees and specified protections for consumers enrolling in the NEM system, ensuring long-term agreements entered are adhered to and investments in PV systems based on net-metering are low-risk.

6.6 Conclusions and Recommendations

Below we have set out a series of recommendations to Timor-Leste policy makers on the approach to designing a NEM program for the country. These recommendations reflect analysis on best practices and lessons learned from international experience, NEM payback scenario modelling for Timor-Leste, and application of key NEM principles to the local context.

1) **Start with basic NEM Compensation Scheme** – experience has shown it is best practice to begin with a simple net energy metering compensation scheme that involves providing credits on utility bills for energy exported. The mechanism can adapt over time to fit the changing needs of the power system, such as introducing time of use elements and considering different settlement periods.
2) **Tariff Buy-Back Rate setting** – NEM modelling results for Timor-Leste indicated that all consumer classes except for residential would yield low pay-back periods of under 3 years and BCR over 7 when provided with a 50% buy-back rate for net energy exports from their Solar PV systems. The residential sector will require a 100% buy-back rate to achieve a pay-back period below 5 years, without any capital subsidy, which is an alternative option for keeping a 50% buy-back rate while still encouraging adoption.
3) **Set hosting capacity limits** – is important for smaller power systems such as Timor-Leste, which involves considering maximum NEM program cap limits at the distribution level. These set caps should be monitored closely and adjusted throughout deployment over time.
4) **Establish simple technical standard** – basic technical requirements, such as bidirectional metering, inverter standards, and other safety & protection features are critical to set out prior to NEM program implementation.

5) **Streamline administrative process** – the process to apply, install, and interconnect PV systems to the NEM program should be as streamlined as possible, lowering the barriers to entry for potential consumers.

6) **Develop detailed policy document** – an official government NEM policy document should be developed as a first step, defining key parameters we have outlined in this report, and undergoing a consultation and revision process before implementation.

7) **Establish NEM deployment targets** – developing target for behind the meter Solar PV development at the high-policy level has shown to be a key driver for successful NEM programs. This can be implemented as a sub-target under Timor-Leste's overall renewable energy targets.

7 Draft Net Metering Policy

This section sets out a proposed draft Net Metering Policy based on the design of section 6. The proposed Net-Metering Policy approach takes a "start-simple, evolve-as-needed" framework to match Timor-Leste's current conditions where rooftop solar is in its infancy and where network infrastructure monitoring is limited.

Starting with retail-rate net-metering and monthly credit rollover gives households, schools and businesses a clear and bankable incentive to invest in rooftop solar while the national utility gains experience integrating distributed generation.

A review mechanism has been incorporated to enable Ministry of Public Works and the regulator (DGREAS) to transition as penetration levels increase and monitoring & operations improve over time — to net-billing or time-of-use settlement, ensuring long-term financial sustainability and cost-reflective pricing.

Note that we briefly summarise the context and background to the legal basis for Timor Leste's electricity industry and its institutional structure.

Throughout the policy there are some "touchpoints" for cross-referencing technical codes and standards which will be considered on the Grid Code development component of the project.

7.1 Context and Background

The legal basis for the electricity sector in the Democratic Republic of Timor-Leste is based on several national laws and decree-laws that establish the policy, regulatory and operational framework for generation, transmission and distribution of electricity.

7.1.1 Legal basis

The legal foundation of the electricity sector is primarily based on:

- Decree-Law No. 13/2003, "Bases for the National Electricity System," sets out the principles governing the production, transmission and distribution of electricity and defines electricity as an essential public service.
- Decree-Law No. 22/2006, "Tariff Regulations," establishes the process and criteria for setting and revising electricity tariffs to ensure cost recovery and consumer protection.
- Decree-Law No. 29/2020, "Creation of Electricidade de Timor-Leste, Empresa Pública," creates the national electricity public company and provides its statutes, mandating the modernisation, expansion and reliable operation of the national grid.

7.1.2 Institutional framework

The laws above and subsequent government reforms define three key institutions with complementary roles as follows:

- **Policy Lead – Ministry of Public Works (MOP)**. The MOP is responsible for overall energy and electricity policy, including water and sanitation. It houses the electricity directorates and provides the strategic policy framework for sector development.
- **Regulator – DGREAS (Direção-Geral para a Regulação dos Setores de Eletricidade, Água e Saneamento).** Operating under the MOP, DGREAS is the national regulatory

directorate charged with administering the electricity regulatory framework, monitoring sector performance, and ensuring compliance with technical and economic standards. Government reforms consolidated the former standalone authorities (ANE/ANAS) into DGREAS to provide integrated regulation of electricity, water and sanitation.

- **State-owned Utility – EDTL, E.P. (Eletricidade de Timor-Leste, Empresa Pública).** Created by Decree-Law No. 29/2020, EDTL is the state-owned enterprise responsible for the generation, transmission, distribution and sale of electricity nationwide. EDTL implements government policy objectives for reliable and affordable electricity supply but does not have a policy or regulatory role in Net Energy Metering beyond normal commercial operations.

7.1.3 Implications for Net Metering Policy and Renewable Energy Development

This legislative and institutional structure provides the legal certainty and governance required to implement new market mechanisms—such as Net Energy Metering (NEM)—that will enable Timor-Leste to expand renewable energy, reduce dependence on imported diesel generation, and support a sustainable, low-carbon electricity system.

7.2 Purpose and Scope

This Policy establishes a national framework to enable grid-connected consumers ("prosumers") to generate electricity from renewable sources—primarily rooftop solar photovoltaic (PV)—and to offset their electricity consumption with exports to the national grid.

It aims to:

- Reduce reliance on diesel generation and lower electricity costs,
- Stimulate private investment in renewable energy, and
- Promote a flexible and resilient power system.

7.3 Legal and Regulatory Basis

7.3.1 Issuing Authority

This Net-Metering Policy is issued by the Ministry of Public Works (MOP) of the Democratic Republic of Timor-Leste, pursuant to the powers granted under:

- Decree-Law No. 13/2003 – Bases for the National Electricity System, which establishes the principles for the production, transmission and distribution of electricity as a public service; and
- Decree-Law No. 22/2006 – Tariff Regulations, which provides the legal basis for setting and revising electricity tariffs.

The Ministry acts as the policy-making authority for the electricity, water and sanitation sectors and is empowered to issue binding policy directives for the electricity industry.

7.3.2 Institutional Roles

To ensure clear separation of functions, the following institutions perform complementary roles under this Policy:

- Ministry of Public Works (MOP) – Policy Lead:
  - Issues the Net-Metering Policy and any future amendments.
  - Sets national targets and strategic directions for distributed renewable energy.
  - Approves the tariff methodology for net-metering credits in consultation with the Ministry of Finance and other relevant agencies.
- Direção-Geral para a Regulação dos Setores de Eletricidade, Água e Saneamento (DGREAS) – Regulator:
  - Administers and enforces this Policy and the related provisions of the National Electricity System law.
  - Licenses or registers qualified net-metering installations.
  - Monitors compliance by both EDTL and participating customers, including technical and safety standards.
  - Reviews data and reports on program performance and advises MOP on any necessary policy adjustments.
- Electricidade de Timor-Leste, Empresa Pública (EDTL, E.P.) – National Utility
  - Provides and maintains the physical grid connection for approved prosumers.
  - Installs and operates bi-directional revenue-grade meters.
  - Applies the approved net-metering credits on customer bills and provides DGREAS with periodic data for compliance monitoring.
  - EDTL has no policy-making or regulatory function under this Policy.

7.3.3 Operationalisation

To operationalise this Policy, the Ministry of Public Works may issue Ministerial Orders or Implementing Instructions (Despacho Ministerial) detailing technical standards, metering specifications, and administrative procedures. DGREAS may issue supplementary regulatory guidelines consistent with this Policy to clarify compliance and reporting requirements.

7.4 Eligibility and Size Caps

The customer classes will include:

- Residential
- Schools
- Commercial/public/government buildings
- Hospitals, and
- Hotels and universities.

The system size caps will apply as follows:

- An initial limit of <= 50 kW for low-voltage connections, and <= 250 kW for medium-voltage connections, or up to 80 % of the customer's peak demand, whichever is lower, and

- A system-wide cap of 5% of feeder peak demand to apply for the first three years, reviewed biennially:

Eligible technologies:

- Grid-connected rooftop PV systems, meeting appropriate national equipment standards[22].

7.5 Metering & Interconnection

- Bi-directional, revenue-grade meters shall measure both electricity imports and exports.
- Interconnection shall follow appropriate technical standards[23].
- EDTL shall publish a simplified interconnection application and approval process, with standard service timelines.

7.6 Compensation Mechanism

Net-Metering Regime in the initial phase shall be characterized by the following:

- Electricity exported to the grid shall be credited to the customer's monthly bill at the prevailing retail tariff (generation + network components minus non-bypassable charges, if any)
- Monthly rollover of unused credits; credits expire after 12 months.

Review mechanism:

- After three to five years or when rooftop PV penetration exceeds agreed thresholds, the Government may transition to Net-Billing or Time-of-Use (ToU) pricing, based on system conditions and cost-recovery needs.

Note that further explanation of the compensation mechanism proposed is set out in Annex B.

7.7 Tariff and Charges

- A minimum monthly service charge shall apply to all customers to ensure recovery of fixed distribution costs.
- Any network upgrade costs required solely to accommodate a prosumer's system will be borne by the applicant.

7.8 Administrative Provisions

- Application Process: EDTL shall issue standard forms and publish an online checklist of required permits and approvals.
- Approval Timeline: EDTL shall complete technical review and provide connection approval within 20 working days of a complete application.
- Record-keeping: DGREAS shall maintain a registry of all NEM participants and report annual uptake to the Ministry of Energy and Natural Resources.

[22] For consideration in the Grid Code component of this project.
[23] Note that the technical standards should be defined in the Grid Code being developed under this project.

7.9 Tariff and Charges

DGREAS shall conduct a comprehensive review every three years, considering:

- Total installed NEM capacity and grid impacts,
- Financial implications for EDTL and customers, and
- Potential migration to Net-Billing or ToU settlement.

7.10 Transitional Arrangements

Early participants shall be grandfathered under the net-metering compensation terms for a minimum of 10 years from date of interconnection, unless mutually agreed otherwise.

8 Annex A: Additional International Experience in NEM

This section features some additional review of international NEM experience from countries that are not islands but have relevant lessons learnt that were considered when designing the approach for Timor-Leste.

8.1 Spain

8.1.1 Summary of Net Metering Experience

The Royal Decree 244/2019, published on April 6th, 2019, outlines the regulatory framework for self-consumption of electricity in Spain. It introduces two main modalities: self-consumption without surpluses, where energy is only used by the consumer, and self-consumption with surpluses (Net-Energy Metering), which allows energy to be injected into the grid, with the customer acting as both a consumer and producer (prosumer). The decree permits collective self-consumption, where multiple consumers share the same generation installation, and each participant interacts individually with the distribution utility.

The compensation mechanism for surplus energy exports is based on the Royal Decree-Law 15/2018, exempting renewable self-consumption from charges and tolls. The new decree provides a simplified compensation model, allowing deficits to be offset against surpluses, with a cap on compensation set by the customer's grid consumption. For each billing cycle, customers with surplus energy receive compensation in the form of a discount, but they cannot be compensated more than the amount of energy consumed from the grid.

8.1.2 Background

On April 6th, 2019, Royal Decree 244/2019, dated April 5th, was officially published in the Official State Gazette. This decree outlines the regulatory framework for the administrative, technical, and economic conditions governing the self-consumption of electricity.[24]

8.1.3 Policy, Regulatory, and Legal Framework

The Policy, Regulatory, and Legal Framework for self-consumption in Spain is primarily governed by Royal Decree 244/2019, which establishes the regulatory conditions for both individual and collective self-consumption of electricity.

According to this new Royal Decree 244/2019, self-consumption can now be either individual or collective. In the case of collective self-consumption, multiple consumers are permitted to draw electricity from the same generation installation. Each participant communicates individually with the distribution utility, which acts as the entity responsible for metering. To enable this arrangement, all participants must sign a unified agreement that outlines the criteria for the distribution of self-consumed energy among them.

One of the most significant aspects of the new Royal Decree is the establishment of specific modalities for self-consumption, as follows:

[24] https://www.osborneclarke.com/insights/analysis-key-developments-introduced-new-royal-decree-2442019-5th-april-regulating-administrative-technical-economic-conditions-self-consumption-electrical-energy

- Self-Consumption without surpluses: In this modality, mechanisms must be installed to prevent surplus energy from being injected into the transmission or distribution network. Here the customer can only act as consumer
- Self-Consumption with surpluses (Net-Energy Metering): This modality allows energy to be used for self-consumption while enabling surplus energy to be injected into the transmission or distribution networks. Here the customer is allowed to be a prosumer (both consumer and producer of electricity). Installations in this category benefit from a surplus compensation mechanism, provided they meet specific conditions.[25]

8.1.4 Compensation mechanism

Under Royal Decree-Law 15/2018, self-consumption from renewable energy sources is exempt from all charges and tolls. Building on this, the new Royal Decree introduces a simplified compensation mechanism. This mechanism allows the deficits of self-consumers to be offset against the total surpluses generated by associated installations, provided these installations have a maximum capacity of 100 kW.

For every billing cycle, the customer with the "Self-Consumption with surpluses" modality receives compensation for the exported surplus electricity in the form of a discount. There is a regulated limit called the "compensation limit" used in the calculation of the surplus compensation which states the customer cannot be financially compensated with a value higher than the kWh consumed from the grid.[26]

8.1.5 Status of Implementation

As of June 2023, Endesa, a multinational electrical utility company in Spain reported over 200,000 self-consumption installations across its network, including 85,000 new installations in the first half of the year which is almost 3.5 times the amount added in 2021. Collective installations have also seen significant growth, tripling from 161 in early 2023 to 488 by June, serving over 2,400 customers.

The combined installed capacity of these systems totals 3 GW, with nearly 99% feeding surplus energy back into the grid.[27]

8.1.6 Key Lessons Learnt

A key lesson for Timor-Leste in implementing net metering is to create clear regulations that support both individual and collective self-consumption, ensuring flexibility and broad adoption. A well-defined surplus compensation mechanism can incentivize renewable energy use by fairly compensating consumers for excess energy exported to the grid.

Additionally, it's important to also implement financial limits along with incentives, like the "compensation limit" in Spain, to ensure sustainability and prevent overcompensation. This ensures that the system is viable for both consumers and energy utilities.

[25] Ibid.
[26] https://www.endesa.com/en/catalog/endesa-self-consumption/compensation-surpluses
[27] https://www.smart-energy.com/regional-news/europe-uk/self-consumption-connections-accelerate-in-spain/

8.2 Australia (Victoria)

8.2.1 Summary of the Net-Metering Experience

Victoria's net-metering and solar rooftop policies have evolved to promote RE adoption while also balancing market dynamics. Initially, premium feed-in tariffs (PFITs) exceeding retail electricity rates incentivized solar rooftop installations. However, as solar technology became more affordable, the tariffs were reduced, encouraging consumers to maximize self-consumption of their generated electricity. The Essential Services Commission (ESC) regulates feed-in tariffs, requiring retailers to offer at least the annually revised minimum rates, which are now lower than retail electricity prices.

The compensation mechanisms include two primary feed-in tariffs: single-rate and time-varying tariffs. These rates reflect declining wholesale electricity prices due to increased solar generation during the day, particularly from rooftop and utility-scale PV systems. While the PFIT scheme ended in 2024 after a 15-year term, current tariffs (much lower than the retail price) continue to support solar adoption under Victoria's renewable energy target of 50% by 2030, aligning with broader national electricity market regulations.

8.2.2 Background

In the early stages of promoting solar rooftop adoption in Victoria, the government implemented premium solar feed-in tariffs, which are more than the retail price of electricity. This initiative aimed to incentivize households and businesses to invest in solar rooftop systems.

Over time, as the cost of solar rooftop systems decreased and the technology became more accessible, the feed-in tariff rates were adjusted and are now lower than retail electricity rates. As a result, customers with solar installations are advised to maximize their consumption of the electricity generated by their systems to offset the higher retail electricity costs. Surplus electricity can then be exported to the grid, although it will be compensated at a rate lower than the retail electricity price. This approach encourages self-consumption and supports the efficient use of solar energy.[28]

8.2.3 Policy, Regulatory and Legal Framework

Victoria's renewable energy policies, including the 50% Renewable Energy Target (VRET) by 2030, rely on mechanisms like net metering to promote solar adoption and reduce fossil fuel dependency.[29]

Victoria operates under a regulated feed-in tariff system rather than traditional net metering. The Essential Services Commission (ESC) oversees this framework, setting minimum feed-in tariff rates that electricity retailers must offer to customers who export solar energy back to the grid.[30]

The legal framework for electricity markets for retail customers in Victoria operates within the National Electricity Market (NEM), managed by Australian Electricity Market Operator (AEMO)

[28] https://www.energy.vic.gov.au/households/solar-premium-feed-in-tariff
[29] https://www.energy.vic.gov.au/renewable-energy/victorian-renewable-energy-and-storage-targets
[30] https://www.esc.vic.gov.au/electricity-and-gas/electricity-and-gas-tariffs-and-benchmarks/minimum-feed-tariff

under the National Electricity Law (NEL)[31], National Electricity Rules[32], and National Energy Retail Law (Victoria) Act 2024 (NERL)[33].

8.2.4 Compensation Mechanisms

8.2.4.1 Solar Premium Feed-in Tariff Scheme (PFIT)

In 2009, Government of Victoria introduced a solar premium feed-in tariff (PFIT) scheme for Victorians installing RTS systems. This scheme was legislated to run for 15 years and closed new applications by end of 2011 as it met the capacity. As part of this scheme, eligible solar customers with small scale solar rooftop systems with a capacity of under 5 kW receive a PFIT credit of 60 cents/kWh for excess electricity exported to the grid.

On 1 November 2024, with the completion of 15 years since inception, the PFIT scheme ended, and the retailers are no longer obligated to provide the premium feed-in tariff to the customers, and all the customers with solar PV get a solar feed-in tariff for exports which is described in detail in Section 7.2.4.2.

8.2.4.2 Solar Feed-In Tariff

Customers with solar rooftop systems are incentivised for exporting excess electricity to the grid by feed-in tariffs which are lower than the retail electricity price.

Energy retailers in Victoria also offer two kinds of feed-in tariffs including a single-rate feed-in tariff that applies regardless of the time of day or day of week and a time varying tariff that pays differently depending on the time of day and day of week. The retailers are also obligated to provide at least the minimum tariff, which is set and revised annually by the Essential Services Commission (ESC).

Minimum feed-in tariffs for 2024-2025 for both the single rate and time varying tariffs set by the ESC are shown in Table 16.

Table 16 Minimum feed-in tariffs for 2024-2025 (Victoria) – in AUD

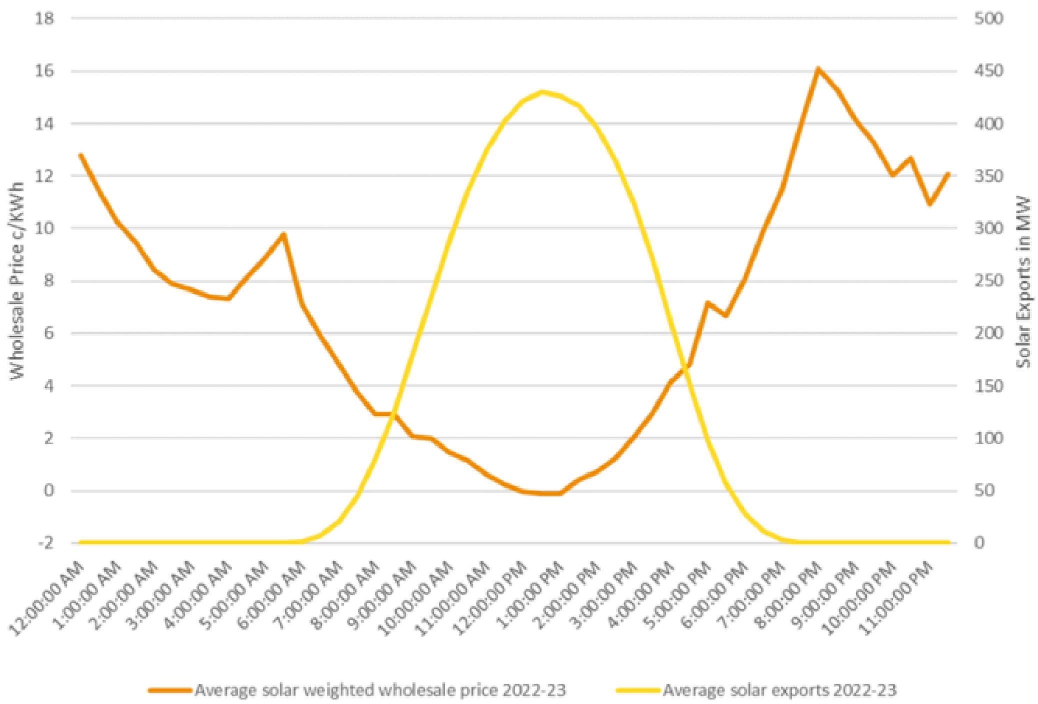
Flat minimum rate (at all times)		
3.3 c/kWh		
Time-varying minimum rates		
Option 1		
Overnight Weekdays: 10 pm to 7 am Weekends: 10 pm to 7 am	**Day** Weekdays: 7 am to 3 pm, 9 pm to 10 pm Weekends: 7 am to 10 pm	**Early evening** Weekdays: 3 pm to 9 pm Weekends: n/a
7.6 c/kWh	2.8 c/kWh	7.0 c/kWh
Option 2		
Shoulder Everyday: 9 pm to 10 am 2 pm to 4 pm	**Off-peak** Everyday: 10 am to 2pm	**Peak** Everyday: 4 pm to 9 pm
4.1 c/kWh	2.1 c/kWh	8.4 c/kWh

[31] https://www.aemc.gov.au/regulation/legislation
[32] https://www.aemc.gov.au/regulation/energy-rules/national-electricity-rules
[33] https://www.legislation.vic.gov.au/as-made/acts/national-energy-retail-law-victoria-act-2024

Source: https://www.esc.vic.gov.au/electricity-and-gas/electricity-and-gas-tariffs-and-benchmarks/minimum-feed-tariff

The minimum feed-in tariff rates for solar exports have declined over time due to the significant growth in rooftop and utility-scale PV installations. This expansion has increased the daytime electricity supply while reducing demand. Consequently, wholesale electricity prices, particularly during periods of peak solar exports, have decreased. This reduction in solar-weighted wholesale prices has resulted in the downward trend in feed-in tariff rates. A graph illustrating the low wholesale electricity prices during the day when solar exports are high is shown in Figure 33.

Figure 33 Average solar weighted wholesale prices and solar exports over the day



Source: https://www.esc.vic.gov.au/electricity-and-gas/electricity-and-gas-tariffs-and-benchmarks/minimum-feed-tariff

8.2.5 Status of Implementation

As of 2024, solar energy systems have been installed in 30% of homes across Victoria, totalling 352,862 installations. This includes 275,643 solar panel systems with a combined capacity of 2 GW, 17,460 solar battery systems, and 30,474 solar hot water systems.[34]

This was made possible due to various incentives and subsidies introduced by the Victorian Government including the Solar Homes Program (SHP), PFIT and FIT schemes (for net metering).

8.2.6 Key Lessons Learnt

Key lessons learnt for Timor Leste are:

[34] https://www.pv-magazine-australia.com/2024/08/13/victorian-rooftop-solar-uptake-exceeds-five-million-panels-and-2-gw-of-power/

- While introducing net metering in the country start with strong incentives, like premium feed-in tariffs, to boost solar adoption but transition to market-aligned tariffs as costs decline.
- A clear regulatory framework and adaptable compensation models, like time-varying tariffs, are crucial.

8.3 Vietnam

8.3.1 Summary of Net-Metering Experience

Vietnam's net-metering mechanisms have evolved significantly since their introduction in 2017. Initially, a net-metering system under Decision No. 11/2017/QD-TTg allowed surplus electricity from rooftop solar (RTS) to be carried over to the next billing cycle, with any remaining electricity sold to the grid at a tariff of VND 2,086/kWh. However, this system was reformed in 2019 to an all-buy all-sell approach under Decision No. 02/2019/QD-TTg, where customers paid for electricity imported from the grid and sold excess solar energy back at the same tariff. This led to rapid and uncontrolled development of RTS, which led to the discontinuation of the scheme in 2020.

In 2024, Vietnam proposed a new net-metering scheme to address these challenges. The updated system retains the carry-forward mechanism for surplus electricity but introduces a reduced tariff of VND 671/kWh (USD 0.027/kWh), significantly lower than the 2017 rate. Additionally, a cap has been placed on exported electricity, limiting it to no more than 20% of the total energy generated by the RTS system. This new approach aims to balance renewable energy growth with grid stability while providing clear compensation for solar energy producers.

8.3.2 Background

In 2017, Vietnam started by implementing a net-metering mechanism which was then reformed in 2019 to an all-buy all-sell approach where exporting to the grid required consumers to sign a long-term feed-in-tariff agreement at predetermined rate. This approach resulted in a remarkable uncontrolled development of RTS solar PV in the country, due to favourable FIT rates offered, and has since been discontinued in 2020. In 2024, Vietnam proposed plans to launch a new net-metering scheme for RTS.

8.3.3 Policy, Regulatory and Legal Framework

On 22 October 2024, the Vietnamese government officially issued Decree No. 135/2024/ND-CP, which establishes the mechanism and policy framework to incentivize the development of self-consumption RTS. This decree provides a legal foundation for the expansion of RTS in alignment with the national power development master plan for the period 2021–2023 ("PDP8") and addresses the challenges faced by RTS developers following the expiration of feed-in-tariff policies (net-metering schemes detailed in sections below).

8.3.4 Compensation mechanisms

8.3.4.1 Net-Metering Scheme (Decision No: 11 /2017/QD-TTg)[35]

In 2017, Vietnam introduced Decision No. 11/2017/QD-TTg, which established a FIT mechanism for solar projects. According to Clause 2, Article 12 of this decision, RTS systems benefit from a net-metering scheme. Under this arrangement, any surplus electricity generated during a payment cycle if it is more than consumption is carried forward to the subsequent cycle.

At the end of the calendar year, or upon the termination of the Power Purchase Agreement (PPA), any remaining surplus electricity is sold to the Electricity Buyer, Vietnam Electricity Corporation (EVN), at the tariff rate specified in Clause 1 of the same article. This rate is set at VND 2,086/kWh (USD 0.0935/kWh).

The adjustment of the FIT, subject to fluctuations in the VND-USD exchange rate, shall be implemented in accordance with the Standard Power Purchase Agreement (SPPA) issued by the Ministry of Industry and Trade (MoIT).

8.3.4.2 All-buy all-sell approach (Decision No: 02/2019/QD-TTg)[36]

In 2019, Vietnam introduced Decision No. 02/2019/QD-TTg, amending certain provisions of Decision No. 11/2017/QD-TTg to further promote the development of solar power projects. According to Article 1 of this decision, customers with rooftop solar (RTS) systems are permitted to separately apply an electricity transaction mechanism based on the input and output recorded by two-way electricity meters.

Under this mechanism, customers with RTS pay for the electricity received from the grid at a price in accordance with the prevailing regulations. EVN pays the customer for the electricity exported the grid at the same price as mentioned in clause 1 of Article 12 in Decision No.11/2017/QD-TTg, which is VND 2.086/kWh.

This mechanism was later discontinued in 2020 following uncontrolled development of RTS solar PV in the country.

8.3.4.3 Net-Metering Scheme (Proposed in 2024)[37]

In September 2014, Vietnam announced plans to introduce a new net-metering scheme for RTS systems. Under this scheme, similar to the one introduced in 2017 (as mentioned in Section 7.3.4.1), any surplus electricity generated during a payment cycle if it is more than consumption is carried forward to the subsequent cycle, and at the end of year or if the PPA is terminated, the remaining surplus sold to EVN at the new proposed tariff of VND 671/kWh (USD 0.027/kWh), which is lower than the tariff rate from 2017. In addition, the government has introduced a restriction on the volume of electricity that can be exported to the grid. Under this new scheme, the electricity exported must not exceed 20% of the total power generated by the RTS system.

[35] Prime Minister's Decision No. 11/2017/QD-TTg of 2017 on the Mechanism for Encouragement of the Development of Solar Power Projects in Vietnam. Available at: https://policy.asiapacificenergy.org/node/3446

[36] Decision No. 02/2019/QD-TTg Amending and Supplementing Some Articles of Decision No. 11/2017/QD-TTg dated 11 April 2017 by the PM on Mechanism for Encouragement of the Development of Solar Power Projects in Vietnam. Available at: https://policy.asiapacificenergy.org/node/4058

[37] https://www.pv-magazine.com/2024/09/26/vietnam-to-launch-new-net-metering-scheme-for-rooftop-solar/

8.3.5 Status of Implementation

Vietnam’s solar power capacity experienced significant growth in the past years from 2018-2020, due to favourable policies and high feed-in tariffs. Installed capacity surged from just 105 megawatts in 2018 to 16 gigawatts by the end of 2020. However, since January 1, 2021, growth has reduced due to the absence of new government incentive policies and discontinuation of net-metering in 2020, limiting further expansion of RTS in the country.[38]

8.3.6 Key Lessons Learnt

Key lessons learnt for Timor Leste are:

- Tariffs that encourage solar use but don't overload the grid. Limiting how much electricity can be sent to the grid and adjusting tariffs over time can help keep the system stable. Vietnam's experience shows that setting limits, like the 20% cap on exports in 2024, helps keep the grid working properly.
- It's also important to keep policies flexible, as seen in Vietnam's changes to their system. Clear communication with everyone involved, like consumers and utilities, helps them understand the rules and encourages long-term investment, ensuring steady growth and a reliable grid.

8.4 Summary of Additional Experience in NEM

Table 17 below sets out a summary of additional non-island net-metering international experience, featuring key areas of policy, regulatory and legal frameworks, compensation mechanisms considered, status of implementation, and key lessons learned for Timor-Leste policy makers.

[38] https://www.vietnam-briefing.com/news/draft-rooftop-solar-decree-overview.html

Table 17 Summary of Additional Net-Metering International Experience (Non-Island)

	Spain	Australia (Victoria)	Vietnam
Policy, Regulatory and Legal Framework	The Policy, Regulatory, and Legal Framework for self-consumption in Spain is primarily governed by Royal Decree 244/2019, which establishes the regulatory conditions for both individual and collective self-consumption of electricity.	The legal framework for electricity markets for retail customers in Victoria operates within the National Electricity Market (NEM), managed by Australian Electricity Market Operator (AEMO) under the National Electricity Law (NEL) , National Electricity Rules , and National Energy Retail Law (Victoria) Act 2024 (NERL) .	On 22 October 2024, the Vietnamese government officially issued Decree No. 135/2024/ND-CP, which establishes the mechanism and policy framework to incentivize the development of self-consumption rooftop solar power systems (RTS).
Compensation mechanism	Net-Billing Mechanism	Introduced as a premium FIT scheme and changed to lower FITs after increased adoption	Net-Metering (2017) All-buy All-sell (2019) Proposed net-metering with lower tariffs (2024)
Status of Implementation	By June 2023, Spain's Endesa reported 200,000+ self-consumption installations, with 85,000 added in the first half, nearly 3.5 times 2021's additions.	As of 2024, solar energy systems have been installed in 30% of homes across Victoria, totalling 352,862 installations. This includes 275,643 solar panel systems with a combined capacity of 2 GW, 17,460 solar battery systems, and 30,474 solar hot water systems.	Vietnam's solar capacity grew rapidly from 105 MW in 2018 to 16 GW by 2020, driven by favourable policies, but slowed after 2021 due to halted incentives and net-metering.
Key Lessons learnt	Support individual and collective self-consumption with flexible, well-defined policies.	While introducing net metering in the country start with strong incentives, like premium feed-in tariffs, to boost	Set export limits and adjust tariffs to avoid grid overload.

	Incentivize renewable energy by fairly compensating exported excess energy. Implement limits, like Spain's "compensation limit," to ensure system sustainability and prevent overcompensation.	solar adoption but transition to market-aligned tariffs as costs decline. A clear regulatory framework and adaptable compensation models, like time-varying tariffs, are crucial.	Maintain adaptable policies and clear communication to encourage investment and grid reliability.

9 Annex B: Proposed Compensation Mechanism

Under the proposed Net-Metering Policy of section 7, prosumers—customers who both consume and generate electricity, typically with rooftop solar PV—receive credit for the electricity they export to the national grid. The mechanism works in three linked steps:

- **Step 1: One-for-one kWh credit at the retail tariff**

  For every kilowatt-hour (kWh) exported, the customer receives a credit equal to the prevailing retail electricity tariff (the same tariff they pay for imported grid power).

  Rationale: This "retail-rate netting" gives a simple, transparent incentive and allows customers to offset their own consumption costs.

- **Step 2: Monthly "netting" of imports and exports**

  Over the course of each billing cycle, EDTL's bi-directional meter separately records:

  - Imports – kWh drawn from the grid when the customer's PV is not generating enough to meet their own load.
  - Exports – kWh sent to the grid when on-site PV generation exceeds their own load.

  At the end of the month, exports are subtracted from imports.

  - If imports > exports, the customer pays only for the net kWh.
  - If exports > imports, the surplus is carried forward as a kWh credit to the next billing month.

- **Step 3: Credit rollover and expiry**

  Unused export credits roll over month-to-month and can be used to offset future consumption charges.

  Credits have a 12-month validity; any credits remaining after 12 months expire (or are settled at a token value if specified in future implementing rules). This ensures customers cannot indefinitely accumulate credits and protects EDTL's revenue stability.

10 Annex C: References

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