



Renewable Energy for Mobile Networks in Asia

October 2026

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Acknowledgements

This report was prepared by Siripak Sangsinsorn (ACE Partners), Athita Vivatpinyo (ACE Partners), and Balaji MK (ACE Partners), with contributions and guidance from George Kamiya (GSMA).

The authors would like to thank the following mobile network operators for their input throughout the project: Advance Info Service (AIS), Axiata Group (Robi, Smart), Bharti Airtel, CelcomDigi, Far EasTone, Globe Telecom, KDDI, LG Uplus, M1, Maxis, NTT DOCOMO, Reliance Jio, Smart Communications (PLDT), Singtel, Telenor Group (Grameenphone), True Corporation, Telekom Malaysia.

The authors would also like to thank the following experts for sharing their insights through discussions and review comments on earlier drafts of the report: Fadli Amin (Malaysian Communications and Multimedia Commission), Hannah Broman (Climate Group), Nicola Cullen (Climate Group), Henry Eu (Asia Clean Energy Coalition), Grayson Heffner (ACE Partners), Inchan Hwang (SCC Partners), Jade Kim (Climate Group), Ernst Kuneman (Agora Energiewende), Heungkoo Lee (Corporate Renewable Energy Foundation), Mia Nguyen (Asia Clean Energy Coalition), Sophie Ribas (Google), Wini Rizkinigayu (Rocky Mountain Institute), Emma Saraff (Asia Clean Energy Coalition), Tharinya Supasa (ASEAN Center for Energy), Peerapat Vithayasrichareon (International Energy Agency).

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Executive Summary

This report assesses the state of renewable energy access for mobile networks across 13 Asian markets, representing around 85% of mobile connections in the Asia Pacific region. It examines mobile network electricity demand, the readiness of on-site and off-site renewable energy procurement mechanisms, and the policy and investment environment, including financial and non-financial incentives. It identifies the main challenges limiting mobile operators' ability to access renewable energy and sets out recommendations to address them. The report also provides in-depth analyses of Malaysia, the Philippines, South Korea, and Thailand to support advocacy and offer practical lessons for other Asian markets.

Access to renewable energy is critical for mobile networks to meet growing electricity demand and achieve climate targets

Mobile networks account for the majority of energy use for a typical mobile network operator, with electricity demand driven by the scale and geographic distribution of base stations and the type of network technology deployed. As network traffic grows and 5G infrastructure expands, many operators, particularly in emerging markets, face rising energy requirements while seeking to improve efficiency and increase the share of renewable energy in their electricity supply.

- **Mobile networks are significant electricity users**, typically accounting for 1–2% of national electricity demand. For most operators, mobile base stations account for the largest share of company-wide electricity consumption, followed by fixed and core networks, data centres and offices.
- **The distributed nature of mobile network infrastructure presents unique energy challenges.** Mobile towers are spread across tens or hundreds of thousands of sites per country, each with a relatively small load (typically under 10 kW) and limited space for on-site renewable generation. These characteristics make renewable procurement more complex than it is for large, centralised energy users.
- **Electricity demand for mobile networks is increasing as demand for connectivity grows.** Globally, mobile operators consumed around 300 TWh of electricity in 2024, up 16% since 2019. Electricity consumption in Asia Pacific increased by one-third over the same period. Electricity demand is expected to continue to grow, with the fastest growth in emerging markets.
- **Renewable energy adoption is accelerating but uneven.** Globally, the share of renewable electricity used by operators increased from 10% in 2019 to 24% in 2024. However, the share in Asia Pacific (15%) remains well below that in Europe (70%) and North America (50%), reflecting constraints from policy and market design, including limited procurement options and high costs.
- **Trends in operational emissions are diverging significantly between subregions, largely corresponding to the level of access to renewable energy.** For example, mobile operators in Japan cut their emissions by 30% between 2019 and 2024 due to a growing share of renewable energy purchases, reaching half of their electricity consumption in 2024. Strong connectivity demand growth and infrastructure buildout in emerging and developing markets have pushed operational emissions up almost 20% in Southeast Asia and 30% in South Asia, where access to renewables remains challenging.
- **With more than half of mobile connections in the Asia Pacific region covered by validated near-term science-based targets, improved access to renewable energy is critical to achieve these targets.**

Renewable energy market readiness and policy frameworks vary significantly across Asia

Market readiness and policy frameworks shape how mobile operators can access renewable electricity. While many countries have introduced regulatory mechanisms, incentives, and renewable procurement options, the overall enabling environment remains uneven across the 13 markets assessed.

The 13 markets are classified into three readiness tiers (Table ES-1) based on an assessment across key criteria. Tier 1 countries generally demonstrate stronger overall readiness for renewable energy procurement, while several Tier 2 and 3 markets are still developing the regulatory frameworks and market mechanisms needed to scale corporate renewable energy adoption.

Table ES-1 Renewable energy readiness assessment by market

	South Asia				Southeast Asia					East Asia			
	Bangladesh	India	Pakistan	Cambodia	Indonesia	Malaysia	Philippines	Singapore	Thailand	Vietnam	Japan	South Korea	Taiwan
Overall tier	2	1	2	3	3	1	1	1	2	2	1	1	1
On-site (wired) RE readiness	●	●	●	●	●	●	●	●	●	●	●	●	●
Off-site (non-wired) RE readiness	●	●	●	●	●	●	●	●	●	●	●	●	●
Incentives	●	●	●	●	●	●	●	●	●	●	●	●	●
Market-based instruments (e.g. RECs)	●	●	●	●	●	●	●	●	●	●	●	●	●
Operator climate and RE commitments	●	●	●	●	●	●	●	●	●	●	●	●	●
Cost competitiveness of RE	●	●	●	●	●	●	●	●	●	●	●	●	●

Note: RE = renewable energy. RECs = renewable energy certificates. Green (●) = Supports readiness; Yellow (●) = Neutral impact on readiness; Red (●): Hinders readiness.

- **On-site (wired) renewable energy options are generally more mature than off-site procurement mechanisms.** Many countries have established regulatory frameworks for rooftop solar and other on-site installations, making these solutions easier for companies to implement compared with off-site procurement models such as direct power purchase agreements (PPAs) or green tariffs.
- **Off-site (non-wired) renewable procurement frameworks are less developed and uneven across the region.** While some countries have introduced green tariffs or direct PPAs, regulatory restrictions, capacity limits, and evolving market rules continue to constrain wider adoption.
- **Incentive structures play an important role in enabling renewable energy investments.** Many countries provide financial incentives such as tax credits, subsidies, concessional finance and grants.
- **Renewable electricity is increasingly cost-competitive in several markets.** In countries such as India, the Philippines, Japan, and Taiwan, some renewable options are already competitive with or cheaper than grid tariffs, strengthening the business case for adoption.

- **Corporate climate commitments are an important driver of renewable electricity demand.** Mobile operators in several markets have adopted ambitious climate targets, accelerating interest in renewable procurement despite regulatory and infrastructure challenges.
- **Unclear policy and restrictive market design remain key barriers.** Unclear regulations, limited access to renewable procurement mechanisms, and restrictions on corporate PPAs continue to constrain renewable energy adoption in parts of Southeast and South Asia.

Recommendations and regulatory priorities

Tier 1 – Advanced Markets

India, Japan, Malaysia, Philippines, Singapore, South Korea, Taiwan

Tier 1 markets have established renewable procurement mechanisms such as green tariffs, direct power purchase agreements (DPPAs) and third-party access (TPA). However, these mechanisms are typically designed for large electricity users and do not fully accommodate the distributed electricity demand of mobile networks.

Key recommendations for mobile operators

- **Short term: Use available on-site and off-site options**, including self-owned systems (delivered through bulk procurement or third-party engineering, procurement and construction [EPC] contracts), open access, green tariffs and aggregated corporate PPAs (e.g. the Retail Aggregation Program [RAP] in the Philippines).
- **Short term: Procure renewable electricity through credible, certified market-based instruments** that meet RE100 technical criteria and other standards, including the GHG Protocol Scope 2 requirements and national schemes (e.g. K-RE100). Factor into long-term contracts the proposed revisions to the GHG Protocol Scope 2 Guidance (e.g. hourly matching and deliverability/market-boundary requirements).
- **Short-medium term: Deploy solar-plus-storage systems at telecom sites** to improve energy resilience, increase the renewable share and reduce reliance on diesel backup generation.
- **Short-medium term: Adopt aggregation-based Energy-as-a-Service (EaaS) models**, under which service providers manage renewable energy across portfolios of telecom sites and charge for energy delivered (kWh) rather than installed capacity (kW).
- **Medium-long term: Engage with regulators and utilities to advocate for policies that recognise mobile networks as a distributed-load sector**, lower minimum participation thresholds and allow demand aggregation for renewable procurement (e.g. India, Philippines), enable the export or sale of surplus electricity from telecom sites, and support increased renewable energy supply for shared mobile network infrastructure.

Regulatory priorities

- **Reduce minimum participation thresholds for renewable PPAs and green tariff programmes** and enable demand aggregation across multiple sites and operators to expand access for distributed electricity users.
- **Scale up renewable energy supply aligned with corporate and infrastructure-sector demand**, including dedicated renewable procurement windows or corporate offtake allocations to increase the share of renewables in grid mix.

- **Improve tariff design and transparency**, including clear methodologies for wheeling charges, surcharges and ancillary fees so that buyers can compare the full cost of renewable electricity with grid tariffs and conduct scenario analyses to anticipate future costs.
- **Modernise grid infrastructure and strengthen energy planning** to enable greater renewable integration and improve overall system resilience.
- **Increase the renewable energy share in the national grid** which helps mobile operators reduce Scope 2 emissions, especially in regulated or semi-liberalised markets where direct procurement options are limited.
- **Recognise energy storage as a key enabling technology** and set clear rules on ownership, interconnection and compensation, including for ancillary services, to support grid reliability with higher shares of renewable energy.

Tier 2 – Developing Markets

Bangladesh, Pakistan, Thailand, Vietnam

Tier 2 markets have relatively mature frameworks for on-site solutions, but off-site procurement mechanisms remain limited or under development. Mobile operators therefore rely mainly on on-site solutions to increase their use of renewable energy.

Key recommendations for mobile operators

- **Short term: Scale on-site renewable energy deployment** by installing solar photovoltaic (PV) systems with battery storage at mobile tower sites, using bulk procurement of standardised systems to reduce costs.
- **Short term: Adopt aggregation-based EaaS models** by managing distributed telecom sites as energy portfolios and engaging service providers to deliver energy services, reducing upfront investment and operational complexity.
- **Medium term: Prepare for corporate renewable procurement** by strengthening internal energy data management, load profiling and aggregation strategies to enable future participation in direct PPAs as regulatory frameworks mature.
- **Medium-long term: Strengthen sector-wide policy engagement** by collaborating through industry platforms to advocate for aggregation mechanisms and competitive renewable electricity tariffs.

Regulatory priorities

- **Establish clear frameworks for corporate renewable procurement:** Develop transparent legal frameworks for corporate PPAs and third-party access to enable companies to procure renewable electricity directly.
- **Expand renewable energy deployment and modernise grid infrastructure:** Increase renewable generation capacity in the grid mix and recognise energy storage as a key enabling technology to support grid reliability, facilitate higher shares of variable renewable energy integration, and strengthen overall system resilience.
- **Simplify permitting for distributed renewable energy:** Streamline approval and interconnection processes for on-site renewable installations, such as solar systems at telecom and other commercial facilities.

Tier 3 – Limited Markets

Cambodia, Indonesia

Tier 3 markets have more restrictive electricity systems, often dominated by state-owned utilities, with limited frameworks for corporate renewable procurement.

Key recommendations

- **Short term: Prioritise behind-the-meter renewable energy solutions** by deploying on-site solar PV systems at suitable sites to reduce emissions and fuel costs.
- **Short-medium term: Combine solar PV with battery storage** to improve reliability, increase energy autonomy, and reduce dependence on diesel generators.
- **Short-medium term: Apply international technical standards** to ensure behind-the-meter installations follow recognised safety, design, installation and operational requirements.
- **Medium term: Prepare for future market opportunities** by documenting deployment performance, reliability and cost savings to support engagement with policymakers and utilities as market frameworks evolve.

Regulatory priorities

- **Establish clear, streamlined approval processes:** Introduce standardised procedures and transparent timelines for behind-the-meter renewable energy and storage interconnection, and develop legal frameworks for TPA, DPPAs and green tariffs.
- **Develop grid codes and technical standards for renewable energy and storage systems:** Establish clear rules for renewable energy development and battery energy storage systems (BESS), including ownership, interconnection, and compensation, to support renewable integration and improve grid reliability.

Deep-dive country insights: South Korea, Philippines, Malaysia, Thailand

The report includes detailed analyses of South Korea, the Philippines, Malaysia, and Thailand, which illustrate different stages of renewable procurement development.

South Korea has advanced renewable procurement mechanisms, including the Green Premium, third-party PPAs, direct PPAs, and REC purchases, supported by moderate incentives for renewable self-consumption investments. However, complex PPA structures, high charges, limited cost transparency, restricted aggregation options, and grid constraints limit participation by distributed consumers such as mobile network operators. In the short term, mobile operators can expand aggregated on-site renewable deployment combined with energy storage. In the medium to long term, operators could engage with regulators to introduce PPA aggregation models with lower eligibility thresholds and advocate for stronger incentives to expand renewable supply.

The Philippines has one of the most advanced renewable procurement markets in Southeast Asia, supported by the Green Energy Option Program (GEOP), Retail Competition and Open Access (RCOA), and the Retail Aggregation Program (RAP), along with well-established grid codes and fiscal incentives. However, challenges remain for mobile networks, including individual tower loads that remain well below the GEOP eligibility threshold, limits on aggregating sites across different franchise areas, reliance on distribution utilities, and operational constraints under tower company ownership models. In the short term, mobile operators can expand renewable procurement through GEOP and portfolio-based solar EaaS deployment. In the medium to long term, operators could work

with regulators and tower companies to embed renewable energy requirements in tower leasing contracts and advocate for further reductions in GEOP thresholds and for aggregation across franchise areas.

Malaysia has a moderately advanced renewable procurement environment supported by rooftop solar deployment frameworks and corporate procurement schemes such as the Green Electricity Tariff (GET) and Corporate Renewable Energy Supply Scheme (CRESS), alongside tax incentives and green financing. However, participation by distributed consumers such as mobile operators remains constrained by a fully subscribed GET quota, high system access charges under CRESS, the lack of an aggregation route for distributed sites, and tower company leasing arrangements. In the short term, mobile operators can expand on-site solar and use CRESS for large facilities. In the medium to long term, operators could develop aggregated procurement models across telecom sites and engage with regulators to introduce aggregation frameworks and reduce wheeling charges.

Thailand has strong readiness for on-site (wired) renewable energy, but off-site (non-wired) procurement mechanisms are less mature. Programmes such as the Utility Green Tariff (UGT) and the pilot DPPA scheme are still limited by regulatory uncertainty, high wheeling charges, eligibility thresholds, and an unclear application process. The latest policy direction extends direct PPAs via TPA from data centres to industrial users that require green electricity, but implementing regulations have not yet been finalised. As a result, distributed consumers such as mobile operators continue to rely mainly on on-site renewable energy. In the short to medium term, operators could develop aggregated solar EaaS procurement models to prepare for future peer-to-peer electricity trading. In the medium to long term, operators could engage with regulators to introduce aggregation schemes, extend DPPA eligibility to mobile network sites, and secure more transparent, cost-reflective wheeling charges.

1. Introduction

Objectives and Scope

The report aims to provide a robust analytical and policy-relevant foundation for the GSMA's engagement and advocacy to increase renewable energy access for mobile network operators in Asia.

The report focuses on 13 markets that account for around 85% of mobile connections in the region (Table 1), covering three key areas:

1. **Current status of mobile operator energy demand and renewable energy markets:** On the demand side, Section 2.1 examines trends in mobile network electricity demand and drivers of operator demand for renewable energy. On the supply side, Section 2.2 assesses each country's grid mix and readiness for on-site and off-site procurement options. Section 2.3 assesses financial and non-financial incentives, and Section 2.4 summarises procurement and deployment models.
2. **Understanding and addressing the challenges:** Based on this analysis, Section 3 groups markets into readiness tiers, identifies the key challenges limiting mobile operators' access to renewable energy, and sets out recommendations for operators and policymakers.
3. **Country Deep Dives:** Section 4 applies this analysis in more depth to Malaysia, the Philippines, South Korea, and Thailand to support advocacy in these markets and provide lessons for operators elsewhere.

Table 1 **Geographic scope of the report**

South Asia	Southeast Asia	East Asia
Bangladesh	Cambodia	Japan
India	Indonesia	South Korea*
Pakistan	Malaysia*	Taiwan
	Philippines*	
	Singapore	
	Thailand*	
	Vietnam	

Note: * denotes deep-dive countries.

Methodology

The analysis combines desk research, quantitative data analysis, an operator survey and stakeholder consultation.

- **Policy and regulatory review:** National energy policies, regulations, renewable procurement schemes and incentive programmes in the 13 markets were reviewed. The analysis reflects policy frameworks in place as of September 2026.

- **Operator climate targets and energy data:** Data on mobile operator climate targets, electricity consumption and renewable electricity use are based on analysis from the Mobile Net Zero 2026¹ and Mobile Net Zero Asia Pacific 2026².
- **Market readiness assessment:** Each market was assessed against indicators and criteria including drivers of renewable energy adoption for mobile operators (Table 2), on-site procurement readiness (Table 5), off-site procurement readiness (Table 6) and incentives (Table 7). Markets were grouped into three readiness tiers.
- **Operator survey:** The GSMA surveyed mobile network operators on expected electricity demand growth, renewable energy targets and barriers to accessing renewable electricity. Results are reported as averages or shares of respondents and may not be representative of all operators.
- **Stakeholder consultation and validation:** Additional insights were gathered through interviews with mobile operators in deep-dive markets and group meetings with operators across the region. The draft report was reviewed by external experts.

The readiness ratings give a qualitative, comparative snapshot and involve expert judgement. They do not capture differences within countries (for example, between Indian states) or between operators in the same market. Policy frameworks in many markets are changing quickly, so some ratings may become outdated after publication.

Target Audiences

This report has two primary audiences:

- **Energy and climate policymakers and energy market regulators in Asia** – to raise awareness of mobile operators' demand for renewable electricity and their distinct operational needs (e.g. many distributed, low-load sites), so that renewable energy policy, market design and regulations take these needs into account.
- **Mobile network operators**, particularly senior leaders responsible for infrastructure and energy, or for government affairs and policy – to build their understanding of energy markets and policy, and to provide evidence, key messages and strategies for engaging with policymakers.

The report is also relevant to telecommunications policymakers and regulators, helping them understand how they can support renewable energy access for mobile network operators in their country, including by supporting advocacy efforts.

Companies in other sectors with growing renewable energy demand may find the market assessment useful for their own advocacy. Renewable energy solution providers can also use the report to identify emerging business opportunities to supply renewable energy to mobile network operators.

¹ GSMA (2026). [Mobile Net Zero 2026](#).

² GSMA (2026). [Mobile Net Zero Asia Pacific: Regional Focus on Climate Action 2026](#).

2. Analysis of the Current Situation

2.1 Energy Demand for Mobile Networks

This section provides an overview of mobile network operators' energy consumption trends and highlights key drivers influencing their efforts to adopt renewable energy.

Operator Energy Demand Characteristics

For most operators, mobile networks account for the majority of their energy consumption, followed by fixed and core networks, data centres, office buildings, and other operations.³ While some operators are expanding their business to develop and operate large-scale data centres, most continue to focus on their network operations. This study focuses on near-term energy demand growth, which will be primarily driven by mobile networks.

With the majority of overall energy use coming from electricity, mobile network operators are some of the biggest users of electricity in many countries, with operators typically contributing a combined 1–2% of national electricity demand. To provide connectivity to people and businesses across a country, mobile base stations are distributed across tens or hundreds of thousands of sites, covering urban, suburban, rural, and even remote off-grid areas.

Mobile operators face several distinct challenges in accessing and buying renewable energy compared with other sectors and companies. The wide geographic distribution and relatively low power consumption per site of mobile towers (less than 10 kW) are significantly different demand load characteristics compared with large electricity users such as data centres, heavy industry, and manufacturing. In cities, base stations often sit in cramped spaces that operators do not own (e.g. leased rooftops), limiting options for on-site generation and storage.

Energy Consumption Trends

Globally, electricity consumption by mobile network operators increased by 16% between 2019 and 2024, reaching around 300 TWh in 2024.⁴ The Greater China region accounted for more than 40% of the global total, followed by the rest of Asia (17%).

Mobile operators in the Asia Pacific region⁵ consumed nearly 50 TWh of electricity in 2024, or 0.8% of regional electricity use. Operators' electricity consumption increased by a third between 2019 and 2024 with growth across all subregions, including a nearly 80% increase in South Asia, 29% increase in Southeast Asia, and 26% increase in East Asia.⁶

The power consumption characteristics of base stations are changing rapidly with technological change. While newer technologies such as 5G transmit more data with less energy (i.e. less energy per bit) compared with older networks such as 3G, they require more power per site than legacy systems.⁷ This underscores the rising electricity demand expected to 2030 as countries and

³ GSMA (2026). [Mobile Net Zero 2026](#).

⁴ GSMA (2026). [Mobile Net Zero 2026](#).

⁵ Excludes Greater China.

⁶ GSMA (2026). [Mobile Net Zero Asia Pacific: Regional Focus on Climate Action 2026](#).

⁷ Huawei (2019). [5G Power Whitepaper](#)

operators expand their tower infrastructure and deploy 5G networks, particularly in emerging markets where 5G deployment is accelerating.

The network technology mix in the Asia Pacific region is rapidly evolving, with the share of 5G connections projected to grow from 27% in 2025 to 50% by 2030.⁸ Mobile operators recognise the need to implement innovative energy-efficiency measures in the 5G era, such as holistic network planning, legacy modernisation during 5G expansion, and energy optimisation enabled by artificial intelligence and machine learning (AI/ML).^{9,10}

To understand energy demand growth and renewables demand over the next decade, the GSMA collected survey responses from mobile operators across the region.

In advanced economies with mature mobile networks such as Japan and Taiwan, most operators surveyed expect total electricity use to decline by more than 20% over the next ten years. In Japan, one company indicated an expected reduction of more than 50%. These expectations reflect advanced 5G rollout and structural changes in mature markets, including increased infrastructure sharing and the continued implementation of energy efficiency measures and innovative technologies.

In Southeast Asia, surveyed operators had a wide range of expectations for projected energy demand growth, ranging from flat demand to increases of more than 50% over the next decade, with most respondents expecting growth of around 20–50%. Despite rising connectivity demand, new tower deployment is expected to slow as networks achieve high coverage and investment shifts towards densification and efficiency improvements rather than extensive new tower construction.

In South Asia, all operators surveyed expected electricity consumption to increase by more than 50%, driven by the continued expansion of mobile network infrastructure. In India, telecom operators have expanded their 5G networks nationwide, deploying more than half a million sites as of February 2026.¹¹

Operator Demand for Renewable Energy

Mobile operators across all global regions have been buying and using more renewable energy in recent years. In 2024, 24% of operator electricity consumption globally came from purchased or generated renewables, up from 10% in 2019.¹² Operators' share of renewables in Asia Pacific (15%) is comparatively lower than the global average (24%) and regions such as Europe (70%) and North America (50%) (Figure 1).¹³

⁸ GSMA (2026). [The Mobile Economy Asia Pacific 2026](#).

⁹ GSMA Intelligence (2026). [Going green: measuring the energy efficiency of mobile networks and towers](#).

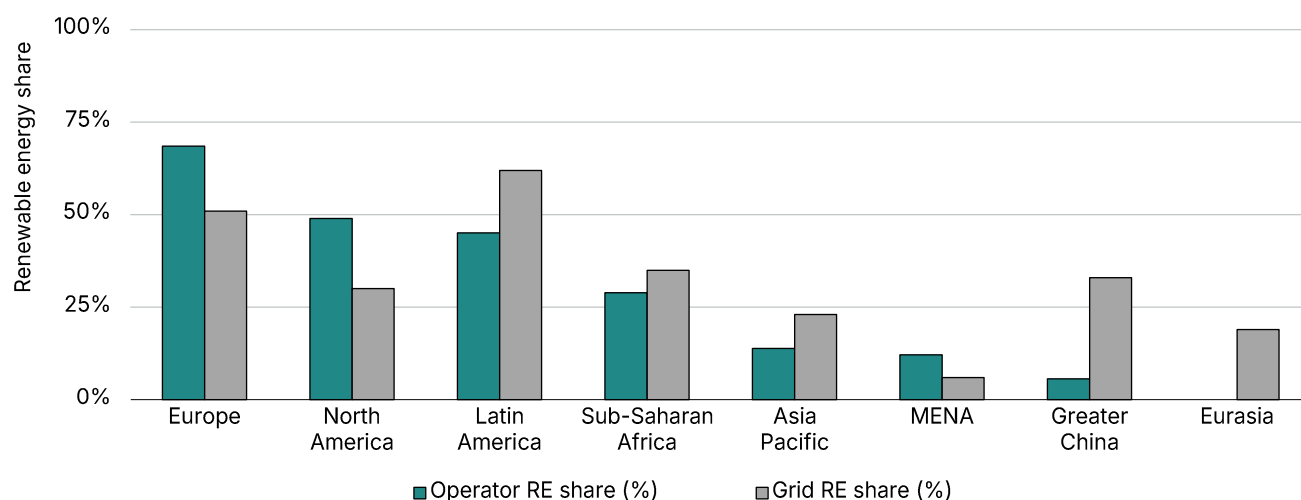
¹⁰ Ericsson (2025). [How to improve energy efficiency](#).

¹¹ India Ministry of Communications (2026). [Status of 5G Rollout](#).

¹² GSMA (2026). [Mobile Net Zero 2026](#).

¹³ GSMA (2026). [Mobile Net Zero Asia Pacific: Regional Focus on Climate Action 2026](#).

Figure 1 Operator and grid renewable electricity shares in selected markets, 2024

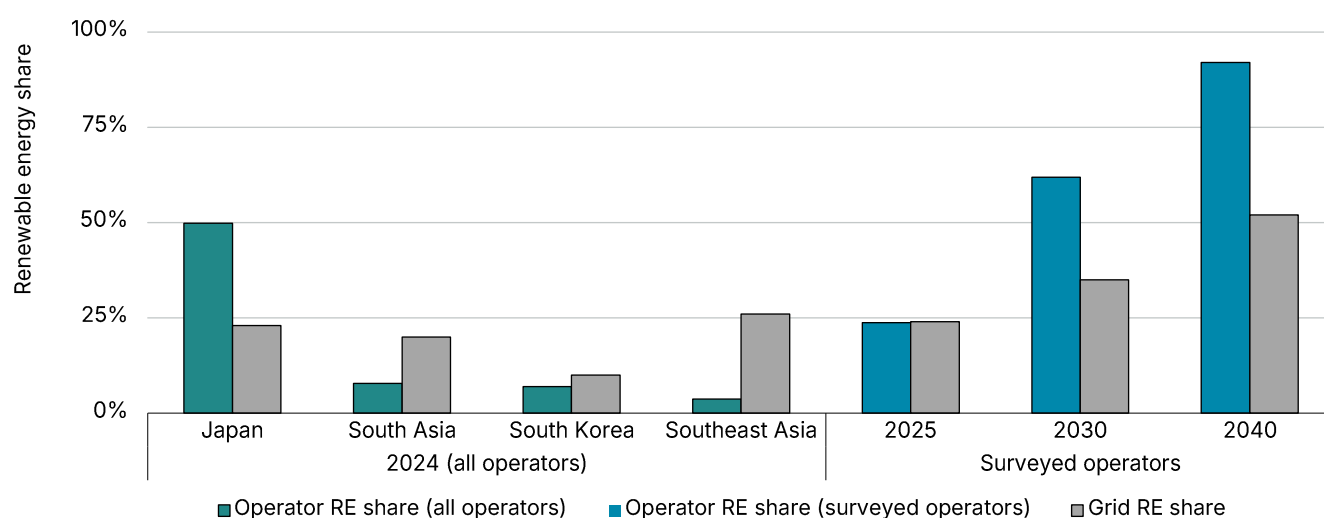


Source: Analysis based on Mobile Net Zero 2026.

Mobile operators in Japan accounted for almost 70% of the regional total, purchasing nearly 5 TWh of renewable electricity. Around half of their electricity consumption was matched by purchased or generated renewables (Figure 2). The renewables share was significantly lower for mobile operators in South Korea (7%), South Asia (8%), and Southeast Asia (4%).

Mobile operators in Asia report facing significant barriers to accessing renewable electricity, including high cost (90% of operators surveyed), limited space for on-site solar PV (80%), and restricted renewable procurement options (50%). Despite these challenges, most operators surveyed are aiming to rapidly increase their share of renewables over the next 10–20 years. The average share of renewables targeted by operators surveyed was 62% by 2030 and 92% by 2040, up from an average of 26% in 2025 (Figure 2, right). These targets are well above the projected renewables shares on the grid under the IEA Stated Policies Scenario (STEPS).

Figure 2 Operator and grid renewable electricity shares in selected Asian markets



Note: RE = renewable energy. 2030 and 2040 grid renewable energy share based on IEA World Energy Outlook 2025 Stated Policies Scenario (STEPS) for Asia Pacific excluding China.

Source: 2024 data from Mobile Net Zero 2026 Asia Pacific. Survey data from operator survey

Improving renewable procurement mechanisms can help address challenges related to the geographic distribution and low electricity demand of individual mobile tower sites. For example, policies enabling aggregated procurement, such as distributed PPAs with retail aggregation of smaller sites, have been introduced through programmes such as the Retail Aggregation Program (RAP) in the Philippines.

Key considerations driving network operators to use renewable electricity include cost competitiveness, corporate climate and renewable energy commitments, existing grid reliability challenges, and renewable energy mandates. The assessment of the degree to which drivers accelerate renewable energy adoption in each country is shown in Table 2.

Table 2 Drivers of renewable energy adoption for mobile operators

Driver	South Asia					Southeast Asia					East Asia		
	Bangladesh	India	Pakistan	Cambodia	Indonesia	Malaysia	Philippines	Singapore	Thailand	Vietnam	Japan	South Korea	Taiwan
Cost competitiveness of RE	●	●	●	●	●	●	●	●	●	●	●	●	●
Operator climate and RE commitments	●	●	●	●	●	●	●	●	●	●	●	●	●
Grid reliability*	●	●	●	●	●	●	●	●	●	●	●	●	●
Regulations, e.g. minimum renewable energy consumption requirement	●	●	●	●	●	●	●	●	●	●	●	●	●

Note: Green (●) = Accelerates renewable energy adoption; Yellow (●) = Moderate – limited impact on adoption; Red (●) = Hinders adoption. RE = renewable energy. * Poor grid access and reliability increase the incentive to invest in on-site power systems, so these markets are rated as 'green'.

- **Cost competitiveness of renewable electricity:** The cost differential between renewable electricity and the average grid tariff can make or break the business case for switching to renewable electricity. For example, retail electricity tariffs in the Philippines are among the highest in Southeast Asia (often USD 0.16–0.22/kWh)¹⁴ because of reliance on imported fuels and high system costs across its archipelagic grid. In contrast, utility-scale and commercial solar can generate electricity at around USD 0.04–0.08/kWh,¹⁵ making renewable energy cheaper than grid power.
- **Climate and renewable energy targets:** Whether operators in a market have set climate and renewable energy targets, including validated near-term and net zero targets under the Science-Based Targets initiative (SBTi) and pledges to achieve 100% renewable electricity (RE100).
- **Grid reliability:** In countries with poor grid access and reliability, there are stronger incentives to switch to on-site solar to increase uptime and reduce reliance on diesel generators.
- **Regulations:** In some countries, there are regulatory requirements for the minimum renewable energy consumption or minimum renewables share. The assessment considers where such requirements are in force or due to take effect.

¹⁴ Global Petrol Prices (2026). [Philippines electricity prices](#).

¹⁵ BloombergNEF (2025). [The Philippines' Path to Clean and Affordable Electricity](#).

2.2 Renewable Energy Markets and Policy

Current Electricity Grid Mix

Mobile operators and other companies have set net zero and sustainability commitments but continue to rely largely on grid electricity. Table 3 presents the GHG emissions intensity of electricity generation, the share of renewable energy in the grid, and the main generation technologies in the focus countries, across Asia, and globally.¹⁶

Table 3 Electricity GHG intensity and renewables shares, 2025

Geography	GHG intensity of electricity generation		Share of RE in grid		Top three generation sources, 2025
	gCO ₂ e/kWh, 2025	Δ vs. 2015 (%)	% RE, 2025	Δ vs. 2015 (pp)	
World	458	-14%	34%	+11pp	Coal (33%), Gas (22%), Hydro (14%)
Asia	560	-14%	28%	+10pp	Coal (49%), Gas (16%), Hydro (12%)
Bangladesh	696	+3%	2%	+1pp	Gas (64%), Coal (22%), Oil (12%)
Cambodia	499	+11%	41%	-8pp	Coal (56%), Hydro (30%), Solar (11%)
India	670	-11%	24%	+9pp	Coal (71%), Solar (9%), Hydro (9%)
Indonesia	680	-2%	19%	+5pp	Coal (61%), Gas (19%), Hydro (7%)
Japan	477	-17%	24%	+9pp	Gas (33%), Coal (32%), Solar (10%)
Malaysia	602	-10%	21%	+11pp	Coal (44%), Gas (33%), Hydro (18%)
Pakistan	347	-20%	43%	+9pp	Gas (21%), Hydro (20%), Solar (19%)
Philippines	588	+8%	23%	-2pp	Coal (59%), Gas (17%), Hydro (10%)
Singapore	497	-2%	5%	+3pp	Gas (91%), Bioenergy (3%), Solar (3%)
South Korea	417	-14%	10%	+8pp	Coal (31%), Nuclear (30%), Gas (28%)
Taiwan	633	-3%	12%	+9pp	Gas (49%), Coal (36%), Solar (5%)
Thailand	546	-9%	17%	+9pp	Gas (66%), Coal (18%), Bioenergy (5%)
Vietnam	461	-5%	45%	+11pp	Coal (48%), Hydro (33%), Solar (7%)

Note: RE = renewable energy. Asia data includes China.

Source: Adapted from Ember Electricity Data Explorer (Carbon Intensity and Electricity Generation)

Bangladesh, Indonesia, India, Taiwan, Malaysia, and the Philippines have higher GHG intensities than the Asian average (560 gCO₂e/kWh) due to their heavy reliance on fossil fuels, particularly coal. In contrast, Pakistan, South Korea, Vietnam, and Japan have lower intensities, reflecting greater use of low-carbon generation technologies such as renewables and nuclear.

In 2025, the average renewable energy share in Asian power grids was lower than the global average (34%). Across the focus countries, the share of renewables ranged from 2% to 45%, with most remaining below the Asian average (28%). Exceptions include Vietnam (45%), Cambodia (41%), and Pakistan (43%), where hydropower accounts for more than 20% of generation. Malaysia and Vietnam recorded the largest increase in renewable energy share, rising by 11 percentage points

¹⁶ Ember. [Electricity Data Explorer](#).

(pp) between 2015 and 2025. Several other countries saw increases of close to 10pp, while the Philippines and Cambodia saw declines in renewables share as coal generation increased.

Options to Access Renewable Energy

Companies that want to increase their renewable energy consumption beyond what is available on the grid have two main routes: wired (on-site) and non-wired (off-site) options.

- **Wired (on-site) options**, where the renewable generation source is usually located on-site or close to the point of use and the supply and consumption points are directly connected by a dedicated wire, often referred to as behind-the-meter installations.
- **Non-wired (off-site) options**, where the renewable generation is not located close to the point of use. The consumer accesses the renewable electricity through electric utility networks using mechanisms such as green tariffs or direct power purchase agreements (DPPAs) between the supplier and the consumer.

Table 4 provides an overview of these options, including examples, advantages, limitations and risks. Section 2.4 and Table 8 provide additional procurement and deployment options and details.

Table 4 Overview of wired vs. non-wired renewable energy options

Option	Examples	Advantages	Limitations and risks
Wired (On-site)	Self-investment, leasing, energy-as-a-service, rooftop solar PPAs	Generally more mature frameworks, grid codes, and standards than off-site options No minimum demand threshold; low participation barriers in most markets Simpler and faster implementation	Limited installation space Conflicts in shared or leased facilities (e.g. tower company models, or property-owner-controlled sites) High upfront investment for self-owned (CAPEX) systems, especially with battery energy storage system (BESS)
Non-wired (Off-site)	Green tariff, direct PPAs (third-party access / open access), aggregated corporate PPAs	No site space constraints Access to larger volumes of renewable energy Better scalability; aggregation possible where rules allow	Unavailable or at pilot stage in several markets; frameworks still evolving elsewhere Green premiums and wheeling charges can make supply more expensive than standard grid tariffs Minimum demand or eligibility requirements Purchasing caps or quota limitations Longer lead times and exposure to policy and counterparty risks

Note: PPA = power purchase agreement.

Both options depend on a set of market, legal, technical and operational conditions. This section discusses the importance of these enabling conditions for each option and then provides a comparative analysis of the focus countries in Table 5 and Table 6.

Wired (On-site) Options

Wired options include self-investment (CAPEX models) and on-site PPAs (OPEX models). Under an on-site PPA, a renewable generator, such as a third-party rooftop system or private mini-grid, sells electricity directly to the buyer through a private connection, without using the public grid.

Rooftop solar (RTS) and similar systems sit behind the utility meter and are designed mainly for self-consumption. The system is installed on the user's premises, and the electricity is used locally. In some countries, surplus electricity can be exported to the public grid, subject to country-specific capacity limits and regulations.

To assess each country's readiness for the adoption of wired options, this study analysed three considerations. Throughout this discussion RTS is used as a proxy representative for wired options.

1. Regulatory and policy landscape¹⁷: Assessed using five indicators: net zero target ambition, regulatory clarity for RTS development, distribution company (DISCOM) investment, grid codes and standards, and quality certification and installation requirements for RTS projects.

- **Net zero and clean energy targets¹⁸:** A country's net zero target may be considered as a key driver for the adoption of renewable energy. Rated green if country's net zero target year is 2050 or earlier, yellow if the target year is later, and red if no target is specified.
- **Regulations for RTS development:** The regulations often include clearly defined processes for licences and permits and technical standards for equipment. Rated green if regulations are clear and supportive of RTS adoption, yellow if limitations exist, and red if RTS is largely not permitted.
- **Investment by distribution utilities:** Distribution utilities may offer RTS services themselves to retain customers and revenue. Rated green if distribution utilities directly invest in or implement RTS projects, yellow if they facilitate RTS without direct investment, and red if no direct or indirect support exists.
- **Grid codes and standards:** A grid code is a set of technical and operational rules that generators, network operators, and large consumers must follow to connect to and operate on an electricity grid safely, reliably, and efficiently. Rated green if officially established, yellow if under development or pilot implementation, and red if unavailable.
- **Quality certification and installation standards:** These pertain to the published standards for equipment, installation, operation and maintenance of such systems. Rated green if officially established, yellow if under development or pilot implementation, and red if unavailable.

2. Conducive investment environment¹⁹: Assesses power off-take regulations, incentives, financial support mechanisms, and access to finance. Indicators are rated green if direct support for RTS projects is provided, yellow if support is indirect (e.g. broader sustainability incentives or financial instruments not specifically targeted at RTS but potentially applicable), and red if no support is available.

3. Capacity building²⁰: Examines the availability of technical expertise and skills for installing, operating, and maintaining RTS. Rated green if skilled workforce and regular public training

¹⁷ USAID (2024). Southeast Asia Smart Power Program, Strategies for Expansion of Rooftop Solar PV.

¹⁸ Climate Action Tracker. [Countries](#).

¹⁹ USAID (2024). Southeast Asia Smart Power Program, Strategies for Expansion of Rooftop Solar PV.

²⁰ Ibid.

programmes are available, yellow if workforce is evolving and training is provided intermittently, and red if no relevant programmes exist.

The assessment of readiness for each country to adopt wired PPA is shown in Table 5.

Table 5 **Wired (on-site) readiness assessment**

Factors	South Asia				Southeast Asia						East Asia		
	Bangladesh	India	Pakistan	Cambodia	Indonesia	Malaysia	Philippines	Singapore	Thailand	Vietnam	Japan	South Korea	Taiwan
1. Regulatory and policy landscape													
Government climate and clean energy targets	●	●	●	●	●	●	●	●	●	●	●	●	●
Clear regulations for RTS and grid development for on-site PPA	●	●	●	●	●	●	●	●	●	●	●	●	●
Distribution utilities investment in RTS and grid development	●	●	●	●	●	●	●	●	●	●	●	●	●
Grid codes and interconnection standards ²¹	●	●	●	●	●	●	●	●	●	●	●	●	●
Quality certification and installation standards	●	●	●	●	●	●	●	●	●	●	●	●	●
2. Conducive investment environment													
Power off-take regulation with standardised on-site PPA	●	●	●	●	●	●	●	●	●	●	●	●	●
Project development support and soft costs reduction	●	●	●	●	●	●	●	●	●	●	●	●	●
Tax incentives (for RTS)	●	●	●	●	●	●	●	●	●	●	●	●	●
Availability of finance (e.g. availability of commercial loans for large and small enterprise)	●	●	●	●	●	●	●	●	●	●	●	●	●
3. Capacity building													
Availability of training programmes	●	●	●	●	●	●	●	●	●	●	●	●	●
Vocational training and skills development	●	●	●	●	●	●	●	●	●	●	●	●	●

Note: RTS = rooftop solar.

Green (●) = High (the conditions provide "high" benefits for RE PPA in the telecom sector); Yellow (●) = Moderate; Red (●) = Low.

²¹ This assessment is based on the readiness of rooftop solar (RTS) standards. Countries in Southeast Asia including Singapore, Thailand, and Malaysia, also show strong readiness in BESS safety standards. Source: ASEAN Centre of Energy. (2025). [Standard Guideline-Enhancing Electrical Safety Standards for Rooftop PV and BESS Installations in ASEAN through Safety Features Application](#).

Non-wired (Off-site) Options

Non-wired options include green tariffs and direct power purchase agreements (DPPA).

- **Green tariff:** A pricing scheme that lets consumers buy renewable electricity from an existing utility for a premium on top of the standard tariff.
- **DPPA:** A long-term contract signed directly between a power generator and an electricity user, typically lasting 10–20 years. It offers stable and often competitive electricity rates, enabling users to secure renewable energy at predictable prices.

Non-wired options allow electricity users to access renewable electricity without developing their own dedicated transmission or distribution infrastructure. Green tariffs and DPPA use the public grid, allowing generators to sell electricity and consumers to receive contracted renewable energy through the public grid.

To assess readiness for non-wired PPA adoption, this study evaluates three key dimensions:

1. Regulatory and policy landscape: Assessed based on net zero targets and the availability of green tariffs or DPPAs (e.g. third-party access or TPA).

- **Net zero and clean energy targets:** A country's published net zero targets may be considered as a key driver for the adoption of such solutions. Evaluated using the same criteria as wired PPA options.
- **Green tariff and DPPA implementation:** Rated green if commercially available, yellow if under pilot implementation, and red if unavailable. Each mechanism is described in Appendix A. Renewable Energy Procurement and Deployment Model.

2. Technical and infrastructure readiness: Assesses grid capability to support variable renewable energy (VRE), focusing on storage, reliability, and standards.

- **VRE integration (BESS adoption):** Rated green if BESS is commercially deployed, yellow if in pilot phase, and red if not included in the national energy plan.
- **Grid reliability:** Assessed using System Average Interruption Frequency Index (SAIFI) and Duration Index (SAIDI)²²—green for rare and short outages (less than once per year and under three hours), yellow for moderate outages (one to three hours and more than twice per year), and red for frequent or prolonged outages.
- **Grid code and standards harmonisation:** Rated green if a single national grid code is applied, yellow if a national grid code exists but practical connection requirements vary across regions due to differences in grid conditions or electricity authorities, and red if no nationwide grid code is in place.

3. Market considerations: PPA flexibility is evaluated based on electricity market structure and regulatory constraints, such as limits on eligible participants or contracted capacity.

- **Market openness:**²³ Rated green for liberalised markets with open PPA access (where generators and consumers can contract directly), yellow for moderate restrictions (e.g. capacity caps), and red where both capacity and eligible business types are restricted.

²² Lee et al. (2024). [The Water, Energy, and Food Security Nexus in Asia and the Pacific](#).

²³ International Finance Corporation (2021). [Power Markets Database](#).

The assessment of readiness for each country to adopt non-wired PPA is shown in Table 6.

Table 6 Non-wired (off-site) readiness assessment

Factors	South Asia				Southeast Asia					East Asia			
	Bangladesh	India	Pakistan	Cambodia	Indonesia	Malaysia	Philippines	Singapore	Thailand	Vietnam	Japan	South Korea	Taiwan
1. Regulatory and policy landscape													
Climate and clean energy targets	●	●	●	●	●	●	●	●	●	●	●	●	●
Clear non-wired PPA regulations (e.g. green tariff, DPPA)	●	●	●	●	●	●	●	●	●	●	●	●	●
TPA readiness (private sector support, grid code, wheeling charge)	●	●	●	●	●	●	●	●	●	●	●	●	●
2. Technical and infrastructure considerations													
Grid is flexible to allow VRE flows (e.g. BESS integration available)	●	●	●	●	●	●	●	●	●	●	●	●	●
Transmission and distribution systems are reliable (e.g. low SAIFI, SAIDI)	●	●	●	●	●	●	●	●	●	●	●	●	●
Harmonised grid codes are available across networks	●	●	●	●	●	●	●	●	●	●	●	●	●
3. Market considerations													
Power market liberalisation	●	●	●	●	●	●	●	●	●	●	●	●	●
Regulated PPA markets (e.g. capacity thresholds, limited business types, or no PPA provided)	●	●	●	●	●	●	●	●	●	●	●	●	●

Note: Green (●) = High (the conditions provide “high” benefits for RE PPA in the telecom sector); Yellow (●) = Moderate; Red (●) = Low.

2.3 Incentives for Renewable Energy

This section outlines the financial and non-financial incentives supporting the development of renewable energy projects in each country. Incentives are grouped into two categories:

- **Financial incentives** (e.g. subsidies, tax breaks, concessional loans)
- **Non-financial incentives** (e.g. regulations, technical standards, permitting support)

Governments and organisations worldwide provide a range of incentives to speed up adoption of renewables. These financial and non-financial measures help corporations reduce upfront costs, improve project viability, and strengthen sustainability commitments. However, these incentives are most effective where the regulatory environment is enabling (discussed in Section 2.2), for example, where regulations allow electricity to be sold or distributed to utilities and/or end-users.

Financial Incentives

Financial incentives can generally be grouped into three categories based on their influence on investment decision-making: core financial incentives, supplementary support mechanisms, and other market-based instruments.

Core financial incentives:

- **Project savings:** Renewable energy and energy efficiency measures reduce long-term operating expenses through lower electricity bills, improving overall project returns.
- **Revenue generation:** Mechanisms such as feed-in tariffs (FITs), net metering, long-term PPAs and production-based tax credits.

Supplementary:

- **Investment subsidies:** Import-duty reductions or equipment subsidies lower the cost of renewable energy technologies, making clean energy investments more competitive.
- **Tax incentives:** Tax credits such as green investment tax allowances allow renewable energy generators, including utility and self-investing renewable energy generators, to deduct a percentage of project costs from their tax liability, making renewable energy investments more affordable.
- **Loans and concessional finance:** Governments and financial institutions often offer low-interest or zero-interest loans to help businesses spread upfront costs while modernising their energy systems.

Others:

- **Energy attribute certificates (EACs):** EACs such as renewable energy certificates (RECs) provide a market-based revenue stream for renewable energy providers. They are tradable market instruments issued in association with renewable electricity supplied to the grid. Electricity consumers purchase EACs to claim renewable electricity use under the GHG Protocol's market-based Scope 2 method.
- **Carbon credits:** Carbon credits represent verified reductions or removals of greenhouse gas emissions, typically one tonne of CO₂ equivalent. Under emissions trading systems, companies must surrender allowances, and sometimes eligible credits, to cover their emissions; some carbon taxes let firms use credits to offset part of their liability.

- **Grants:** Government grants can partially cover installation or development costs, improving financial feasibility for businesses adopting renewable energy technologies.

Overall, these incentives help companies overcome capital constraints, accelerate renewable energy uptake, and strengthen the region's clean energy transition.

Non-Financial Incentives

Non-financial incentives complement financial measures by supporting sustainability commitments and operational readiness.

- **Environmental benefits:** Verifiable EACs can also serve as non-financial incentives when purchased. They enable electricity users to meet market-based GHG reporting requirements and demonstrate environmental leadership, thereby supporting broader renewable energy adoption.
- **Skills development:** Training programmes and knowledge-sharing platforms lower capacity-building costs and help companies adopt renewables.

Together, these non-financial incentives reinforce corporate sustainability strategies, improve compliance, and support long-term organisational transformation.

Table 7 provides an assessment of incentive availability in each country, using a traffic-light approach to indicate status: green for implemented, yellow for under development or planned, and red for not mentioned in official sources.

Table 7 **Assessment of incentives for renewable energy**

Factors	South Asia				Southeast Asia						East Asia		
	Bangladesh	India	Pakistan	Cambodia	Indonesia	Malaysia	Philippines	Singapore	Thailand	Vietnam	Japan	South Korea	Taiwan
1. Financial Incentives													
Project savings ²⁴	●	●	●	●	●	●	●	●	●	●	●	●	●
Revenue generation (ceiling price, FiT, net metering)	●	●	●	●	●	●	●	●	●	●	●	●	●
Investment subsidies ²⁵	●	●	●	●	●	●	●	●	●	●	●	●	●
Tax incentives	●	●	●	●	●	●	●	●	●	●	●	●	●
Loans and support programmes (e.g. from financial institutions)	●	●	●	●	●	●	●	●	●	●	●	●	●
EACs (e.g. RECs)	●	●	●	●	●	●	●	●	●	●	●	●	●
Carbon credits	●	●	●	●	●	●	●	●	●	●	●	●	●
Grant programmes (e.g. government- and institution-funded) ²⁶	●	●	●	●	●	●	●	●	●	●	●	●	●
2. Non-Financial Incentives													
Environmental benefits (benefits from GHG or carbon reduction, carbon pricing)	●	●	●	●	●	●	●	●	●	●	●	●	●
Skills development (e.g. training programmes)	●	●	●	●	●	●	●	●	●	●	●	●	●

Note: Green (●) = implemented; Yellow (●) = under development or planned; Red (●): not mentioned in official sources.

²⁴ For example, rooftop solar projects in Thailand typically achieve payback periods of around 3–5 years for C&I installations, demonstrating strong project economics driven by electricity cost savings. Source: Krungsri Research, (2025), [Rooftop Solar: Suitable Business and Investment Models for Thailand](#).

²⁵ Subsidies for renewable energy and RTS are no longer available in several countries because these technologies and procurement mechanisms are mature and commercially viable; therefore, governments have phased out such subsidies.

²⁶ Grants are similar to subsidies and are not widely used, as these technologies are already mature and commercially viable without government support.

2.4 Renewable Energy Procurement and Deployment Options

This section describes the main renewable energy procurement and deployment options available to mobile operators, including wired and non-wired models. Table 8 compares these options by cost and contract structure, company eligibility, in-house capacity requirements, GHG emissions reporting, and procurement simplicity and speed, and identifies the countries where each option has been implemented.

- **On-Site Rooftop Solar (RTS):**
 - **Self-Owned Model:** Customers invest in and own the rooftop system, providing full control, long-term savings, and typically the lowest levelised cost of electricity.²⁷
 - **Leasing Model:** Customers use rooftop solar with no upfront cost by paying a fixed monthly lease. The system is owned, installed, and maintained by the provider.
 - **RESCO Model:** A renewable energy service company installs, owns, and operates the system, while the customer pays only for the electricity consumed under a long-term PPA, typically at rates below utility tariffs.
 - **On-Bill Model:** The customer repays the cost of the system through a charge on its electricity bill. Under on-bill financing or repayment, the customer usually owns the system and repays a loan from the utility or a third-party lender. Under tariffed on-bill models, the utility funds the system and recovers costs through a charge linked to the meter.
 - **Aggregator Model:** Demand from multiple sites, whether owned by one customer or by several, is pooled to achieve economies of scale, diversify risk and improve bankability. Electricity is supplied under PPAs with an independent provider.
- **Green Tariff:** A utility-offered programme that allows customers to buy renewable electricity, usually for a premium on top of the standard tariff. Supply may come from existing or new renewable capacity, and certificates should be retired on the customer's behalf to support Scope 2 claims.
- **Renewable Energy Certificate (REC):** A REC represents the environmental attributes associated with one megawatt-hour (MWh) of electricity generated from an eligible renewable source. Customers can purchase RECs and retire them in the relevant registry to substantiate renewable electricity consumption claims, including under the GHG Protocol Scope 2 market-based method.
 - **Bundled purchases:** the REC is acquired together with the underlying electricity from the same generator, for example through a PPA or utility green tariff, with the certificate cost embedded in the contract price.
 - **Unbundled purchases:** the REC is bought separately from the electricity, often from a different project or supplier, while the customer continues to receive power from its existing supplier.
- **Direct Power Purchase Agreement (DPPA):**
 - **Third-Party Access (TPA) / Open Access:** Generators and buyers agree on electricity prices directly, while paying wheeling charges to use the existing grid.

²⁷ Levelised cost of electricity is a metric representing the average, net present cost of electricity generation for a power plant over its lifetime, usually expressed in USD/MWh.

- **Aggregated DPPA:** An entity aggregates electricity demand across multiple facilities to procure renewable power from a developer under a single PPA.
- **Virtual (financial) PPA:** Generators and buyers agree on a fixed electricity price, but the electricity is sold by the generator into the wholesale market rather than delivered to the buyer. The price difference is settled financially, and the buyer receives the renewable energy certificates.

Table 8 Renewable energy procurement and deployment options and consideration factors

Option	Model	Cost and Contracts	Company Eligibility	In-house Capacity	GHG Emission Reporting	Procurement Simplicity and Speed	Countries Implemented
Wired	Self-owned system (CAPEX)	High upfront investment for consumers. Significant electricity bill savings and reduced exposure to future electricity price increases. No PPA required.	Not restrictive, subject to site availability and local regulations.	Requires in-house technical capacity for system operation and maintenance.	High-integrity contribution to Scope 2 emissions reduction.	Least-cost option. Simple and fast, subject to construction lead time.	All countries
	Bundled / aggregated self-owned system (CAPEX)	High upfront investment for end-users. Large electricity bill savings and reduced exposure to future electricity price increases.	Not restrictive, subject to aggregation rules and regulations.	Requires in-house technical capacity for O&M	High-integrity contribution to Scope 2 emissions reduction.	More complex than single-site self-ownership due to multi-entity coordination.	Typically allowed in open electricity markets (e.g. Japan, some states in India)
	Leasing model (OPEX)	No upfront investment. Fixed lease payments, often competitive with or lower than retail tariffs. An aggregation portfolio for leasing can also be implemented. Long-term contract (typically >10 years).	Not restrictive, subject to local regulations.	Minimal, as the developer manages all O&M during the contract period.	High-integrity contribution to Scope 2 emissions reduction, subject to attribute ownership.	Simple and fast. Requires a contract between the rooftop owner and the PV system owner (investor).	All countries (subject to regulatory conditions)
	RESCO model (OPEX)	No upfront investment. Electricity costs based on actual consumption under a long-term PPA, typically lower than standard tariffs. Contract usually >10 years.	Not restrictive, subject to third-party ownership and electricity sale regulations.	Minimal, as the developer owns the system and manages all O&M.	High-integrity contribution to Scope 2 emissions reduction, subject to contractual transfer of attributes.	Simple and relatively fast. Requires a contract between the rooftop owner and the PV system owner (developer); utility involvement mainly for interconnection.	Allowed in several countries; constrained in markets with strict third-party rules (e.g. Indonesia, Vietnam, Pakistan)
	On-bill model (OPEX)	No upfront investment. Costs recovered through a fixed service or repayment	Not restrictive, but dependent on	Minimal, as the system is usually owned by a utility	Can support Scope 2 emission reduction claims,	Simple for customers, but requires utility participation and	Allowed only in countries with approved on-bill

Option	Model	Cost and Contracts	Company Eligibility	In-house Capacity	GHG Emission Reporting	Procurement Simplicity and Speed	Countries Implemented
Non-wired		charge on the electricity bill. Long-term contract (typically >10 years).	utility program design.	or third party, with O&M managed by an ESCO.	subject to certificate allocation and accounting rules.	approved on-bill programmes.	financing schemes, such as Japan, South Korea, Malaysia, the Philippines, and India, where market maturity remains low to medium.
	Bundled / Aggregation system (OPEX)	No upfront investment. Electricity costs structured via long-term contracts, similar to RESCO PPAs or on-bill mechanisms.	Not restrictive, subject to aggregation rules and contracts with aggregators and/or between participants.	Minimal, as the developer or aggregator manages all O&M.	High-integrity contribution to Scope 2 emissions reduction, subject to attribute transfer.	More complex than single-buyer models. Requires a master aggregation agreement with the aggregator, plus individual participation contracts for each user.	Typically allowed in open or liberalised electricity markets (e.g. Japan, EU, US, Australia, parts of India)
	Green tariffs (e.g. UGT, GET)	No upfront investment. Electricity purchased at standard tariff plus a green premium. Short- to medium-term subscription (1–3 years).	Varies by scheme; quotas or eligibility rules may apply.	None. No installation or O&M responsibility.	Limited integrity for Scope 2 claims unless backed by credible certificates (e.g. I-REC).	Very simple procurement with low transaction complexity.	India, Malaysia, Thailand, South Korea
	Renewable energy certificates (RECs)	No investment in generation equipment. Certificate costs apply. Purchases typically cover annual electricity consumption; contract duration is agreed with the supplier.	Volume, price and delivery adjustments depend on contract terms and eligible REC availability.	No installation or maintenance responsibility for the buyer.	Supports market-based Scope 2 reporting when eligibility requirements are met. Note that the Scope 2 Guidance is undergoing revision, with expected	May involve more administration than green tariffs, as buyers arrange a separate REC purchase and confirm certificate eligibility and retirement.	REC frameworks exist in all 13 markets, but purchasing availability and eligibility vary. As of September 2026, new I-REC(E) issuance in Cambodia remained suspended ²⁸ ;

²⁸ I-TRACK (2025). [Temporary Suspension of I-REC\(E\) Issuance in Cambodia.](#)

Option	Model	Cost and Contracts	Company Eligibility	In-house Capacity	GHG Emission Reporting	Procurement Simplicity and Speed	Countries Implemented
					publication in late 2027.		Cambodia has adopted a domestic REC framework, but implementation still in progress. ²⁹
	TPA / Open access PPAs	No upfront investment. Long-term contracts (>10 years). Large minimum demand threshold. Wheeling charges may apply and can be high in some countries.	Large electricity demand required.	None.	High-integrity contribution to Scope 2 emissions reduction.	More complex than green tariffs due to price, wheeling, and regulatory negotiations.	India, Japan, Malaysia, Philippines, Singapore, South Korea, Taiwan
	Aggregated corporate PPAs	No upfront investment. Long-term contracts (>10 years). Minimum demand thresholds and special metering may apply. Wheeling charges can be as high as for TPA/open-access PPAs	Suits businesses with many small, low-load sites through demand pooling, subject to regulatory rules.	None.	High-integrity contribution to Scope 2 emissions reduction.	More complex and slower than standard DPPAs due to coordination among participants.	Philippines, Japan, Taiwan
	Virtual (financial) PPAs	No upfront investment. Long-term contracts (often 10–20 years). Price difference settled financially against the wholesale market price; buyer exposed to market price risk.	No physical delivery, so not limited by site location or load. Requires liberalised wholesale market.	Requires financial, legal and risk management expertise to manage settlement and price exposure.	Supports market-based Scope 2 when certificates are transferred and retired, subject to market boundary rules.	Complex. Requires a liquid wholesale price reference and may be subject to financial or derivatives regulation.	Japan, Singapore, Vietnam, Philippines; emerging in India

Note: O&M = operation and maintenance; RESCO = renewable energy service company.

²⁹ Khmer Times (2026). [RECs to Power Cambodia's Export Competitiveness](#).

3. Renewable Energy Procurement Options for Mobile Network Operators

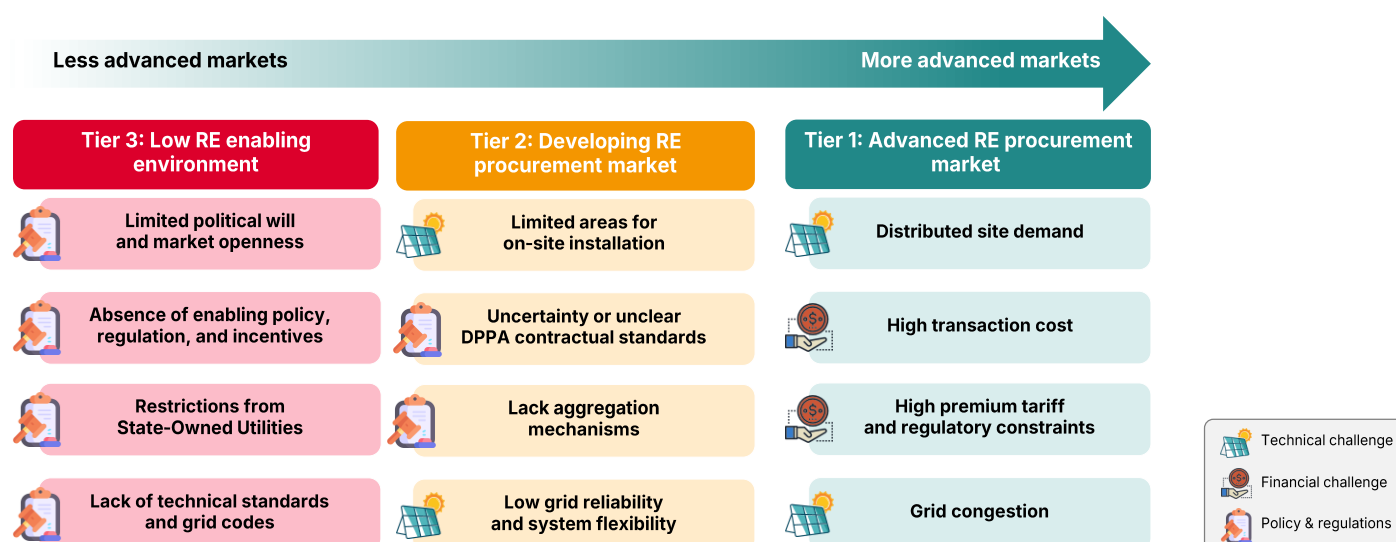
Building on the analysis in Section 2, this section categorises countries into three tiers based on the level of enablement for renewable energy procurement. The tiered approach reflects differences in market maturity, regulatory readiness, and practical procurement pathways, and provides a structured basis for tailoring recommendations to country-specific conditions.

The 13 focus countries in this study are grouped into three tiers based on their level of renewable energy (RE) procurement advancement.

- **Tier 1 – Advanced renewable energy procurement markets:** Markets with mature on-site (wired) PPAs under both CAPEX (self-investment) and OPEX models (e.g. leasing, Energy-as-a-Service), and commercially available off-site (non-wired) procurement mechanisms such as green tariffs, DPPAs, and open access. The countries in this group include India, Malaysia, Singapore, the Philippines, Japan, South Korea, and Taiwan.
- **Tier 2 – Developing renewable energy procurement markets:** Markets where on-site PPAs are common, but off-site renewable energy procurement is emerging or limited to pilot applications. Bangladesh, Pakistan, Thailand, and Vietnam are considered in this tier.
- **Tier 3 – Limited renewable energy procurement environments:** Markets with constrained on-site renewable energy deployment, often due to dominant state-owned enterprises and weak private-sector participation, and where off-site renewable energy procurement is largely absent. Indonesia and Cambodia fall into this category.

Key challenges for each tier are summarised in Figure 3.

Figure 3 Key challenges by tier



Note: RE = renewable energy. DPPA = direct power purchase agreement.

3.1 Tier 1 Markets: Advanced Renewables Procurement Options

Countries in Tier 1, including India, Malaysia, Singapore, the Philippines, Japan, South Korea, and Taiwan, have established regulatory frameworks for renewable energy procurement. Instruments such as Third-Party Access (TPA), Direct Power Purchase Agreements (DPPAs), and green tariff schemes are generally available and operational. Despite this maturity, mobile network operators (MNOs) continue to face structural and operational barriers that limit effective access to clean energy.

Common Gaps

- **Distributed site demand:** A defining characteristic of MNO energy demand is the highly distributed nature of assets, particularly mobile towers. MNO electricity demand is fragmented across thousands of low-load mobile network sites, making it difficult to meet minimum demand thresholds required for participation in TPA and DPPA schemes designed for centralised consumers.
- **High transaction costs:** Sites are scattered nationwide, often in rural or remote areas where grid infrastructure is weaker and renewable project development is less attractive for developers. Aggregating multi-site demand under existing procurement frameworks involves complex contracting, metering, settlement, and compliance processes that increase costs and administrative burden for MNOs. These transaction costs can outweigh the financial benefits of renewable procurement, particularly when compared with simple grid supply.
- **High green premiums and regulatory constraints:** Despite liberalised markets, green tariffs and wheeling arrangements can result in higher-than-grid electricity prices, reducing the economic

incentive to switch. MNOs often have limited ability to export surplus on-site generation, as net-metering and export schemes are capped or poorly suited to small, distributed sites.

- **Grid congestion and system flexibility for high renewable energy integration:** Grid congestion is a key barrier to scaling renewable electricity. Access to renewable supply is often constrained by available transmission and distribution capacity and insufficient system flexibility (e.g. the need for BESS or ancillary services).

Recommendations for MNOs

In advanced markets, the challenge is no longer the absence of policy instruments, but their fit-for-purpose application to distributed, infrastructure-heavy sectors such as telecommunications. Priority actions should therefore focus on adaptation rather than reinvention.

- **Accelerate on-site renewable deployment:** Prioritise solar installations at technically and economically viable sites using flexible models such as self-installation, bulk procurement, PPAs, or third-party EPC contracts. This approach delivers immediate emissions reductions, avoids regulatory complexity, and builds internal experience with clean energy assets.
- **Deploy solar plus storage:** Deploy solar combined with battery energy storage systems to enhance renewable penetration, ensure power reliability, and reduce dependence on diesel backup at tower sites. Given the criticality of uninterrupted power supply for mobile networks, solar plus BESS should be promoted as a core solution rather than an add-on.
- **DPPA participation through aggregation:** Enable aggregation of electricity demand across MNO sites, and potentially across operators, to meet minimum capacity requirements for DPPA participation.
- **Regulatory recognition of MNO aggregation needs:** Engage regulators to formally recognise MNOs as a distributed-load sector requiring adapted procurement rules and lower aggregation thresholds.
- **Electricity export and sales from sites:** Allow MNOs and tower owners to sell or export surplus electricity generated at tower sites to improve project economics and incentivise larger on-site renewable systems. Mirror emerging practices in more advanced markets, like Australia (e.g. allowing infrastructure owners to act as micro-producers).
- **Deploy Aggregation-Based Energy-as-a-Service (EaaS) models:** Promote EaaS approaches that allow service providers to manage MNO sites as a portfolio and deliver energy outcomes (kWh) rather than capacity-based solutions (kW). Combine multiple solutions (on-site solar, BESS, grid supply, DPPA-linked supply) across sites.

3.2 Tier 2 Markets: Developing Renewables Procurement Options

Countries in Tier 2, including Bangladesh, Pakistan, Thailand, and Vietnam. Tier 2 countries are characterised by regulated electricity markets where renewable energy deployment is relatively mature, but off-site procurement mechanisms remain under development. For MNOs, this creates a hybrid context where technical solutions for clean energy are increasingly available, but market and regulatory structures have not yet evolved to accommodate distributed, multi-site demand profiles.

Common Gaps

- **Physical area limits on on-site installation:** Even where self-investment is permitted, MNOs often face constraints on available installation areas at tower sites, rooftops, or leased land, limiting the scale of on-site renewable energy deployment.
- **Early-stage TPA and DPPA frameworks:** While TPA and DPPA mechanisms are being introduced, they remain nascent in design and implementation. Regulatory uncertainty, limited track records, and unclear contractual standards reduce bankability and deter both MNOs and developers from active participation.
- **Uncompetitive electricity premium tariffs:** Green tariffs and early DPPA pricing often result in electricity costs that are higher than conventional grid tariffs, undermining the commercial case for voluntary renewable procurement.
- **Minimum capacity thresholds and lack of aggregation mechanisms:** High minimum MW requirements for DPPA participation persist, with limited or no provision for demand aggregation across multiple sites or operators. This effectively excludes MNOs, whose electricity demand is inherently fragmented across thousands of small-load sites.
- **Grid reliability and system flexibility constraints:** Grid reliability remains a key concern in several Tier 2 countries, particularly outside major urban centres. Limited system flexibility to integrate VRE further constrains reliance on grid-supplied green electricity, reinforcing dependence on diesel backup generation at mobile tower sites.

Recommendations for MNOs

Tier 2 markets are at a transitional stage, where renewable energy deployment is mature, but corporate procurement mechanisms are still evolving. Building on the experiences of Tier 1 countries, MNOs in Tier 2 markets can begin adopting proven aggregation, on-site generation, and service-based models, while proactively shaping regulatory frameworks to enable more advanced procurement options over time.

- **Maximise on-site renewable deployment:** Deploy the highest feasible level of on-site solar PV at tower and facility sites, supported by BESS, bulk procurement of standardised systems, and portfolio-level optimisation to address scattered sites issues.
- **Adopt aggregation-based EaaS models:** Aggregate distributed tower sites into managed energy portfolios and engage service providers to deliver electricity as a service (kWh), reducing transaction complexity and upfront investment requirements. This could help enhance MNOs' capacity to prepare for the adoption of peer-to-peer electricity trading in the near future.
- **Prepare for future DPPA participation:** Structure internal energy data, load profiles, and aggregation strategies to be DPPA-ready when regulatory frameworks mature and minimum capacity requirements are gradually reduced.
- **Coordinate sector-wide policy advocacy:** Work collectively through industry platforms (e.g. GSMA, national telecom and energy councils) to communicate aggregated demand for affordable green electricity and advocate for DPPA aggregation mechanisms and competitive tariff structures.
- **Position clean energy as a competitiveness enabler:** Frame renewable energy access as critical infrastructure for digital connectivity, network resilience, energy security, and cost competitiveness, aligning MNO decarbonisation needs with national energy security and climate objectives.

3.3 Tier 3 Markets: Limited Enabling Environment for Renewables Procurement

Tier 3 countries, Cambodia and Indonesia, represent the most challenging environments for corporate renewable energy procurement. Electricity markets are largely dominated by state-owned utilities, with limited political momentum to open access for private or corporate-led renewable energy integration. Policy frameworks for renewable energy procurement are either absent or highly restrictive, and enabling instruments such as DPPA, TPA, or green tariffs are generally unavailable.

Common Gaps

- **Limited political will and market openness:** A lack of strong political commitment to renewable energy market liberalisation restricts the introduction of corporate procurement mechanisms. In some cases, renewable energy integration by non-utility actors is actively discouraged to protect incumbent utility models.
- **Absence of enabling policy, regulation, and incentives:** There is limited availability of clear policies, regulatory frameworks, or financial incentives to support private-sector renewable energy deployment. This creates uncertainty for investment and limits the scalability of clean energy solutions for MNOs.
- **Restrictions from State-Owned Utilities:** State-owned utilities often maintain exclusive control over generation and grid operations, avoiding or delaying the integration of distributed renewable energy systems. This reduces opportunities for grid-connected or export-enabled renewable installations.
- **Lack of technical standards and grid codes:** Inadequate or outdated technical standards, grid codes, and interconnection guidelines increase safety, reliability, and operational risks for renewable energy deployment, particularly for distributed and hybrid systems combining solar, storage, and backup generation.

Recommendations for MNOs

In Tier 3 markets, where regulatory, policy, and market conditions do not yet support corporate renewable energy procurement, MNO decarbonisation strategies must focus on solutions that are technically robust, regulator-agnostic, and fully under operator control.

- **Prioritise behind-the-meter solutions:** In the absence of enabling market frameworks, MNOs should prioritise behind-the-meter renewable energy installations, particularly solar PV systems deployed at tower sites and operational facilities. These solutions allow MNOs to reduce emissions and fuel costs without reliance on grid export.
- **Apply international technical and safety standards:** While the market lacks technical standards and compliance provided by regulators, all behind-the-meter installations should follow internationally recognised technical, safety, and performance standards, covering system design, installation, operation, and maintenance.
- **Integrate storage to enhance reliability and autonomy:** Where feasible, BESS should be integrated with on-site renewable generation to improve energy autonomy, mitigate grid outages, and reduce dependence on diesel generators in weak-grid or off-grid locations.
- **Maintain optionality for future market development:** Even in restrictive environments, MNOs should document performance, reliability, and cost savings from behind-the-meter deployments.

This evidence base can support future engagement with policymakers and utilities if political or regulatory conditions begin to shift toward Tier 2-style enablement.

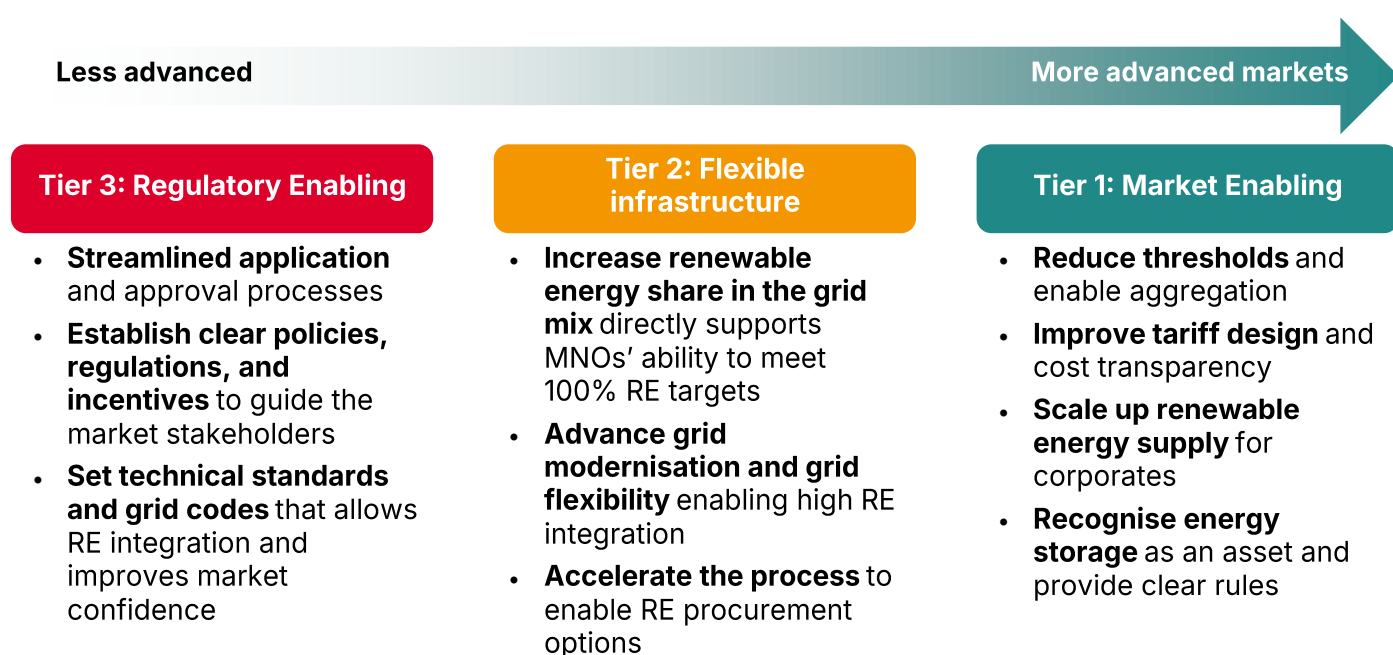
3.4 Recommendations for Regulators, Policymakers, and Market Stakeholders

Speeding up mobile operators' access to clean electricity requires coordinated action by regulators, policymakers, utilities, system operators and market intermediaries.

While market maturity differs across countries, several cross-cutting reforms can significantly reduce barriers for distributed infrastructure sectors and unlock scalable renewable energy procurement.

Figure 4 summarises the recommended actions by tier; Table 9 gives additional details for each of the recommendations.

Figure 4 Summary of recommended actions by tier



Note: RE = renewable energy. MNOs = mobile network operators.

Table 9 **Relevance of recommended actions by tier**

Recommendation	Tier 1	Tier 2	Tier 3
Streamline application and approval processes: Regulators and utilities should cut application processing times for renewable energy interconnection, TPA, DPPA, and green tariff participation. Simplified procedures, standardised documentation, and clear timelines are particularly important for MNOs, which manage large portfolios of small, distributed sites.	●	●	●
Recognise energy storage as an enabling asset: Regulators should explicitly recognise battery energy storage systems (BESS). Batteries can store electricity during periods of high renewable generation and discharge it when demand is high, helping balance supply and demand. This enables greater integration of variable renewable energy, supports grid reliability, and provides services such as peak shaving and frequency regulation. Clear rules on ownership, interconnection, and compensation for storage services would facilitate higher renewable penetration, improve grid reliability, and support distributed consumers such as MNOs.	●	●	●
Increase renewable energy share in the grid mix: Raising the overall renewable energy share in the national grid helps mobile operators reduce Scope 2 emissions and meet renewable electricity targets, particularly in markets where direct procurement options remain limited.	●	●	●
Advance grid modernisation and grid flexibility: The government should develop grid modernisation and transmission expansion, prioritising areas with high-quality renewable resources and competitive generation costs. Additionally, Advanced Metering Infrastructure (AMI) and automated grid control systems should be implemented to enable electricity users (e.g. telecom towers, cell sites, and other buildings) to participate in future flexibility markets	●	●	●
Improve tariff design and cost transparency: Tariff structures for green electricity should be reviewed to ensure competitiveness with conventional grid tariffs. Clear, transparent tariff calculation methodologies, covering wheeling charges, surcharges, and ancillary fees, are essential to improve bankability and encourage voluntary renewable energy procurement.	●	●	●
Scale up renewable energy supply for corporate demand: Governments and utilities should increase renewable energy generation capacity explicitly aligned with corporate and infrastructure-sector demand. Dedicated RE procurement windows or corporate offtake allocations can help ensure sufficient supply to meet growing voluntary RE commitments.	●	●	●
Reduce minimum capacity thresholds and enable aggregation: Minimum MW requirements for participation in TPA and DPPA schemes should be lowered or complemented with formal aggregation mechanisms. Allowing demand aggregation across multiple sites and operators would align regulatory frameworks with the realities of distributed electricity consumers and expand access beyond large industrial loads.	●	●	●

Note: ● = Most relevant; ● = Somewhat relevant.

4. Country Deep Dive Analysis

4.1 South Korea

South Korea is a Tier 1 market with advanced renewable electricity procurement frameworks and a leading technology hub in Asia. Many companies have established sustainability commitments, net zero targets, or RE100 goals. However, MNOs in South Korea still face challenges and gaps. This section identifies and analyses these issues and provides recommendations and roadmaps to support MNOs in achieving their commitments.

Supply of Renewable Energy

Wired Procurement Readiness: High Level

In South Korea, wired renewable electricity procurement is mature. Rooftop PV systems with capacities of up to 1 MW may export surplus electricity to the grid under the net-metering scheme of the Korea Electric Power Corporation (KEPCO), with exports credited against on-site consumption or paid in cash at the annual system marginal price (SMP).³⁰ Systems exceeding 1 MW are not eligible for net-metering and must participate under other regulatory or market frameworks if they intend to export or sell electricity. Any commercial sale or third-party supply of electricity requires registration under the Distributed Energy Act.³¹

Non-Wired Procurement Readiness: High Level

MNOs can procure renewable electricity through several mechanisms, including the Korea Green Premium, third-party PPAs, corporate PPAs, and self-consumption facilities that are operating within a standardised and tightly regulated grid and retail market structure. These mechanisms are recognised for achieving K-RE100 targets, alongside market-based instruments such as RECs.

- **Korea Green Premium:** Korea has developed a national REC system managed by the Korea Energy Agency. The Green Premium procurement mechanism is recognised by RE100 and Korean regulators. Each REC represents 1 MWh of renewable electricity, traceable under the Renewable Portfolio Standard (RPS), and certificates are retired after being matched with Green Premium certificates to prevent reuse. Korean RECs apply a matching rule using generation after July 2025, broadly aligning with international requirements that generation occur within the same reporting year or close to the consumption period. Although full plant-level details are not publicly disclosed due to business confidentiality constraints, power plants provide key characteristics such as plant age and location.³²
- **Off-site Power Purchase Agreements (PPAs):** Off-site PPAs allow consumers to procure renewable energy from generators through the grid, similar to DPPA framework used in Vietnam. Off-site PPAs are structurally complex because the electricity market combines a wholesale electricity spot market (operated by the market operator, Korea Power Exchange or KPX) with a vertically integrated retail monopoly, where KEPCO is the sole electricity supplier to end-users. As

³⁰ OECD (2021). [Korea Electricity Security Review](#)

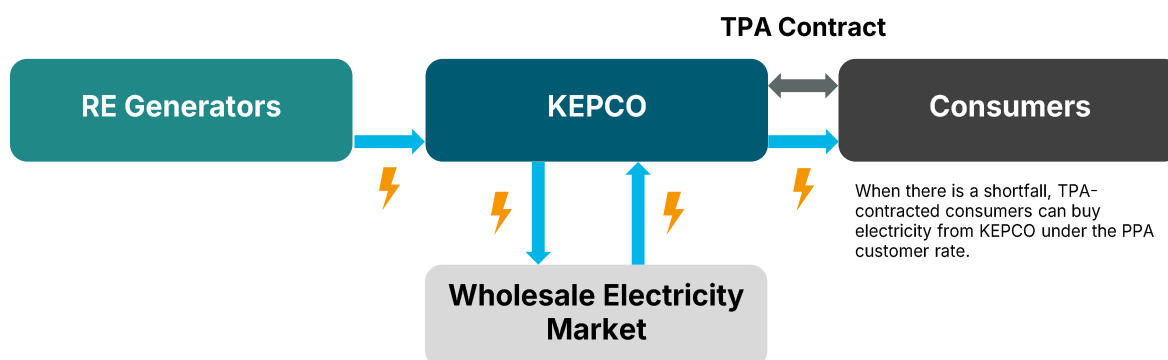
³¹ Kim and Chang (2024). [Pre-Announcement of Legislation of Subordinate Laws of the Special Act on Promotion of Distributed Energy](#)

³² Korean Energy Agency New and Renewable Energy Center (2025). [녹색프리미엄은 GHG 프로토콜 기준에 부합 \[한국에너지공단\]](#)

a result, corporate buyers cannot contract directly for physical power delivery in the same way as in liberalised markets. Two main off-site PPA models are used in practice:

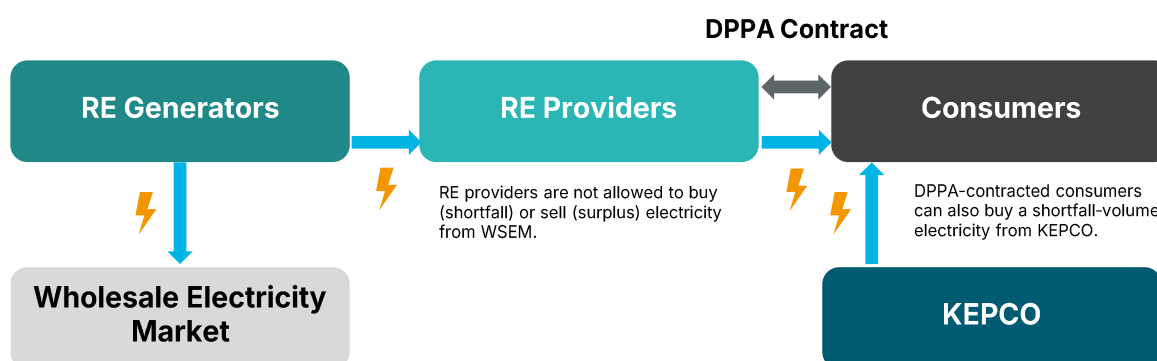
- **Third-party intermediary PPA (KEPCO-mediated physical structure):** the generator sells power into the market, KEPCO supplies the electricity to the third-party PPA-eligible customer (consuming at least 300 kW), and contractual arrangements link the parties.³³
- **Corporate PPA (CPPA):** Renewable generators contract with registered renewable energy providers. These providers then sign DPPAs with electricity users, while KEPCO is not a contractual party. If generation exceeds the contracted volume, the generator can sell surplus electricity in the wholesale market. Similarly, if generation is insufficient, customers buy the remaining electricity from KEPCO. However, renewable energy providers are not allowed to buy or sell electricity in the wholesale electricity market.³⁴ In addition, direct CPPA participation has been limited to electricity users with a minimum contracted capacity of 300 kW or consumers with electricity receiving equipment of at least 300 kVA. Previously, renewable generators were required to have more than 1 MW of capacity to supply under a direct CPPA,³⁵ but this requirement was removed in a 2025 regulatory amendment.³⁶

Figure 5 TPA in South Korea



Source: Adapted from IEEFA – Bottlenecks to Renewable Energy Integration in South Korea³⁷

Figure 6 CPPA in South Korea



Source: Adapted from IEEFA – Bottlenecks to Renewable Energy Integration in South Korea

³³ IEEFA (2025). [Bottlenecks to Renewable Energy Integration in South Korea](#)

³⁴ [Ibid](#)

³⁵ Shin and Kim (2022). [Development in Korean Direct PPAs](#)

³⁶ Todayenergy (2025). [직접 PPA 문턱 낮춘다...1MW 용량요건 폐지](#).

³⁷ IEEFA (2025). [Bottlenecks to Renewable Energy Integration in South Korea](#)

Incentives: Medium Level

South Korea's renewable energy development is supported by the Act on the Promotion of the Development, Use and Diffusion of New and Renewable Energy, which mandates national planning, funding, and technology promotion.³⁸ The government provides CAPEX subsidies for renewable systems installed for self-use, including support for projects in industrial complexes and for specific technologies such as agri-PV and offshore wind.³⁹ In addition, it offers technical and regulatory support through clear standards, certification requirements, and grid interconnection procedures to facilitate project implementation.

Demand for Renewable Energy

In 2025, around 10% of South Korea's electricity was generated from renewable energy. This share is significantly below the Asia regional average of 28%.

An IEEFA analysis identifies several key bottlenecks to renewable energy expansion, including grid constraints due to limited HVDC infrastructure, delays in grid expansion and reinforcement, geographic mismatches between supply and demand centres, and weak profitability for renewable energy generators.⁴⁰ In addition, the RPS, implemented in 2012, requires power generators with capacities of at least 500 MW to increase their share of renewable energy each year. However, the scheme includes a loophole that allows generators to meet their obligations by purchasing RECs instead of investing in and operating physical renewable energy facilities.⁴¹

Operator Landscape

South Korea has three major mobile network operators: SK Telecom, LG Uplus, and KT. Together, the three operators consumed 7.7 TWh of electricity in 2025, with similar consumption levels across the three operators. All three have announced corporate net zero targets (including two of the three operators with validated near-term science-based targets). SK Telecom and KT are members of the global RE100 initiative, aiming to reach 100% renewable energy by 2050, while LG Uplus is a member of the Korean RE100 initiative. However, renewable energy accounted for less than 10% of their combined electricity consumption in 2025. Most of this share came from market-based mechanisms, particularly Green Premium. On-site solar supplied less than 1%.

MNOs primarily own and operate their mobile network towers, which gives them direct control over sites and facilitates infrastructure upgrades without the potential conflicts of interest associated with the tower company model.

Case Studies

Case 1: SK Telecom

In 2025, SK Telecom purchased 284 GWh of renewable electricity through the Green Premium and generated 5.6 GWh from on-site solar systems, meeting around 11% of its electricity consumption

³⁸ Korea Legislation Research Institute. (2020). [Act on the Promotion of the Development, Use and Diffusion of New and Renewable Energy](#)

³⁹ Eco-Business (2025). [South Korea Doubles Financial Support for Renewable Projects in 2026 Budget](#)

⁴⁰ [Ibid](#)

⁴¹ [Ibid](#)

with renewables.⁴² According to its sustainability report, SK Telecom has installed 4.9 MW of self-consumption solar capacity at telecommunication facilities and office buildings.

Case 2: LG Uplus

In 2025, LG Uplus met nearly 9% of their electricity consumption with renewable energy, purchasing nearly 270 GWh of renewable electricity through the Green Premium and generating around 1.9 GWh from its on-site solar systems.⁴³ Its main installation is a 1 MW solar system at a single facility, which represents the maximum capacity allowed without registration as an electricity business operator.

Key Stakeholders Driving Renewable Energy Acceleration in South Korea

Table 10 Stakeholder Mapping – South Korea

Stakeholder group	Examples	Level of influence	Description
Regulators	Ministry of Climate, Energy, and Environment (MCEE)	High	MCEE ⁴⁴ can strengthen Green Premium, DPPA, and RPS frameworks to better enable renewable energy deployment, for example by simplifying DPPA procedures, enabling DPPA aggregation models, lowering participation thresholds, increasing the Green Premium quotas, and strengthening RPS enforcement to encourage physical renewable energy investments.
Implementing Agency	Korea Energy Agency (KEA)	High	KEA plays a significant role in implementing government renewable energy policies and managing Green Premium, which is the most widely used procurement method by companies.
MNO Companies	SK Telecom LG Uplus KT	High	MNOs can play a significant role by investing in on-site solar at their facilities, including cell sites, and by procuring renewable electricity through existing mechanisms such as the Green Premium. DPPA could become a viable option if demand thresholds are lowered and aggregation models are permitted.
Utility	KEPCO	High	KEPCO has a high level of influence because it invests in grid modernisation and expansion, operates the transmission and distribution networks, implements and enforces interconnection standards, and acts as the main counterparty in the TPA/DPPA scheme. The company is also a key actor in addressing grid constraints to enable a higher share of renewable energy.
RE Providers	SK E&S	Medium	RE providers manage DPPA contracts and renewable attributes for corporate buyers, but their role in physical power trading is limited by current market regulations.
RE Generators	SK Ecoplant Hanwha Renewables	High	RE generators play a key role in expanding physical renewable capacity, which increases the amount of renewable electricity available to corporate buyers and raises the overall share of renewable energy in the grid.

Note: Numerous companies operate as renewable energy providers and generators; the examples in the table are provided for illustration.

⁴² SK Telecom (2026). [SK Telecom Annual Report 2025](#)

⁴³ LG Uplus (2026). [Sustainability Report 2025](#)

⁴⁴ As of October 2025, Korea established the MCEE to function the former MOTIE and responds for climate, electricity, grid, and energy transition policies. Source: IEA (2025). [Energy Policy Review Korea 2025](#).

Addressing the Gaps and Challenges

South Korea's MNOs have committed to net zero targets, including sourcing 100% of their electricity from renewable energy by 2050. However, the share of renewable electricity in the national grid remains below the Asia average, requiring MNOs to rely more on available renewable procurement mechanisms.

Key challenges include:

- **Complex DPPA framework:** The current structure is poorly suited to operators with many small sites, and aggregation models are not yet permitted. In addition, DPPAs are more expensive than other procurement options due to high ancillary charges and opaque and duplicative grid fees.⁴⁵
- **Grid constraints:** Limited grid capacity and slow network expansion restrict new renewable connections and hinder renewable energy growth.

Recommendations and Roadmap

Short term – Pursue aggregated on-site renewable solutions

MNOs can significantly increase renewable energy use for network operations by investing in on-site generation. Aggregation models that combine on-site solar with energy storage, under contracts priced per kWh consumed can enable larger and more stable renewable supply beyond the capacity limits of individual facilities. This benefits both sides: renewable energy providers can sell larger, more economically viable volumes of electricity, while MNOs gain access to greater and more reliable renewable energy supply.

Medium to long term – Introduce a DPPA aggregation model and lower eligibility thresholds

MNOs and stakeholders could propose a DPPA aggregation model with lower participation thresholds (similar to the RAP scheme in the Philippines discussed in the section 4.2) to enable companies with geographically dispersed loads to access renewable electricity more effectively.

Medium to long term – Strengthen incentives for physical renewable energy investment

MNOs could work with renewable energy providers and generators to advocate for stronger incentives for new renewable capacity. At present, DPPA-based electricity is often not cost-competitive with standard tariffs or the Green Premium, and the monopoly retail market structure further constrains renewable energy expansion.

⁴⁵ Park and Lee (2024). [South Korea's PPA System: Status and Opportunities for Renewable Energy Development](#)

4.2 Philippines

The Philippines has one of the most advanced electricity markets and procurement frameworks in Southeast Asia. This section analyses existing renewable energy procurement mechanisms and case studies of adoption, identifies key gaps and challenges, and presents recommendations and roadmaps to increase the share of renewable energy used by mobile network operators.

Supply of Renewable Energy

Wired Procurement Readiness: High Level

On-site and wired solar PPAs are available in the Philippines. Grid and interconnection standards are well-established under the Philippine Grid Code and Distribution Code, and installation and quality requirements follow national electrical and safety standards, including the Certificate of Final Electrical Inspection (CFEI) process. Net metering is available, with an installation capacity of up to 100 kW. Digitalisation measures have been implemented to streamline the process, significantly reducing approval timelines, although processing times may vary across local government units (LGUs). While direct subsidies and grants are limited due to the maturity stage of the technologies, the government provides tax incentives under RA 9513, and commercial green financing options are broadly available.

Direct PPA Policy Readiness: High Level

The Philippines operates the Wholesale Electricity Spot Market (WESM) and applies standardised technical rules under the Philippine Grid Code and Philippine Distribution Code for interconnection and operations. Third-party access is implemented through open-access frameworks: Green Electricity Option Program (GEOP) and Retail Competition and Open Access (RCOA) and Retail Aggregation Program (RAP) for contestable customers.

- **RCOA:** RCOA allows individually eligible end-users with an average monthly peak demand of at least 100 kW to choose their licensed retail electricity supplier. The threshold was reduced from 500 kW to 100 kW on 26 June 2026.⁴⁶ RCOA promotes competition and consumer choice by allowing renewable or conventional electricity supply, whereas GEOP specifically supports renewable electricity procurement.
- **RAP:** Retail Aggregation Program (RAP) is a pathway into RCOA, allowing multiple end-users under the same customer or business group (typically within the same distribution utility area) to aggregate their loads to reach the 100 kW threshold (effective in June 2026, reduced from the previous threshold at 500 kW⁴⁷) and contract with a licensed RE or non-RE Retail Electricity Supplier (RES).
- **GEOP:** A renewables-only retail program for eligible end-users with at least of 50 kW demand, reducing from 100kW in 2026.⁴⁸ Customers purchase renewable electricity from licensed renewable energy suppliers, with the distribution utility providing wheeling and network services.

⁴⁶ BusinessWorld (2026). [ERC says 11,500 businesses can tap new 100-kW power market](#)

⁴⁷ PNA (2026). [ERC slashes threshold for retail aggregation program to 100kW/month](#)

⁴⁸ PhilStarGlobal (2026). [DOE opens direct green energy contracting to more consumers](#)

Incentives: Medium Level

The Philippines offers fiscal incentives dedicated to renewable energy under RA 9513, mainly for renewable energy developers/project owners. Building or factory owners who self-install renewable energy systems do not automatically qualify. They may become eligible either by (i) registering their self-generation plant with DOE as a qualified renewable energy developer/facility under RA 9513, or (ii) registering the project with BOI to obtain CREATE/SIPP incentives. For example, renewable energy, battery storage, and energy efficiency projects of self-investment may qualify as Tier 2 investments under the CREATE, which can provide fiscal incentives such as an Income Tax Holiday (ITH) or Special Corporate Income Tax (SCIT).^{49 50}

Demand for Renewable Energy

In 2024, renewable energy supplied approximately 27.4 TWh, accounting for about 22% of the Philippines' electricity generation, supported by around 10 GW of installed renewable capacity.⁵¹ While the Renewable Portfolio Standard (RPS) policy is enforcing electricity providers to rise renewable energy shares in their portfolio, supply may still trail demand, particularly with new data centre load projected around 1.3 GW by 2030.⁵²

Operator Landscape

The Philippines has three major mobile network operators: DITO Telecommunity, Globe Telecom, and Smart Communications (PLDT). In 2025, Globe consumed around 440 GWh of electricity, of which around one-third came from renewable sources. Smart (PLDT) consumed nearly 1 TWh, with around 5% sourced from renewables. Electricity demand from mobile network operations is expected to continue increasing.

At the same time, Philippine MNOs operate under a mixed infrastructure ownership structure, with roughly half of network infrastructure owned by MNOs and the remainder leased under the TowerCo model.⁵³ Additionally, the Konektadong Pinoy Act (2025) promotes infrastructure sharing to reduce duplication of data transmission networks, improve network capacity, and lower barriers to market entry which is expected to increase infrastructure sharing.⁵⁴ Under the sharing models, mobile network operators lease passive infrastructure from TowerCo companies, which retain decision-making authority over renewable energy investment and installation at tower sites. As a result, effective coordination between MNOs and TowerCos is essential to align infrastructure operations with renewable energy demand and decarbonisation targets.

⁴⁹ Congress of the Philippines (2021). [Corporate Recovery and Tax Incentives for Enterprises \(CREATE\) Law](#).

⁵⁰ The Philippines Board of Investment (2022). [Specific Guidelines to Implement The 2022 Strategic Investment Priority Plan](#).

⁵¹ Ember. [Electricity Data Explorer \(The Philippines\)](#)

⁵² ASEAN Briefing (2025). [Rising Demand for Data Centers in The Philippines](#)

⁵³ Arthur D. Little (2023). [How telcos, TowerCos, data centers & investors can harness this billion-dollar opportunity](#).

⁵⁴ Congress of the Philippines (2025). [The Konektadong Pinoy Act](#)

Case Studies

Case 1: Globe Telecom's transition of 3,000+ sites to renewable energy via RAP⁵⁵

Globe Telecom has begun shifting more than 3,000 cell sites and other facilities in Metro Manila and Region IV-A to renewable energy, with full transition targeted by 2028. This is being implemented through the RCOA with RAP, which allows Globe to aggregate its electricity-consuming facilities within the same distribution utility area and directly contract renewable supply from licensed Retail Electricity Suppliers, such as ACEN Renewable Energy Solutions (ACEN RES).

Case 2: Smart PLDT purchased renewable energy under GEOP for data centre

PLDT and Smart have expanded their partnership with renewable energy producer First Gen Corporation to supply 100% renewable energy to six critical network facilities in Mindanao, including the first PLDT Group data centre in Davao City to run entirely on renewable energy. The expanded agreement builds on earlier renewable energy deployments in the Visayas, where PLDT and Smart partnered with First Gen to switch sites to geothermal energy aligning with the Philippines' Green Energy Option Program (GEOP).

Key Stakeholders Driving Renewable Energy Acceleration in Philippines

Table 11 Stakeholder Mapping - Philippines

Stakeholder group	Examples	Level of influence	Description
Regulators	Department of Energy (DOE) Energy Regulatory Commission (ERC) Electricity National Grid Cooperation of the Philippines (NGCP)	High	The relatively mature WESM and established schemes such as GEOP and RAP mean the basic regulatory framework for corporate PPAs and BESS are already in place, with regulators now mainly shaping adoption through market rules and eligibility criteria. However, the influence of NGCP and DOE remains high, as they are the key actors for transmission grid development that still faces significant constraints for integrating large-scale renewable energy. In parallel, the DOE and ERC can revise renewable energy and DPPA regulations and implementing rules to improve accessibility.
MNO Companies	Globe Smart PLDT DITO Telecommunity	High	MNOs have high influence because they directly create renewable energy demand and negotiate prices with renewable energy providers through on-site aggregation model or off-site procurement mechanisms such as RAP, RCOA, and GEOP. Globe, for example, uses the RAP to increase its renewable energy consumption.
TowerCo Companies	Frontier Tower Associates Philippines (FTAP) EDOTCO PhiTower-MIDC	High	TowerCo companies play a critical role because they own the physical infrastructure that MNOs use and make decisions on renewable energy investments.

⁵⁵ ACEN (2025). [Globe to shift over 3,000 cell sites to renewable energy](#)

DISCOMs	Manila Electric Company Visayan Electric Davao Light and Power	High	Distribution utilities have a high level of influence because they are the key actors for distribution grid development and for enabling renewable energy connections within local grid capacity constraints.
RE Providers	Several companies due to WSEM	High	Eligible Retail Electricity Suppliers (RES) have high influence of preparing supply renewable electricity to qualified end-users through the open access framework under the GEOP, RCOA, and RAP. In addition, they can indirectly improve grid stability by investing BESS grid integration initiatives.

Note: Numerous companies operate as TowerCo companies, DISCOM, and renewable energy providers; the examples in the table are provided for illustration.

Addressing the Gaps and Challenges

While Philippines aims to increase the share of renewable energy in the power grid to around 50% by 2050, this trajectory may not be fast enough with the MNO's near-term demand. Investing in renewable energy through programmes such as RAP or through company-owned facilities, as Globe has already begun to do, is an appropriate approach but requires faster scaling. Key challenges include:

- Not all facilities are eligible for RAP because aggregated demand does not meet the threshold,
- Some facilities operate under leasing or TowerCo models, where an MNO does not own the infrastructure and therefore cannot directly invest in wired renewable energy solutions.
- The transition to renewable energy is constrained by reliance on Distribution Utilities (DUs), due to lower DU electricity prices compared to renewable energy suppliers, limited technical readiness for switching, and commercial resistance stemming from concerns over stranded assets and revenue loss.

Recommendations and Roadmap

Short term: Adopt GEOP

MNOs in the Philippines can procure renewable electricity through GEOP when individual electricity end-users meet the 50 kW average monthly peak demand threshold. The revised 2026 guidelines also allow eligible smaller end-users within a contiguous area to aggregate their demand to meet this threshold.

Short term: Aggregation demand model

In addition to RAP, MNOs may procure renewable electricity through contracts structured primarily around energy consumption (kWh) rather than installation capacity (kW). Such arrangements allow renewable energy supply to be optimised over MNO sites as a portfolio, rather than a location approach. This approach can increase renewable energy utilisation, offering mutual benefits by enabling developers to optimise generation while allowing users to achieve a higher share of renewable electricity, subject to grid and regulatory constraints.

Short term: Incentivise Grid Flexibility Investments

Accelerate deployment of more battery energy storage systems (BESS) and advanced metering infrastructure through both financial and non-financial incentives. This will improve grid flexibility to enable more integration of renewable energy (RE) into the grid, and as aligned with the Philippines' Smart Grid Roadmap.

Medium term: Embed clean energy requirements into TowerCo leasing contracts.

As more than half of network towers are owned by TowerCo companies, which may lack incentives or experience in renewable energy procurement, MNOs can drive clean electricity adoption by incorporating renewable energy requirements into lease agreements and engaging regulators to align incentives and market frameworks. For example, new towers can be mandated to be "Renewable Energy (RE)-Ready," designed with sufficient structural loading and land area to accommodate on-site solar and battery storage systems (BESS) immediately or in the future, preventing the need for costly retrofitting. Alternatively, TowerCos can be incentivised by recognising them as micro-grid operators in some areas.

Medium-long term: Negotiate to continuously reduce the GEOP threshold

Reducing GEOP threshold would move the electricity market closer to open-market models, such as those in Singapore or Japan, enabling greater access to renewable electricity. For example, in 2024, SoftBank sourced more than 90% renewable electricity for its base stations, exceeding both its corporate target⁵⁶ and Japan's average renewable share of around 22% in the same year.⁵⁷

⁵⁶ Softbank (2026). 4. [Contributing to the Global Environment with the Power of Technology](#)

⁵⁷ Ember. [Electricity Data Explorer](#)

4.3 Malaysia

Malaysia has a moderately advanced level of both wired and non-wired clean energy procurement. The country shows high maturity in wired procurement, supported by government incentives for RTS investments, as well as several commercial options such as the Green Tariff and the Corporate Renewable Energy Supply Scheme (CRESS).

Supply of Renewable Energy

Wired Procurement Readiness: High Level

Rooftop solar in Malaysia is well developed, supported by established grid codes, technical and installation standards, and clear qualification requirements. Malaysia's wired solar framework is structured around two complementary programmes:

- **Solar Accelerated Transition Action Programme (Solar ATAP):** Solar ATAP took effect on 1 January 2026, replacing the Net Energy Metering (NEM) programme which closed in June 2025.⁵⁸ Solar ATAP allows consumers to install rooftop solar PV primarily for self-consumption while enabling surplus electricity to be exported to the grid. The programme operates on a 10-year contract term from the commencement date. It allows installations of up to 100% of a consumer's maximum demand, capped at 1 MW. It also maintains the core principle of NEM by allowing excess electricity exported to the grid to be credited against electricity consumption within the same billing period through a net-offset mechanism. Domestic consumers receive bill credits based on the energy charge component of the utility tariff, while non-domestic consumers receive credits based on the average system marginal price (SMP).⁵⁹
- **SELCO (Solar for Self-Consumption):** SELCO allows consumers to generate solar electricity for 100% on-site consumption, with no export to the grid. The programme was significantly expanded in January 2025 to include ground-mounted and floating solar installations, with no capacity quotas for non-domestic users. From 1 January 2026, BESS is required for systems exceeding 1 MWac (revised from the previous 72 kWp threshold). A standby charge of RM 12/kWp per month applies to systems above 1 MWac.^{60 61}

Direct PPA Policy Readiness: Medium-High Level

Malaysia targets net zero by 2050. Corporate renewable energy procurement is enabled by Green Electricity Tariff (GET), by Corporate Renewable Energy Supply Scheme (CRESS) and by previous program such as Corporate Green Power Programme (CGPP).

- **GET:** Customers pay their normal tariff plus a green premium (GET subscription) and are exempt from the monthly Automatic Fuel Adjustment (AFA) and the 1.6% renewable energy fund levy. Effective 1 July 2025, GET was restructured from a category-based premium to a single-tier pricing model: 5 sen/kWh (1-year contract), 4 sen/kWh (2-year), and 3 sen/kWh (3-year), representing a reduction of up to 80% from previous rates of 10 sen/kWh for domestic and low-voltage users and up to 20 sen/kWh for medium/high-voltage users⁶² to encourage higher participation. Additionally, GET subscribers receive Malaysia Renewable Energy Certificates

⁵⁸ Energy Commission Malaysia (2026). [Guidelines for Solar Accelerated Transition Action Programme in Peninsular Malaysia](#).

⁵⁹ Sustainable Energy Department Authority (SEDA) Malaysia. [Solar Accelerated Transition Action Program](#)

⁶⁰ Progressture Solar. [Self-Consumption \(SELCO\)](#)

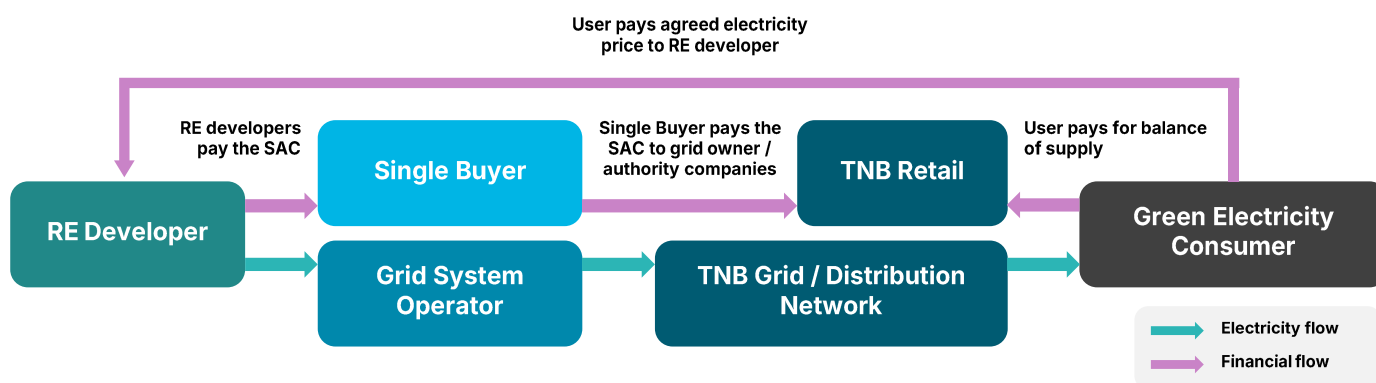
⁶¹ Sunview. [SELCO: Everything You Need to Know About Malaysia's Current Solar Programme](#)

⁶² TNB. [Green Electricity Tariff \(GET\)](#)

(mRECs) which can be used for market-based Scope 2 reporting and meet RE100 technical criteria. Additionally, GET Greenpath, extended from GET programme, launched in August 2025 allowing tenants under bulk-meter premises (e.g. MNO facilities in shared or multi-tenant buildings) can obtain mREC with a nominal of administrative 0.2 sen/kWh.⁶³

- CRESS:** A virtual corporate renewable energy scheme using open-grid access. The customer pays the renewable energy developer at an agreed renewable energy price, while the renewable energy developer pays the system access charge. The customer also continues paying TNB retail for delivered electricity and regulated network charges. Unlike the Philippines' GEOP and RCOA programmes, CRESS does not limit the minimum energy consumption threshold for a participated energy user, but the renewable energy power plant under this program must have a minimum capacity of 30 MW and directly connect to the grid. The CRESS framework has undergone four rounds of revision since 2025 providing a more accessible for participating CRESS:
 - March 2025:** all new and existing customers can participate the program and can source green energy from multiple REDs.
 - August 2025:** The system access charge (SAC) was reduced from 25 to 20 sen/kWh for firm supply and 45 to 40 sen/kWh for non-firm supply, addressing market concerns about high participation costs that had previously limited uptake.
 - December 2025:** Term sheets are now accepted at the application stage, replacing the previous requirement for executed agreements. Excess energy is no longer considered "free to the grid" but is governed by a Bilateral Energy Supply Contract, allowing REDs to sell excess electricity to other consumers. In addition, the power system study has been split into two stages to streamline the process.⁶⁴
 - September 2026:** The CRESS Acceleration Package set the firm-supply access charge at 14 sen/kWh (down from 20 sen and the original 25 sen). Contracts must run at least 10 years, and projects must be operating by the end of December 2028. The non-firm charge remains at 40 sen/kWh.⁶⁵
- CGPP:** A virtual PPA under NEDA for solar, now closed to new applications after its 800 MW quota was fully subscribed (projects continue to proceed). Pricing settles financially under the NEDA rules; customers continue paying TNB for delivered energy.

Figure 7 Electricity and financial flows under CRESS



Source: Adapted from Guidelines for Corporate Renewable Energy Supply Scheme⁶⁶

⁶³ TNB. [Green Electricity Tariff \(GET\)](#)

⁶⁴ Energy Commission Malaysia. [Corporate Renewable Energy Supply Scheme \(CRESS\)](#)

⁶⁵ PETRA (2026). [Press Release PETRA.100-9/1/4 JLD.2 \(34i\)](#)

⁶⁶ Energy Commission Malaysia (2026). [Guidelines for Corporate Renewable Energy Supply Scheme \(CRESS\)](#)

- **CREAM (Community Renewable Energy Aggregation Mechanism):** Launched in March 2025, CREAM is Malaysia's first rooftop solar aggregation programme. It enables homeowners to lease their residential rooftops to Local Energy Generators and Aggregators (LEGAs), who aggregate rooftop spaces for solar PV generation and supply green electricity to local green consumers within a 5 km radius via TNB's distribution network. A flat community access charge of 9 sen/kWh applies (cut from 15 sen in August 2025). Sime Darby Property and TNB operationalised the first CREAM project at Elmina in September 2025. While primarily residential-focused, CREAM's aggregation principles provide a potential model for future corporate demand aggregation frameworks relevant to MNOs.⁶⁷

Incentives: Medium-High Level

Malaysia's corporate renewable energy PPA landscape is supported mainly by tax incentives and green financing rather than direct grants such as Green Investment Tax Allowance (GITA), Green Income Tax Exemption (GITE), and Green Technology Financing Scheme (GTFS). GITA and GTFS are two incentives that are beneficial for energy users such as MNOs.

- **GITA⁶⁸:** Following the 2024 Budget revision, GITA now operates under a tiered approach with two categories for own-consumption assets as shown in Table 12. Applications must be received by MGTC between 1 January 2024 and 31 December 2026. Unused allowances may be carried forward to subsequent assessment years.⁶⁹

Table 12 GITA Two-Tier Structure: Qualifications and Rates (Relevant to MNOs and TowerCos)

Tier	Qualifying Assets	GITA Rate	Set-Off	Incentive Period
Tier 1	Includes Battery Energy Storage Systems (BESS), Green Buildings, and specific assets approved by the Minister of Finance.	100%	70% of statutory income	CAPEX incurred 1 Jan 2024 – 31 Dec 2026
Tier 2	Includes Renewable Energy Systems (such as solar PV) and Energy Efficiency projects.	60%	70% of statutory income	CAPEX incurred 1 Jan 2024 – 31 Dec 2026

- **GITE:** Available for qualifying green technology service provider companies listed under the MyHIJAU Directory, including companies undertaking solar leasing activities. Under the revised tiering approach, GITE provides income tax exemption of 70% on statutory income for eligible green service providers. While GITE primarily benefits renewable energy developers and solar service providers rather than MNOs directly, it supports the broader ecosystem by reducing costs for solar leasing and RESCO providers that serve MNO tower sites.
- **GTFS 5.0⁷⁰** applications are open with a 60–80% government guarantee on the green component through participating financial institutions; guarantee mechanics administered by CGC. Budget 2026 confirmed the extension of GTFS 5.0 until 31 December 2026, with a cumulative financing limit of RM 1 billion across the scheme's phases. The guaranteed rate is 80% for waste-sector

⁶⁷ Energy Commission Malaysia (2026). [Guidelines for Community Renewable Energy Aggregation Mechanism \(CREAM\)](#)

⁶⁸ MGTC (2024). [Green Investment Tax Allowance](#)

⁶⁹ MGTC. [Green Investment Tax Allowance \(GITA\) & Green Income Tax Exemption \(GITE\)](#)

⁷⁰ MGTC. [Green Technology Financing Scheme](#)

projects and 60% for other industries, including energy, transport, and manufacturing. While GTFS 5.0 no longer provides interest rate subsidies as in earlier versions, the government guarantee serves as a key credit enhancement. This can facilitate financing for solar PV and BESS projects at tower sites—particularly when implemented through REDs or ESCOs—with MNOs and TowerCos participating via PPAs and benefiting from reduced collateral requirements.

Demand for Renewable Energy

In 2025, renewable energy accounted for around 21% of total grid generation in Malaysia, mostly from hydro.⁷¹ Solar capacity has been expanding rapidly in recent years, with annual additions in the hundreds of megawatts.⁷² However, renewable energy deployment may struggle to keep pace in the near term with rapidly rising electricity demand, particularly from hyperscale data centres, projected to rise to more than 30% of Peninsular Malaysia's power demand by 2035.⁷³ Access to renewable electricity is likely to become increasingly strategic, not only from a sustainability perspective, but also in terms of cost exposure, transition readiness and long-term competitiveness.

Operator Landscape

There are five major mobile network operators in Malaysia: CelcomDigi, Maxis, U Mobile, Yes (YTL Communications), and Unifi (Telekom Malaysia). In 2025, mobile operators combined to consume 2 TWh of electricity, up almost 40% from 2019. Nearly 100 GWh (5%) came from purchased and generated renewables.

Case Studies

Case 1 – Unifi (Telekom Malaysia): Rooftop Solar and GET

Telekom Malaysia, the parent company of Unifi, subscribed to the GET program and purchased 97 GWh of renewable electricity – 20% of its electricity consumption in 2025.⁷⁴ The company also signed an agreement with Gentari, a renewable energy developer, to install 4.3 MWp of rooftop solar systems across six buildings.

Case 2 – CelcomDigi: On-site Solar and GET

CelcomDigi's near-term science-based target and 2050 net zero target were validated by the SBTi in 2026.⁷⁵ To support its clean energy transition, the company has invested in rooftop solar installations and is currently evaluating other renewable energy solutions.⁷⁶

⁷¹ Ember. [Malaysia Electricity Data Explorer](#).

⁷² [Ibid.](#)

⁷³ Reuters (2026). [Malaysia's data centres guzzling more power as temperatures soar, officials say](#).

⁷⁴ Telekom Malaysia (2026). [Integrated Annual Report 2025](#).

⁷⁵ SBTi (2026). [Target Dashboard](#).

⁷⁶ CelcomDigi (2026). [Integrated Annual Report 2025](#).

Key Stakeholders Driving Renewable Energy Acceleration in Malaysia

Table 13 Stakeholder Mapping – Malaysia

Stakeholder group	Examples	Level of influence	Description
Polymakers and regulators	Ministry of Energy Transition and Water Transformation (PETRA) Energy Commission (Suruhanjaya Tenaga - ST) Sustainable Energy Development Authority (SEDA) Malaysian Communications and Multimedia Commission (MCMC)	High	Regulators such as Energy Commission (Suruhanjaya Tenaga - ST) and Sustainable Energy Development Authority (SEDA) influence is high because GET and CRESS schemes are well established. Recent reductions in GET fees have improved the competitiveness of renewable electricity. In addition, battery energy storage system (BESS) bidding processes are underway, with momentum expected to be driven by renewable energy suppliers and growing corporate demand, including from mobile network operators. Additionally, MCMC may help signal sector sustainability direction on clean energy transition and convene industry and relevant stakeholders to address implementation barriers and support practical decarbonisation pathways.
MNO companies	CelcomDigi Telekom Malaysia Berhad (TM) - Unifi Maxis Berhad U Mobile Sdn Bhd YTL Communications Sdn Bhd	High	MNOs have a high level of influence as they directly drive renewable energy demand. Common solutions include the GET and on-site solar installations, but the GET quota is currently fully subscribed. The CRESS scheme is also being considered if low and medium-voltage customers and aggregation can allow operator participation.
Tower companies	EDOTCO Sdn Bhd EdgePoint Towers Sdn Bhd OCK Group Sacofa Sdn Bhd	High	TowerCo companies play a critical role because they own the physical infrastructure and make decisions on renewable energy investments.
DISCOMs	Tenaga Nasional Berhad (TNB)	Medium	TNB must comply with licenses, technical codes, and market rules enforced by ST and SEDA.
RE Providers	Tenaga Nasional Berhad (TNB) Other private companies	High	Large-scale RE providers (i.e., those with plants of at least 30 MW capacity) are eligible under CRESS programme and thus are well positioned to influence corporate green offtake and contribute to the expansion of renewable energy supply.

Note: Numerous companies operate as TowerCo companies; the examples in the table are provided for illustration.

Addressing the Gaps and Challenges

- Malaysia's National Energy Transition Roadmap (NETR) targets a 70% renewable capacity share in the electricity grid by 2050. However, given this is a capacity share (and not generation), relying solely on grid decarbonisation will be insufficient for companies with net zero and 100% renewable energy targets. Although the country has provided GET and CRESS, the challenges remain for the implementation of renewable energy procurement and investment. The GET quota

(6,600 GWh a year) is limited and is fully subscribed as of September 2026, so new buyers cannot join until the quota is expanded.⁷⁷

- In Malaysia, the increasing reliance on third-party TowerCos is creating a structural dependency in MNOs' decarbonisation pathways. As a larger share of telecommunications infrastructure shifts to leased tower arrangements, MNOs are becoming increasingly dependent on TowerCos for site-level energy provision, efficiency measures, and future clean energy adoption. However, TowerCos are generally not systematically incentivised, required, or commercially structured to prioritise low-carbon energy solutions for tenant operators.
- A standardised framework for demand aggregation in off-site renewable energy procurement applicable for mobile towers is not yet fully established. CRESS is designed for large-scale projects and therefore favours large suppliers and buyers, which can limit participation by smaller electricity users, such as mobile network towers, and create a mismatch between utility-scale renewable supply and dispersed, lower-demand corporate consumers.

Recommendations and Roadmap

Short term: Procure GET if quota expands

If GET quota is available in the future, mobile operators can consider this option when other OPEX on-site models, such as RESCO or rooftop solar leasing, which often offer lower electricity costs, are unavailable or not viable for lease. Operators should consider advocating for a bigger GET quota.

Short term: Adopt CRESS for large facilities

Mobile operators that qualify (i.e. medium and high voltage customers with TNB) should explore the use of CRESS for large loads such as data centres.

Short term: Collaborate with MCMC for accelerating clean energy

Mobile operators should work with MCMC to support sector-level coordination, including developing aggregation models, piloting initiatives, and establishing practical pathways to accelerate clean energy adoption across telecommunications infrastructure.

Medium term: Propose aggregation demand model for CRESS

Mobile operators could advocate to allow aggregated low-voltage sites use CRESS, and initiate aggregated renewable energy procurement contracts structured around total energy consumption (kWh), which aggregate sites as a portfolio. Such an aggregation model would improve project viability and attractiveness for renewable energy suppliers under both approaches, including off-site PPAs (as via CRESS) or on-site PPA solar system installations.

⁷⁷ TNB (2026). [Green Electricity Tariff](#).

Medium term: Embed clean energy requirements into TowerCo leasing contracts.

Mobile operators can encourage tower companies to move beyond space leasing toward value-added clean energy provision by embedding renewable energy requirements into lease agreements and engaging regulators to align incentives and market frameworks.

Medium-long term: Propose aggregation scheme and reducing of wheeling charge

Lessons from Philippines show that an official aggregation framework, such as the RAP, enables small- and medium-demand facilities, including mobile towers, to access clean electricity. In Malaysia, while CRESS does not set a minimum demand threshold for users, it imposes minimum scale requirements on suppliers. The absence of a clear aggregation framework can therefore reduce the viability of renewable procurement for smaller demand profiles.

4.4 Thailand

Thailand has a high level of readiness for wired clean energy procurement, supported by clear regulations, a mature market for ground-mounted and rooftop solar PPAs, and reliable grid infrastructure with early deployment of utility-scale BESS. Non-wired procurement remains at a medium level of maturity, with emerging mechanisms such as Utility Green Tariffs and pilot direct PPAs still constrained by regulatory and technical uncertainties.

Supply of Renewable Energy

Wired Procurement Readiness: High Level

Wired PPAs, particularly for ground-mounted and rooftop solar, are well-established in Thailand. Regulations, installation requirements, and interconnection standards are clear. Electricity users may either invest in their own systems or procure power through PPAs with solar energy developers.

Despite these regulatory gaps, Thailand benefits from strong grid reliability in key service areas and has begun deploying utility-scale BESS, supporting future integration of higher shares of renewable energy.

Non-Wired Procurement Readiness: Medium Level

Thailand's non-wired frameworks are at a medium level of maturity. This reflects moderate renewable-energy ambition, influenced by a 2050 net zero target and uncertainty in meeting renewable-energy capacity goals.

Three non-wired PPA pathways have been introduced:

- **UGT1** is currently operational, supplying hydropower from EGAT with a defined tariff structure. The cost is slightly higher than the standard tariff due to a green premium of 0.00594 THB/kWh.⁷⁸
- **UGT2** is under development. Eligible large consumers (minimum 1 MW peak demand and 250,000 kWh annual consumption) will be able to subscribe to renewable electricity through long-term Electricity Supply Agreements (10–25 years).⁷⁹
- **TPA/Direct PPA** scheme remains under development and lacks full regulatory and technical frameworks. The project was capped at 2,000 MW quota for data centre projects but has been expanded to all industrial customers who require green electricity. The final TPA and wheeling charge design will be concluded by the end of 2026.

Incentives: Medium-Low Level

Thailand has a medium level of direct PPA incentives. Physical PPAs, where private generators or electricity users invest in their own grid infrastructure, are not permitted. However, RTS PPAs have become common. Although the country previously had complex RTS regulations and limited

⁷⁸ Provincial Electric Authority (PEA). [Thailand Utility Green Tariff 1](#)

⁷⁹ Energy Regulatory Commission (ERC) of Thailand. [Draft Criteria UGT Part 2](#)

capacity allowances, these rules have been gradually relaxed since 2024. Still, RTS installations remain more attractive for self-consumption because Thailand provides tax incentives but offers lower FiT rates and no net-metering program. Loan programmes are widely available from both development and commercial banks, while no grant programmes currently exist.

Demand for Renewable Energy

In 2025, renewable energy accounted for only 22 percent of Thailand's grid mix⁸⁰, highlighting the need for increased investment in renewable energy by the utilities, mobile network operators, and other sectors if they want to achieve sustainability commitments.

Operator Landscape

Thailand's mobile network market comprises three major operators: AIS, NT, and True. In 2025, AIS consumed 1.6 TWh of electricity with around 60 GWh (4%) from renewable sources. True used 1.8 TWh with around 420 GWh (23%) from renewable sources.

Thailand has a different infrastructure model from the Philippines and Malaysia. Instead of relying primarily on TowerCo arrangements, most mobile network towers are owned by MNOs themselves, with TowerCo-managed sites accounting for only about 30% in 2024.

Case Studies

Case 1: True — Solar-Powered Network Sites

True Corporation has installed solar PV systems across over 10,000 base stations and mobile switching centres, with a total capacity of 49.27 MWp and annual generation of approximately 38 GWh.

Case 2: AIS — On-Site Electricity and Solar PPA

AIS adopts on-site solar through two models: (i) self-investment and (ii) RESCO model PPAs where a developer finances the system and AIS purchases the electricity. As of the end of 2025, AIS had installed solar panels at 13,465 base stations and facilities, as well as 12 data centres and switching centres. In addition, wind technology has been deployed at one base station, and solar PPAs are in place at five locations. These initiatives generate 60 GWh of renewable electricity annually and reduce GHG emissions by approximately 30,000 tCO₂e per year.

Two examples in Thailand show wired PPAs where on-site or nearby solar systems provide electricity without building new grid infrastructure. Regulatory limits on private transmission lines, and the absence of clear grid codes and technical standards for third-party access, mean that businesses often adopt on-site solar systems through either self-investment or PPAs with developers.

⁸⁰ Ember, [Electricity Data Explorer \(Thailand\)](#)

Key Stakeholders Driving Renewable Energy Acceleration in Thailand

Table 14 Stakeholder Mapping – Thailand

Stakeholder group	Examples	Level of influence	Description
Regulators	Energy Regulatory Commission (ERC)	High	Energy Regulatory Commission (ERC) have a significant influence, particularly in enabling TPA and expanding eligible sectors under the DPPA framework.
MNO Companies	Advance Info Service (AIS) TRUE-DTAC	High	MNOs in Thailand can invest on-site PPA investing. For instance, TRUE and AIS invest in solar energy for their base stations; however, their overall renewable energy share remains limited, and electricity use from other facilities constrains further progress.
DISCOMs	Metropolitan Electricity Authority (MEA) Provincial Electricity Authority (PEA)	Medium	Thai distribution utilities (e.g. MEA, PEA) have limited policy influence. While they may provide input or advocate for certain directions, final decisions rest with central regulators such as ERC and MOE. As of 2025, they are still awaiting the issuance of clear regulations and standards for TPA, which limits their role in enabling open access and DPPAs.
RE Providers	Electricity Generation Authority of Thailand (EGAT) Several RE providers	Medium	Similar to DISCOMs, renewable energy providers face constraints in supplying green electricity due to pending TPA and UGT 2 regulations and technical grid code standards.

Note: add any notes or source here or delete if not needed.

Addressing the Gaps and Challenges

Thailand currently has a relatively low share of renewable energy in its power mix and targets minimum 65% of electricity generation from renewables by 2050, which may still not completely align with corporate sustainability timelines. As a result, MNOs must pursue clean energy options beyond reliance on grid electricity. However, challenges remain, as clean electricity procurement mechanisms. For example, UGT1 electricity is primarily sourced from existing hydropower plants, which raises concerns about additionality and its eligibility under the market-based method. As a result, its contribution to corporate GHG emission reductions may be limited, and it may not be fully recognised under mechanisms such as CBAM and DPPA are largely limited to data centre applications. Consequently, MNOs' access to clean electricity is primarily constrained to on-site PPA options due to limited area for installation.

Recommendations and Roadmap

Medium term: Propose aggregation demand model

MNOs could initiate aggregated renewable energy procurement contracts structured around total energy consumption (kWh). This approach will move from location-based systems management to

EaaS portfolio management. This will also allow stakeholders, MNOs and energy aggregators, to prepare for the near future peer-to-peer energy trading. Such an aggregation model would improve project viability and attractiveness for renewable energy suppliers and enable more advanced solutions, such as solar combined with BESS and other innovative technologies.

Medium-long term: Propose an aggregation scheme, enable DPPA for mobile tower applications, and reduce wheeling charges.

While the private sector on both the supply and demand sides is ready for a more open electricity market, MNOs and other beneficiaries can propose aggregation models similar to the Philippines' RAP. Regulators should enable broader participation across sectors, smaller demand profiles, and diverse applications, and reduce wheeling charges to catalyse renewable energy adoption.

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Appendix

A. Renewable Energy Procurement and Deployment Models

Wired Options

Table 15 Self-Owned Rooftop Solar Systems

Self-own rooftop solar systems		
Model	CAPEX	
Key stakeholders / responsibilities	Customers: Own, invest in, operate, and maintain the solar systems.	
Enabling factors for MNOs	- Greater price stability and protection against future grid tariff and fuel price increases. - Simple process – customer can determine system capacity, technical specifications and investment levels with minimal negotiation.	
Considerations for MNOs	Cost and contracts	High upfront costs and potentially long payback periods, depending on the customer's consumption profile. No external energy-supply contract is required because the building owner is responsible for investment, installation, operation and maintenance.
	Company eligibility	Capacity is limited by available rooftop areas.
	In-house capacity	Requires in-house technical capacity to operate and maintain the system.
	GHG emissions reporting	High integrity since owners can monitor and operate the system.
	Procurement simplicity and speed	Medium lead time, depending primarily on the construction schedule.
Country availability and case studies*	Malaysia	D&Y Textile (Malaysia) Sdn. Bhd. owns and operates a 15 MWp rooftop solar system. ⁸¹
	Philippines	SM City Fairview, a commercial mall, has a 3.785 MWp rooftop solar system. ⁸²
	Thailand	Seacon Square Srinakarin, a shopping mall in Bangkok, installed and owned 5 MW rooftop solar system. ⁸³ Sumitomo Rubber Industries financed and installed a 22 MW rooftop solar system at its Rayong plant with supports from Thailand and Japan governments. ⁸⁴

Note: *The solar rooftop wired options are available in all 13 countries. Examples are provided for three deep-dive countries.

⁸¹ [Astronergy \(2023\). Malaysia 15 MW C&I rooftop solar plant in Johor.](#)

⁸² [SolarQuarter \(2025\). SM launches the country's largest rooftop solar power system at SM City Fairview](#)

⁸³ [PVStatus. "Solar rooftop installation overview."](#)

⁸⁴ [Falken Tyre Europe. \(2023\). World's largest rooftop solar panel installation at Falken tyre manufacturing facility.](#)

Table 16 RESCO Rooftop Solar System Models

RESCO rooftop solar system models		
Model	OPEX	
Key stakeholders / responsibilities	Solar developers: Own, invest in, operate, and maintain the solar systems. Utilities: Manage grid distribution, supply electricity to customers, and may purchase surplus electricity from developers. Customers: Provide rooftops for PV installation, buy solar power from solar developers and electricity retailers.	
Enabling factors for MNOs	• Zero upfront investment is required because the solar developer finances and owns the system. • Minimal responsibility for system operation and maintenance since the developer manages all O&M during the contract period. • No repayment or payback period for the system because the MNOs are not the asset owners.	
Considerations for MNOs	Cost and contracts	Contracts are generally less complex than TPA or open-access PPAs but are still typically long term. The contracts are usually between building owners and RE developers. Most generated power is self-consumed within the building. When surplus electricity stays within the allowable export cap or when a curtailment system is used, no additional regulatory approval may be required.
	Company eligibility	Capacity is limited by available rooftop areas.
	In-house capacity	Minimal technical and legal capacity required.
	GHG emissions reporting	High data integrity because the developer provides monitoring and system performance data that the building owner can use for Scope 2 reporting.
	Procurement simplicity and speed	Medium to fast lead time depending on contract finalisation and construction schedule.
Country availability and case studies*	Malaysia	TechnipFMC Malaysia Sdn. Bhd., oil and gas manufacturing, purchases solar power through a leasing PPA, with TotalEnergies fully funding, installing, and operating a 680 kWp rooftop solar system.⁸⁵ Barry Callebaut Manufacturing Malaysia Sdn. Bhd., a food manufacturer, purchases solar power through a leasing PPA model, with Cleantech Solar financing, operating, and supplying energy from a 2 MWp rooftop system.⁸⁶ Telekom Malaysia signed a series of PPAs with Gentari to supply 4.3 MW of solar power across six sites.⁸⁷
	Philippines	SM City Fairview, a commercial mall, contracted a 3.785 MWp rooftop solar. ⁸⁸
	Thailand	Siam Makro Public Company Limited purchases electricity from GreenYellow, which financed and installed approximately 30 MW of rooftop solar across 50 Makro stores. ⁸⁹

⁸⁵ PR Newswire. (2025). TotalEnergies ENEOS completes rooftop solar project with TechnipFMC in Malaysia.

⁸⁶ Cleantech Solar. (2021). Cleantech Solar deploys 2 MW on-site solar PV system for Barry Callebaut in Malaysia.

⁸⁷ DataCenterDynamics. (2024). Telekom Malaysia signs solar PPA with Gentari to power six facilities.

⁸⁸ SolarQuarter. (2025). SM launches the country's largest rooftop solar system at SM City Fairview.

⁸⁹ GreenYellow Thailand. (n.d.). "Makro solar rooftop project."

Non-Wired Options

Table 17 **Utility Green Tariffs**

Utility Green Tariffs		
Model	OPEX	
Key stakeholders / responsibilities	RE developers: Own, invest in, operate, and maintain renewable power generation systems. Electricity retailers: Purchase electricity from developers and distribute it to customers. Customers: Buy electricity at a premium on top of the normal tariff.	
Enabling factors	• No upfront investment is required. • Less complexity in the procurement process • No installation work or payback period for the customer.	
Considerations for MNOs	Cost and contracts	Suitable for companies that do not want to invest in their own on-site or off-site RE facilities and are willing to pay an additional fee (green premium or green subscription). Companies that are not highly sensitive to tariff fluctuations or premium fee adjustments. Companies that prefer predictable costs and simpler contracting compared to long-term corporate PPAs.
	Company eligibility	Suitable for large low to high electricity demand facilities; however, it depends on the regulations of countries.
	In-house capacity	Suitable for companies with limited technical, legal, or procurement capacity to manage RE projects, permitting, engineering, or PPA negotiations.
	GHG emissions reporting	Suitable for companies not exposed to CBAM or other mechanisms requiring high-integrity, traceable renewable certificates (e.g. EU-linked supply chains). Market-based emission reporting must be accepted by the company's GHG accounting framework, including the GHG Protocol Scope 2 Standard.
	Procurement simplicity and speed	Suitable for companies who want immediate RE procurement without operational disruptions (e.g. RE project approval, bidding and construction periods).
Country availability and case studies	India	Tata reported that 37 companies participated their offered Green Power tariff. ⁹⁰
	Malaysia	Luvata Malaysia Sdn. Bhd. (copper manufacturer) committed to subscribing to GET from TNB in 2025 ⁹¹ ByteDance System Sdn. Bhd. (digital and platform company) subscribed to GET with TNB in November 2025. ⁹²
	Thailand	Siam Piwat (owner and operator of supermalls), subscribed to Thailand UGT1 in 2025. ⁹³
	South Korea	Kakao Pay (digital and platform company) signed a Green Premium contract with KEPCO in 2024. ⁹⁴

⁹⁰ Mercom India (2021, June 29). "Green power tariff: An attractive option for consumers to access solar and wind power."

⁹¹ Luvata Malaysia Sdn Bhd (2024, March 18). "Luvata Malaysia Green Electricity Tariff."

⁹² W.media (2025). "ByteDance first in Malaysia to ink Green Electricity Tariff (GET) deal with TNB."

⁹³ Siam Piwat (2025). "Siam Piwat, Thailand's first shopping-centre group partners with MEA to join the Utility Green Tariff (UGT1) programme."

⁹⁴ The Maeil Business Newspaper / MK. "Economy Home – English News."

Table 18 TPA and Open Access PPAs

Third-Party Access (TPA) / Open-Access PPAs		
Model	OPEX	
Key stakeholders / responsibilities	RE developers: Invest in, operate, and maintain power plants and pay wheeling or grid-use charges. Grid operators: Provide grid access, maintain system balance and stability, and enable power delivery between developers and customers. Customers: Purchase electricity directly from developers under long-term PPAs.	
Enabling factors for MNOs	• Zero upfront investment cost. • No installation work or payback period for the customer. • Competitive and predictable RE pricing under long-term PPAs. • Price stability and protection against future grid tariff and fuel price increases. • High-integrity contribution to Scope 2 emissions reduction.	
Considerations for MNOs	Cost and contracts	Suitable for companies that do not want to invest in their own on-site or off-site renewable energy facilities but want access to competitively priced renewable electricity through third-party developers or utilities. The contracts are long-term contracts (typically more than 10 years). The contracts must consider the key elements including wheeling charges for using the grid, capacity and energy supply commitments, demand obligations from the buyer, and penalty clauses for deviations that are more complex than utility green tariffs.
	Company eligibility	Companies must meet the minimum demand or load threshold defined by national regulations. Examples include: India's Green Energy Open Access (GEOA): ≥ 100 kW⁹⁵ Malaysia's Corporate Green Energy Supply (CRESS): ≥ 30 MW Philippines' Green Energy Option Program (GEOP): ≥ 100 kW for past 12 months. Singapore: ≥ 1 MW for direct market access Japan and Taiwan: subject to local grid and policy requirements
	In-house capacity	Limited technical capacity may be sufficient, but strong legal, financial and procurement capabilities are required to manage power purchase agreement (PPA) negotiations and ongoing contract management.
	GHG emissions reporting	Well-suited for large companies that require high-quality, traceable Scope 2 emissions reductions (e.g. those subject to CBAM or using GHG Protocol market-based accounting). Real-time or metered renewable energy delivery enables reliable tracking.
	Procurement simplicity and speed	More appropriate for companies with the capability and patience to manage the often lengthy and complex PPA or wheeling process. Not ideal for firms seeking instant or low-effort green power procurement.
Country availability and case studies	India	Xpro India and ANAND signed power delivery agreements with Tata Power to procure renewable electricity from 3.1 MW and 4.4 MW captive solar plants through open access.^{96,97} Microsoft and Amazon have signed renewable energy procurement agreements covering hundreds of megawatts across multiple projects.

⁹⁵ Government of India (2022). Electricity (Promoting Renewable Energy Through Green Energy Open Access) Rules, 2022.

⁹⁶ Tata Power Renewable Energy Ltd. (2023). Tata Power Renewable Energy signs PDA with Xpro India for 3.125 MWac group-captive solar plant.

⁹⁷ Tata Power Renewable Energy Ltd. (2024). Tata Power Renewable Energy signs PDA for 4.4 MWac group-captive solar plant with Anand Group.

Malaysia	DayOne (data centre operator) signed an agreement with Tenaga Nasional Berhad (TNB) for 500 MW under CRESS. ⁹⁸
Philippines	More than 700 companies in the Philippines have applied to become GEOP end-users. ⁹⁹ The Linden Suites, hotel, procured 480 kW of geothermal power from First Gen, led by the Lopez Group. ¹⁰⁰
Singapore	Microsoft signed a supply agreement in Singapore for aggregated solar energy from public housing and government buildings, totalling 200 MWp, under the SolarNova 8 program. ¹⁰¹
Japan	Kao Corporation (global consumer and cosmetics company) signed a third-party agreement with electricity retailers to supply renewable energy covering 30% of its headquarters' electricity demand. ¹⁰² JR East (major rail operator) plans to procure 20 MW of wind power. ¹⁰³
Taiwan	TSMC signed a 920 MW CPPA with Ørsted for offshore wind energy. ¹⁰⁴ Google Taiwan signed a 468 MW offshore wind PPA with Denmark's Copenhagen Infrastructure Partners. ¹⁰⁵

⁹⁸ Energy-Box. (2024). Malaysia's TNB and DayOne sign 500 MW CRESS green energy deal.

⁹⁹ IEMOP. (n.d.). GEOP market participants in the Philippines. .

¹⁰⁰ Energy Development Corporation. (2023). The Linden Suites switches to 100% renewable energy.

¹⁰¹ Microsoft signs 637.6 MW Asia-wide solar & green energy deal including Singapore and India.

¹⁰² KWM. (2025). "Redefining energy in Japan: Game-changing corporate PPAs shape the future."

¹⁰³ DeepWind. (2025). "What is a Corporate PPA? Japan market guide with price factors."

¹⁰⁴ OffshoreWind.biz. (2020). "World's largest renewable-energy corporate power-purchase agreement signed in Taiwan."

¹⁰⁵ Ibid

Table 19 Aggregated Corporate PPAs

Aggregated corporate PPAs		
Model	OPEX	
Key stakeholders / responsibilities	RE developers: Invest in, operate, and maintain renewable power plants, and pay grid-use or wheeling charges. Grid operators: Provide grid access for suppliers and customers and maintain system balance and stability. Customers (multiple entity buyers): Jointly purchase electricity from developers through a shared PPA structure.	
Enabling factors for MNOs	• Zero upfront investment cost. • No installation work or payback period for customers. • Access to competitive and stable RE prices under long-term PPAs • Suitable for small and medium buyers by pooling demand to meet minimum PPA size.	
Considerations for MNOs	Cost and contracts	Suitable for companies that do not want to invest in their own on-site or off-site renewable energy facilities but want access to competitively priced renewable electricity through third-party developers or utilities. The contracts are long-term contracts (typically more than 10 years) and may be more complex than a typical single-entity TPA or open access arrangement, as it involves demand aggregation, coordination among multiple buyers with varying risk profiles and preferences, and may require a central contracting entity or platform to manage the agreement.
	Company eligibility	Companies can have smaller individual electricity demand compared to TPA or open access options but still must meet the minimum demand or load threshold defined by national regulations. Examples of applicable thresholds are provided below: Philippines' Retail Aggregation Program (RAP): ≥100 kW (the new threshold is reduced from the previously higher threshold at 500 kW) Singapore: ≥1 MW for direct market access Japan: subject to local grid and policy requirements
	In-house capacity	Suitable for companies with limited in-house technical capacity, but strong legal, finance, or procurement teams able to manage power purchase agreement (PPA) negotiations and ongoing contract management.
	GHG emissions reporting	Suitable for small to medium-sized companies that require high-quality, traceable Scope 2 emissions reductions (e.g. those subject to CBAM or using GHG Protocol market-based accounting). Real-time or metered renewable energy delivery enables reliable tracking.
	Procurement simplicity and speed	More appropriate for companies with the capability and patience to manage the often lengthy and complex PPA process.
Country availability and case studies	Philippines	Filinvest (a holding company) enrolled four facilities under the RAP totalling over 1,000 kW managed through its licensed retail electricity supplier FDC RES. ¹⁰⁶

¹⁰⁶ [GMA Network. \(2025\). "Filinvest's 11 facilities shift to renewable energy."](#)

First Cavite Industrial Estate Association Inc. (FCIE) enrolled multiple accounts in its industrial park into a single aggregated portfolio under the RAP.¹⁰⁷

Contestable customers with 21 facilities inside First Philippines Industrial Park (FPIP) pooled their demand and enrolled the RAP.¹⁰⁸

Japan

AEON Group (major retail company) targets 200 MW of aggregated off-site solar PPAs nationwide through Marubeni Power Retail.

Tokyo Tatemono signed an off-site CPPA for three of its buildings with Kyuden Mirai Energy, which develops and supplies geothermal power through the retail supplier Nippon Steel Engineering.

Taiwan

TSMC initiated an aggregated TPA model by contracting 500 GWh of renewable electricity per year for its own operations and inviting its suppliers to subscribe to an additional 500 GWh.

¹⁰⁷ Context PH (2025). "Cavite industrial estate adopts retail-aggregation programme."

¹⁰⁸ PowerPhilippines (2025). "First Gen to supply hydro to 21 FPIP facilities under RAP."

B. Detailed Gap Analysis

Tier 1 Markets

Table 20 Tier 1 – Advanced DPPA mechanisms

Market	Current status	Operator targets	Gaps	Recommendations
India	- India has a net zero target of 2070, later than the 2050 target adopted by many other countries. - The majority of MNOs in India disclose GHG emissions and have set SBTi targets. - India has a liberalised electricity market that allows open-access RE PPAs (GEOA) and offers green tariffs. In some states, the GEOA is cheaper than normal tariffs. - The share of MNO electricity demand met by renewables is lower than the renewable energy share (24%) in the national grid.¹⁰⁹	MNOs with SBTi targets aim to reduce GHG emissions by 50% from the base year by FY2030.	Offtakers prefer larger renewable energy consumers because these contracts offer better profitability and more efficient project economics.	- MNOs with sufficient technical capacity can increase their renewable energy share by investing in self-owned rooftop solar systems. India also has a strong environment for developing skilled experts in the renewable energy sector. - MNOs can participate in GEOA if they have large electricity demand or can form aggregated demand contracts. Although the legal participation threshold is only 100 kW, renewable energy developers generally prefer larger consumers, typically in the hundreds of megawatts.
Malaysia	- Malaysia has a net zero target for 2050. - Although TNB remains the dominant electricity utility in Peninsular Malaysia, eligible consumers can procure renewable electricity through CRESS or the Green Electricity Tariff (GET). Costs	For example, CelcomDigi targets net zero emissions by 2050, with plans to transition to 100% low-emission	- MNOs have moderate sustainability commitments, supported by a medium level of government pressure to accelerate the renewable energy transition. - CRESS sets a high minimum demand threshold of 30 MW.	- MNOs should establish clear decarbonisation strategies and strengthen their sustainability commitments. - MNOs should consider on-site PPAs, supported by strong government incentives.

¹⁰⁹ IEA. (n.d.). "India — key country profile."

Market	Current status	Operator targets	Gaps	Recommendations
	vary by procurement mechanism, contract terms and applicable charges. The government supports rooftop solar through Solar ATAP and tax incentives such as GITA, subject to eligibility. Solar ATAP succeeded NEM 3.0, which included the NOVA programme and closed to new applications in June 2025.	electricity after 2030.¹¹⁰	Both rooftop solar leasing and self-investment models are limited by available installation capacity.	Solar leasing can reduce upfront investment, although fewer incentives may be available than under self-investment models.
Singapore	- Singapore targets net zero emissions by 2050. - With a fully liberalised electricity market, MNOs can purchase renewable energy directly from licensed electricity retailers. - MNOs achieve a higher renewable energy share than the national grid mix.¹¹¹	MNOs with SBTi targets aim to reduce GHG emissions by 50–55% from their base year by FY2030.	Singapore's renewable energy capacity is technically limited by geography and constrained land availability.	- MNOs should consider on-site PPAs, supported by strong government incentives. - MNOs should explore opportunities to enter into PPAs with renewable energy providers in neighbouring countries, as Singapore is developing transmission infrastructure to import renewable electricity from neighbouring countries.¹¹²
Philippines	- The Philippines does not have an official net zero target year, but the government implements the RPS to require electricity providers to increase the share of renewable energy in their portfolios. - Under the WESM, the GEOP and related programmes allow eligible individual or aggregated consumers with at least 50 kW of demand to purchase renewable energy. - Most MNOs disclose their GHG emissions, but only about half have set net zero targets and SBTi commitments.	For instance, Globe Telecom (Philippines) targets net zero emissions by 2050 and aims to reduce Scope 1 and 2 GHG emissions by 50% by 2030.	- MNOs have moderate sustainability commitments, supported by a medium level of government pressure to accelerate the renewable energy transition. - Grid reliability and flexibility constraints limit renewable energy accessibility in some areas. - Historically high eligibility thresholds for GEOP and RAP may have limited participation in these programmes.	- MNOs should establish a clear decarbonisation vision and strengthen their sustainability commitments. - MNOs should consider on-site PPAs through either self-investment or leasing models to reduce upfront costs and lower reliance on the national grid. - MNOs operating in areas with reliable grid conditions may consider aggregating demand with nearby facilities to qualify for RAP.

¹¹⁰ CelcomDigi's Natural Capital report.

¹¹¹ IEA. (n.d.). "Singapore country profile."

¹¹² EMA. (2025). "Regional power grids – Singapore's energy supply."

Market	Current status	Operator targets	Gaps	Recommendations
Japan	- Japan targets net zero emissions by 2050. - The liberalised electricity market allows companies to contract renewable energy PPAs through national grids or their own on-site investments. - The government strongly supports renewable developers through the FIT scheme for small projects and the newer FIP scheme, which provides a premium when wholesale prices fall below the designated base price. - Most MNOs disclose their GHG emissions and have SBTi commitments. - MNOs use renewable energy at high shares, exceeding the RE mix in the national power grid.	For instance, SoftBank and NTT DOCOMO aim to become carbon neutrality of GHG emission Scope 1 and 2 by 2030.^{113,114}	- Renewable energy capacity is limited by Japan's geography and constrained land availability. - New renewable energy projects face complex approval and grid-connection processes. - Electricity providers have limited appetite for investing in new renewable energy projects because of increasing curtailment risk.¹¹⁵ - Offtakers typically prefer large renewable energy consumers because these contracts offer better profitability and more efficient project economics.	- MNOs should consider on-site PPAs, supported by strong government incentives. - MNOs should explore PPAs with forthcoming renewable energy projects, including offshore wind projects expected to begin operating between 2028 and 2030.¹¹⁶ - MNOs should prepare aggregated demand contracts, as PPAs are typically structured for large consumers.
South Korea	- South Korea has set a net zero emission target for 2050. - Under K-RE100, South Korea offers a green tariff and renewable electricity procurement mechanisms, including direct PPAs and third-party PPAs through KEPCO, allowing companies with demand of at least 300 kW to purchase renewable electricity from developers or retailers. - Most MNOs disclose their GHG emissions, but only about 60% have SBTi targets and participate in RE100.	For example, LG Uplus targets net zero emissions by 2050 and aims to use 100% renewable energy by that year.¹¹⁷	- MNOs have moderate sustainability commitments, supported by a medium level of government pressure to accelerate the renewable energy transition. - PPA mechanisms are inefficient. For example, in the TPA process, RE providers cannot sell excess electricity to the market, and under the direct PPA scheme, renewable electricity suppliers cannot sell surplus electricity to the wholesale market.¹¹⁸	- MNOs should establish a clear decarbonisation vision and strengthen their sustainability commitments. - MNOs should consider on-site PPAs through either own investment or leasing models to reduce upfront costs and lower reliance on the national grid.

¹¹³ SoftBank Corp. (2024). "Sustainability Report 2024."

¹¹⁴ NTT DOCOMO Group. (2024). "Sustainability Report 2024."

¹¹⁵ IEEFA. (2025). "Key barriers in Japan's renewable energy development."

¹¹⁶ Ibid

¹¹⁷ LG Corp. (2024). "ESG Reporting 2024."

¹¹⁸ Presentation: Bottlenecks to renewable energy integration in South Korea

Market	Current status	Operator targets	Gaps	Recommendations
	MNOs use a slightly higher share of renewable energy compared to the national grid mix.		- Grid bottlenecks limit transmission capacity from high-potential renewable energy zones to consumer load centres¹¹⁹ - Direct PPAs require a minimum demand of at least 300 kW and do not allow demand aggregation.	
Taiwan	- Taiwan targets net zero emissions by 2050. - Taiwan requires qualifying electricity users with contracted capacity of at least 5,000 kW to meet renewable energy obligations equivalent to 10% of their previous year's average contracted capacity. - Although Taiwan's electricity market remains dominated by the vertically integrated utility Taipower, companies can purchase renewable electricity from generators or renewable electricity retailers through physical PPAs, including delivery through Taipower's grid. - MNOs actively disclose their GHG emissions, have SBTi commitments, and participate in RE100.	For example, Chunghwa Telecom targets net zero emissions by 2050, with a 50% reduction in Scope 1 and 2 emissions by 2030 and a 95% reduction by 2040.¹²⁰	The TPA-based CPPA market is still limited. Few transactions have been completed, such as TSMC's aggregated program, which is restricted to its own suppliers.	- MNOs should consider on-site PPAs, using either self-investment or leasing models, to lower upfront costs. - MNOs should explore initiating aggregated PPAs, similar to TSMC's example, to improve access to renewable energy.

¹¹⁹ Ibid

¹²⁰ [Chunghwa Telecom Sustainability Commitments](#)

Tier 2 Markets

Table 21 Tier 2 – Developing DPPA mechanisms

Market	Current status	Operator targets	Gaps	Recommendations
Bangladesh	- Bangladesh does not yet have a national net zero emissions target. - The electricity sector operates under a vertically integrated market structure. - A TPA PPA framework exists, but it has not yet been adopted commercially. - Some corporations have established net zero targets and SBTi-aligned commitments.	For example, Robi (Axiata Group) targets net zero by 2050 and aims for a 42% absolute reduction in GHG emissions by 2030.¹²¹	- Grid reliability remains a challenge, with frequent and localised power outages. - TPA-based PPAs are currently in the pilot stage; aggregated demand TPA models are not yet available.	- MNOs should define a clear decarbonisation strategy and enhance their sustainability commitments. - MNOs should consider on-site PPAs, either through direct investment or leasing models, to reduce upfront costs and reliance on the national grid. - MNOs should also explore off-site PPAs while addressing technical and infrastructure constraints.
Pakistan	- Pakistan has set a net zero emissions target for 2060. - The country is transitioning towards a competitive wholesale electricity market. - A TPA framework, known as corporate bilateral trading under the CTBCM, exists. The CTBCM framework enables bilateral electricity trading and grid wheeling. Commercial implementation is progressing, with the first 400 MW wheeling auction launched in September 2026 and bidding scheduled for January 2027.¹²² - Only a few MNOs disclose their GHG emissions or have formal sustainability commitments.	No publicly available information identified.	- Grid reliability remains a challenge due to frequent and localised power outages. - TPA-based PPAs are in the pilot phase, and aggregation models are not yet supported. - Participation in off-site PPAs requires consumers to have a minimum demand of 1 MW.	- MNOs should establish a clear decarbonisation strategy and strengthen their sustainability commitments. - MNOs should consider on-site PPAs through direct investment to reduce dependence on the national grid. - MNOs should explore off-site PPAs and advocate for policy updates that enable demand aggregation and address technical and infrastructure limitations.

¹²¹ [Axiata sustainability commitments](#)

¹²² [ISMO](#)

Market	Current status	Operator targets	Gaps	Recommendations
Thailand	- Thailand targets net zero emissions by 2050. - The electricity market operates under an enhanced single-buyer model led by Thailand's electricity authorities (i.e. EGAT, PEA, and MEA). - Thailand has introduced Utility Green Tariffs (UGTs), while TPA-based Direct PPAs remain under regulatory development. - UGT1, a non-source-specific renewable electricity tariff, has been operational since 2025. - UGT2, a source-specific renewable electricity tariff, received regulatory approval in April 2026, with its tariff effective from May 2026. Customer applications are expected to open by late 2026, with commercial service anticipated in 2027. - The draft TPA Code underwent public consultation in October 2025, with finalisation and implementation still pending as of September 2026. - Among the two private MNOs, both disclose their GHG emissions, but only one has set a net zero year and SBTi commitment.	For example, True Corporation aims to reduce Scope 1 and 2 emissions by 42% by 2030 and reach net zero across all three scopes by 2050. AIS targets a 25% reduction in Scope 1 and 2 emissions from the 2024 baseline.¹²³	- MNOs have moderate sustainability commitments, supported by a medium level of government pressure to increase renewable energy adoption. - UGT 1 is slightly more expensive than the normal tariff due to the added green premium. - TPA-based DPPA frameworks and standards are still under development, with eligibility currently expected to cover data centres and other sectors requiring green electricity. However, the final regulation is still unclear.	- MNOs should establish a clear decarbonisation vision and strengthen their sustainability commitments. - MNOs should consider on-site PPAs through either self-investment or leasing models to help reduce upfront costs. - MNOs should advocate for updated TPA policies and regulations that broaden participation across sectors and business sizes and enable aggregation models.
Vietnam	- Vietnam has set a net zero emissions target for 2050. - The revised Power Development Plan 8 (PDP8) outlines ambitious renewable energy goals.	No publicly available information identified.	MNOs currently show low levels of sustainability ambition, and there are no specific policy mandates requiring them to adopt renewable energy.	MNOs should establish a clear decarbonisation strategy and strengthen their sustainability commitments.

¹²³ [AIS 2025 GHG emission reduction target](#)

Market	Current status	Operator targets	Gaps	Recommendations
	• The electricity market remains vertically integrated and is operated by the state-owned utility Vietnam Electricity (EVN). • The government has issued a framework for off-site direct PPAs. The first grid-based DPPA became operational in June 2026 between Samsung Electronics Vietnam Thai Nguyen and the TTC Duc Hue 2 solar power plant.¹²⁴ • RTS models are already well-developed. • GHG emissions disclosure and sustainability commitments are still in early stages in Vietnam.		• Off-site PPAs are a new and emerging mechanism in Vietnam. • Participation in off-site PPAs currently requires a minimum monthly electricity demand of 200,000 kWh. Aggregation models are not yet supported.	• MNOs should consider on-site PPAs, either through self-investment or leasing models, to reduce upfront costs. • MNOs should support policy updates that enable demand aggregation models for greater PPA accessibility.

¹²⁴ [Samsung Thai Nguyen Becomes the First Company to Officially Purchase Renewable Electricity Through Vietnam's DPPA Mechanism](#)

Tier 3 Markets

Table 22 Tier 3 Markets – Limited renewable energy procurement environments

Market	Current status	Operator targets	Gaps	Recommendations
Cambodia	• Cambodia has set a net zero emissions target for 2050. • The electricity market remains vertically integrated and is operated by state-owned company, Electricité du Cambodge (EDC). • Off-site DPPAs are not available, while rooftop solar models are comparatively well developed. • GHG emissions disclosure and sustainability commitments are still in early stages.	• For example, Smart Axiata (Axiata Group) targets net zero by 2050 and aims for a 42% absolute reduction in GHG emissions by 2030 (vs. 2020).	• MNOs currently demonstrate low sustainability ambition, and there are no policy mandates requiring the adoption of renewable energy. • The electricity market operates as a monopoly, led by state-owned companies. • Off-site PPA frameworks and standards are not yet established. • Grid reliability is low to moderate, with frequent and prolonged power outages.	• MNOs should develop a clear decarbonisation strategy and strengthen their sustainability commitments. • MNOs should consider on-site PPAs through self-investment or leasing models to reduce upfront costs. • MNOs should advocate for policy and regulatory updates that support broader TPA participation.
Indonesia	• Indonesia has set a net zero emissions target for 2060. • The electricity market remains vertically integrated and is operated by state-owned utility, PT Perusahaan Listrik Negara (PLN). • Off-site DPPAs are not available, while rooftop solar models are comparatively well developed. • GHG emissions disclosure and sustainability commitments are still in early stages.	• No publicly available information identified.		

C. Abbreviations

Table A **Abbreviations**

Term	Definition
BOI	Board of Investment (Philippines, Thailand)
BESS	Battery Energy Storage System
CAPEX	Capital Expenditure
CBAM	Carbon Border Adjustment Mechanism
CPPA	Corporate Power Purchase Agreement
CREATE	Corporate Recovery and Tax Incentives for Enterprises Act (Philippines)
CREZ	Competitive Renewable Energy Zones (Philippines)
CRESS	Corporate Green Energy Supply (Malaysia)
DISCOM	Distribution Company
DOE	Department of Energy (Philippines)
DPPA	Direct Power Purchase Agreement
DU	Distribution Utility
EAC	Environmental Attribute Certificate
EEC	Eastern Economic Corridor (Thailand)
ESG	Environmental, Social, and Governance
EU	European Union
FIP	Feed-in Premium (Japan)
FIT	Feed-in Tariff
GEA	Green Energy Auction (Philippines)
GEOA	Green Energy Open Access (India)
GEOP	Green Energy Option Program (Philippines)
GET	Green Electricity Tariff (Malaysia)
GHG	Greenhouse Gas
GITA	Green Investment Tax Allowance (Malaysia)
GITE	Green Income Tax Exemption (Malaysia)
GTFS	Green Technology Financing Scheme (Malaysia)
ITC	Investment Tax Credit
kW	Kilowatt

Term	Definition
MW	Megawatt
MWh	Megawatt-hour
MWp	Megawatt-peak
MNO	Mobile Network Operator
MOE	Ministry of Energy (Thailand)
NEM	Net Energy Metering (Malaysia)
NGCP	National Grid Corporation of the Philippines
NOVA	Net Offset Virtual Aggregation (Malaysia)
O&M	Operation and Maintenance
OPEX	Operating Expenditure
PPA	Power Purchase Agreement
PDA	Power Delivery Agreement
PTC	Production Tax Credit
RAP	Retail Aggregation Program (Philippines)
RCOA	Retail Competition and Open Access (Philippines)
RE	Renewable Energy
REC	Renewable Energy Certificate
RTS	Rooftop Solar
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SBTi	Science Based Targets initiative
SEDA	Sustainable Energy Development Authority (Malaysia)
SIPP	Strategic Investment Priority Plan (Philippines)
ST	Energy Commission (Malaysia)
TNB	Tenaga Nasional Berhad (Malaysia)
TPA	Third-Party Access
UGT	Utility Green Tariff (Thailand)
VPPA	Virtual Power Purchase Agreement
WSEM	Wholesale Spot Electricity Market

