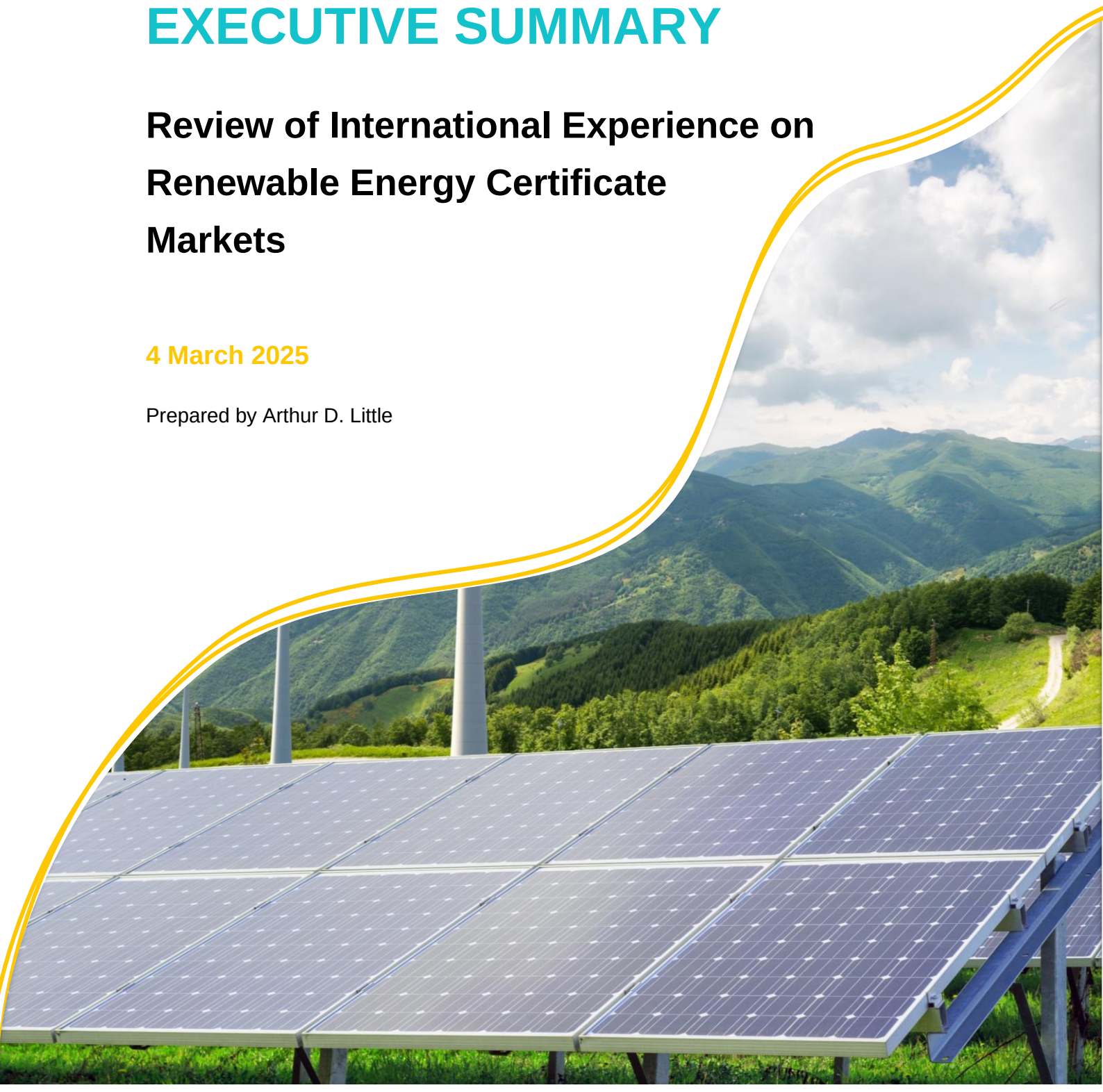
EXECUTIVE SUMMARY

Review of International Experience on Renewable Energy Certificate Markets

4 March 2025

Prepared by Arthur D. Little



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Key indicators for a successful voluntary REC market were identified across five benchmarked jurisdictions, offering insights for designing an optimal VREM model for the Philippines. Figure 1 outlines the approaches each jurisdiction has taken to develop their REC markets.

Key indicators	Viet Nam	Singapore	Australia	California	Germany	Philippines Current state
Period in Operation (Years)	6	12	23	23	24	5
1 Market Type	Fully Voluntary	Fully Voluntary	Mandatory & Voluntary	Mandatory & Voluntary	Fully Voluntary	Mandatory
2 Market Platforms	Fully Voluntary, Single Platform	Fully Voluntary. Single Platform	Mandatory & Voluntary, Single Platform	Mandatory & Voluntary, Single Platform	Fully Voluntary, Single Platform	Mandatory, Single platform
3 Operational Framework & Verification System	Renewable Energy Transition, I-REC, REC retirement system	I-REC & TIGR standards, REC retirement system	Renewable Energy Target (RET), REC registry	Renewable Portfolio Standard (RPS), WREGIS, bilateral contracts	Guarantee of Origins (GO) Register	RPS, Philippine Renewable Energy Market System (PREMS)
4 International or local markets	Both international and local trade	International purchasing to meet local demand	Primarily local consumption	Primarily local consumption	Both international and local trade	Limited to local market
5 Key Stakeholders	Ministry of Industry and Trade (MOIT)	Energy Market Authority	Clean Energy Regulator (CER)	CEC & CPUC	Federal Environmental Agency (UBA)	Department of Energy (DOE)
6 Carbon Credit & REC Synergy	CCs and RECs can be generated by the same entity, provided generation are from distinct activities					No integration with carbon credit market
7 REC Demand Drivers and Market Dynamics	RE100, CSR Initiatives	SG Green Plan, RE100, CSR Initiatives	RET, RE100, Progressive culture	RPS, RE100, Progressive Culture	RE100, CSR Initiatives, Eco-Consciousness	Compliance driven by RPS targets
8 Pricing Dynamics	Contract-based pricing	Local spot pricing	Local spot pricing, price ceiling for STCs	Contract-based pricing	Contract-based Pricing	Regulated within compliance market REC price: PHP 240
9 Stimulate REC Supply	Substantial increase in RE generation	Increasing demand for RE generation	Moderate increase in RE generation	Consistent growth in RE generation	EU sustainability leader in RE production	Eligible local RE generators

Figure 1 | Cross-Country Analysis of Each Jurisdiction's REC Market

2. Market Type

The key consideration in establishing a REC market is determining the appropriate market structure - whether it should be mandatory, voluntary, or a hybrid model. An overview of each market type can be found below.

Mandatory Market:

- **Regulated Participation** – RE generators must produce and sell RECs to meet quotas under the Renewable Portfolio Standards (RPS)
- **Compliance-Driven Demand** – Utilities and businesses are required to buy RECs, ensuring steady demand
- **Government Oversight** – Authorities enforce compliance, set penalties, and adjust targets

Voluntary Market:

- **Corporate-Led Adoption** – Businesses buy RECs for sustainability and ESG goals
- **Market-Driven Demand** – Prices vary based on supply and corporate interest
- **Flexible Participation** – No mandates, allowing optional engagement

Hybrid Market:

- **Hybrid Participation** – Mandating liable entities to produce and sell RECs while incentivizing voluntary contribution to RPS
- **Hybrid Demand Dynamic** – Demand driven by supply and demand between liable and voluntary entities
- **Government Oversight** – Authorities enforce compliance, set penalties and incentives, and adjust targets

The benchmarked jurisdictions have adopted a combination of market types tailored to the needs and structure of their domestic REC markets. While a mandatory market ensures consistent REC demand, integrates with national renewable energy targets, and drives investment in renewables, it may also impose additional costs on businesses and require enhanced government enforcement and compliance mechanisms.

Conversely, a voluntary market introduces demand uncertainty and may require additional government incentives to encourage REC adoption. Despite these challenges, all benchmarked jurisdictions have implemented a voluntary market to promote corporate participation and provide

companies with flexibility in meeting ESG goals. Additionally, engagement with international corporations expands opportunities for international REC trade.

To leverage the benefits of both models, many jurisdictions have adopted a hybrid approach, this ensured steady REC demand while supporting renewable energy targets through both mandatory and voluntary participation. However, a key challenge of this approach is maintaining a steady increase in REC supply, as both market segments compete for a limited pool of RECs.

To illustrate these dynamics, two case studies were selected: Germany, representing a fully voluntary market, and Australia, exemplifying a hybrid model.

For instance, as a purely voluntary market, Germany has no mandatory requirement for **Guarantee of Origin (GO)** trading. Instead, its demand is driven by strong corporate commitments and an eco-conscious society. As a global sustainability leader with high environmental awareness, major German corporations set ambitious targets and actively contribute to the market. Notably, the country's automotive manufacturers play a key role in advancing these initiatives.

Germany’s voluntary market model encourages corporate participation and provides flexibility in meeting their environmental, sustainability, and governance (ESG) goals while also expanding international REC trade opportunities. However, the absence of mandatory participation creates demand uncertainty, necessitating strong incentives to drive adoption.

On the other hand, Australia serves as a strong example of a hybrid market, having introduced its mandatory REC market before expanding voluntary market support. The country established its REC market through the **Renewable Energy Target (RET)** in 2000. After observing successful renewable energy and REC adoption within the mandatory market, Australia further developed and incentivized voluntary participation, notably increasing its RET in 2009 in response to rapid renewable energy growth.

A key milestone in Australia’s voluntary market development occurred in 2011 when the RET was split into the **Large-scale Renewable Energy Target (LRET)** and the **Small-scale Renewable Energy Scheme (SRES)**, creating the **Large-scale Generation Certificate (LGC)** and **Small-scale Technology Certificate (STC) schemes**. In addition to LGCs for RE facilities’ large-scale generation, STCs were introduced to incentivize small-scale technology investments, enabling small businesses and households to participate in REC trading. Additional policies and incentives were released post 2011 to further drive the adoption of renewable energy and REC trade across mandatory and voluntary markets. Furthermore, Australia’s voluntary market is driven by strong corporate demand, supported by a highly eco-conscious population and progressive culture. As a result, Australia maintains consistent REC demand and RET contributions, although the consistently high demand has led to an undersupply of STC’s, resulting in consistently high STC pricing.

3. Market Platforms

The development of REC market platforms must encompass the holistic needs of the market. An analysis of various jurisdictions has identified two potential approaches to REC platform development, considering both mandatory and voluntary markets.

Single Platform:

Centralized Data – A single, unified platform stores all transactions, retirements, and issuance data

Data Consistency – Standardized formats and tracking rules across the country/markets

Multiple Platforms:

Platform Diversity – Platforms are designed to fit needs of specific markets better

Platform Specialization – Presents an opportunity to integrate or focus on specific technologies based on market needs

When considering a hybrid REC market model, each platform approach has its own merits and demerits. A single platform for both mandatory and voluntary markets offers centralized data aggregation and lowers barrier to entry for participants. However, utilizing a centralized platform creates a single point of failure, limiting innovation in platforms, and slowing system upgrades.

Alternatively, multiple platforms allow for customization and specialization, catering to the specific needs of each market. However, this approach fragments data, complicates nationwide data aggregation, and creates inconsistencies in verification and quality control.

While no observed jurisdictions have multiple platforms split between mandatory and voluntary markets, jurisdictions provide valuable insights on establishing an efficient and scalable marketplace. For instance, Singapore utilizes blockchain technology to enhance trading efficiency and facilitate cross-border transactions, expanding Singapore's VREM locally and internationally.

4. Operational Framework & Verification System

Regarding operational framework and verification systems, a country's selection of REC Standards needs balancing between global and local market needs for optimal market impact. In this assessment, options were explored on adopting an international framework such as I-REC and TIGR, or whether to further develop a local REC framework.

International Framework:

- **Global Market Access** – Enables cross-border REC trade, attracting international buyers and investors
- **Standardized Framework** – Ensures credibility, transparency, and compatibility with established global REC mechanisms
- **Supports Corporate Sustainability** – Aligns with multinational companies' ESG targets, driving demand

Local Framework:

- **Custom-fit for Regulations** – Designed to comply with national energy policies
- **Local Participation** – Supports small RE projects and local businesses in meeting sustainability goals
- **Market Control & Flexibility** – Allows government to set unique rules, pricing mechanisms, and compliance measures tailed to Philippine energy needs

Aligning with international frameworks enhances REC credibility, facilitates international trade, and attracts foreign investment. However, compliance with global REC standards can also reduce regulatory flexibility. Conversely, a local framework allows for tailored regulations and policies but limits market participation to domestic players and requires additional efforts to establish credibility.

Singapore exemplifies a market that integrates international frameworks for REC certification, adopting both I-REC and TIGR standards. REC redemptions in Singapore exceed issuances by a factor of 10, highlighting the country's heavy reliance on REC imports to meet corporate demand, which far surpasses domestic supply. By aligning with international frameworks, Singapore increases REC availability and addresses market imbalances. However, this dependence on imported RECs—often priced lower than domestic RECs—can reduce the competitiveness of local producers, who typically command a price premium.

Australia, in contrast, operates under a **strong local framework** with minimal international trade. While it recognizes I-REC for international certification, Australian projects must choose between registering for either the local or international market, prohibiting dual participation. This restriction limits the availability of Australian RECs in the global market. Australia's REC ecosystem is entirely

managed by the **Clean Energy Regulator (CER)**, which oversees local regulations, protocols, standards, and trading platforms tailored to support the Renewable Energy Target (RET) and voluntary market. This localized approach ensures self-reliance in REC supply and allows for policy customization. However, it also restricts Australia's ability to address over- or under-supply due to its minimal integration with international REC trading.

When designing an **operational framework**, there are additional items to be considered, namely registry and trading operations. When considering registry operation, there are two main options.

Government-Run:

- Government developed protocols and standards for REC issuance

Outsourced:

- Appointed agencies developing protocols and standards for REC issuance

Government-run and outsourced registry options have their own unique set of pros and cons. Government-run registries can ensure strict compliance and better policy integration but requires more oversight by the government. Outsourced registries are more market-driven and efficient but have potential conflicts between private and public interests.

For **trading systems**, there are three options that can be utilized for adoption.

OTC/PPA:

- Buyers partner with utilities for trading over the counter (OTC) or through power purchase agreements (PPAs)

Trading Platforms:

- Trading platforms that house RECs and facilitate transactions can leverage emerging technologies such as blockchain

Service Providers:

- Service providers facilitate trades between buyers and sellers

When evaluating trading systems, each option presents distinct advantages and drawbacks. OTC/PPAs offer tailored agreements and stable pricing between entities but lack price and volume transparency. Trading platforms enhance market transparency and efficiency but demand continuous technological innovation. Service providers facilitate supply aggregation and guided trading, yet they pose risks of market manipulation.

5. International or Local Markets

Engaging in international trade offers both opportunities and risks for domestic producers and corporations. This analysis examines these factors from two perspectives—buyer and seller—by comparing local and international trade, highlighting their respective advantages and drawbacks.

Firstly, from the **buyer perspective**:

Local Trade:

- Buyers exclusively purchase RECs from domestic renewable energy projects

International Trade:

- Buyers purchase Rec's from both domestic and international renewable energy projects

Local trade offers buyers a simplified regulatory landscape but limits options to the domestic market and exposes them to local market conditions. In contrast, international trade provides access to a broader REC supply at potentially lower prices. However, sourcing internationally may cannibalize local REC supply, leading to potential backlash for not supporting domestic renewable energy providers.

From the **seller perspective**, similar insights to its pros and cons can be observed:

Local Trade:

- Selling REC's exclusively to the domestic market

International Trade:

- Selling to both domestic and international markets

Sellers engaged in local trade support domestic sustainability efforts but remain dependent on local supply and demand dynamics, lacking international market access to help balance fluctuations. In contrast, international trade offers a broader demand pool, improving supply-demand balance. However, it requires adherence to global REC standards, reducing regulatory flexibility and potentially limiting compatibility with the local market.

6. Key Stakeholders

In determining the optimal stakeholder structure for establishing the VREM, insights from other jurisdictions highlight the importance of a lean framework for end-to-end process optimization. Benchmarking analysis has identified two potential options for REC market governance.

Single Governing Body:

- **Streamlined Reporting Structure** – Liable entities and other key participants report to one authority
- **Centralized Data** – All transactions, retirements, and issuance data housed under one unified platform
- **Simplified Auditing and Compliance** – Easier for participants to adhere to compliance checks

Multiple Governing Bodies:

- **Specialized Entities** – Specific governing bodies tailored to specific portions of the VREM
- **Specified Data Reporting** – Specialized databases can be made to separate market functions or archetypes

Utilizing a single governing body streamlines issuance, data reporting, and governance, ensuring a simplified end-to-end process. However, it also introduces a single point of failure, where errors, outages, disruptions, or scandals could impact the entire market. In contrast, multiple governing bodies offer flexibility and specialization for specific regions or market archetypes, though this approach can lead to market fragmentation, increased complexity, and additional barriers to entry.

Some examples from various jurisdictions illustrate these approaches. Australia, Germany, Singapore, and Vietnam employ a single governing body for their REC markets. Meanwhile, California utilizes a dual-body system, with the California Energy Commission (CEC) and the California Public Utilities Commission (CPUC) managing separate market functions, with the CPUC overseeing public utilities. Table 1 outlines the various jurisdictions and their respective governing bodies.

Jurisdiction	Key Stakeholder
Australia	Clean Energy Regulator (CER)
California	California Energy Commission (CEC) California Public Utiliities Commission (CPUC)
Germany	Unwelt Bundesamt (UBA)
Singapore	Energy Market Authority (EMA)
Viet Nam	Ministry of Industry and Trade (MOIT)

Table 1 | Key stakeholders for each jurisdiction

7. Carbon Credit & REC Synergy

Like RECs, carbon credits play a key role in carbon abatement programs and sustainability initiatives. Many consumers leverage both to meet their ESG goals, making participation in both schemes an appealing opportunity for producers. However, this raises the risk of double counting, necessitating effective countermeasures. Striking a balance between domestic priorities and international integration is essential when establishing double counting rules. From a supplier's perspective, two key approaches can be considered for the treatment and generation of carbon credits and RECs.

Allowing Both:

- **Reasoning** – Acknowledges the distinct environmental benefits between reducing carbon emissions and increasing renewable energy supply
- **Limited Application** – It is uncommon to allow both based on observations on current international certifications and standards

Only Allowing One:

- **Reasoning** – Recognizes the environmental benefits of RECs and carbon credits simultaneously
- **International Application** – International frameworks such as I-REC, TIGR, and the European Energy Certificate System (EECS) prohibit both carbon credits and RECs to be issued for the same unit of electricity produced

Both approaches present compelling arguments. Allowing participation in both markets can boost supply and provide greater financial support for renewable energy producers. However, it may restrict international REC trading and require additional efforts to establish credibility in global markets. Conversely, limiting participation to a single scheme facilitates international trade access and enhances market credibility, potentially attracting foreign direct investment. However, this model necessitates strict government oversight to prevent double counting.

A key takeaway from all studied jurisdictions—Australia, California, Germany, Singapore, and Vietnam—is that **they all prohibit claiming both schemes** for the same unit of renewable energy generated.

Australia presents an interesting case study, as it allows participation in both the carbon credit and REC markets. The Clean Energy Regulator (CER) oversees both markets, managing operations and compliance while defining eligible technologies for generators participating in both the Australian Carbon Credit Unit (ACCU) scheme and the REC scheme. Figure 2 illustrates the CER's role in these two distinct schemes and the eligible technologies for entities engaged in both.

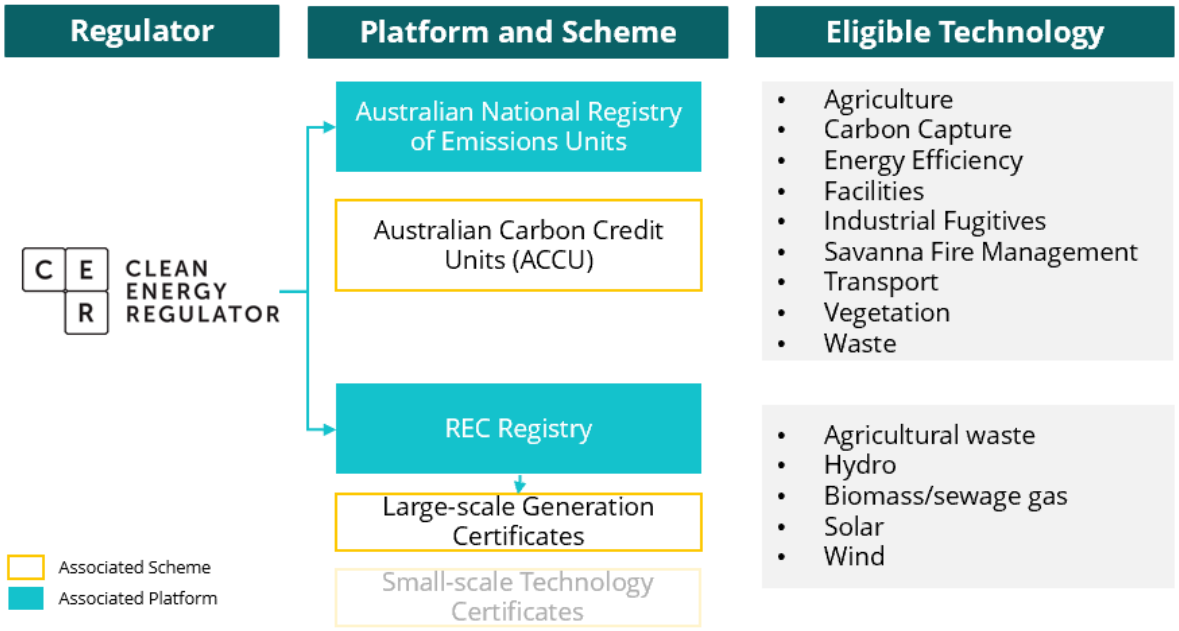

Figure 2 | Flow chart of ACCU and REC scheme participation

Source: Clean Energy Regulator

When an entity participates in both schemes, ACCUs and RECs cannot be generated from the same activity. As generators produce RECs from renewable energy, their ACCUs must come from separate, non-overlapping sources that contribute to carbon abatement through other means. Figure 3 illustrates an example of an entity engaging in both schemes, generating ACCUs and RECs from distinct activities to ensure compliance with regulatory guidelines.

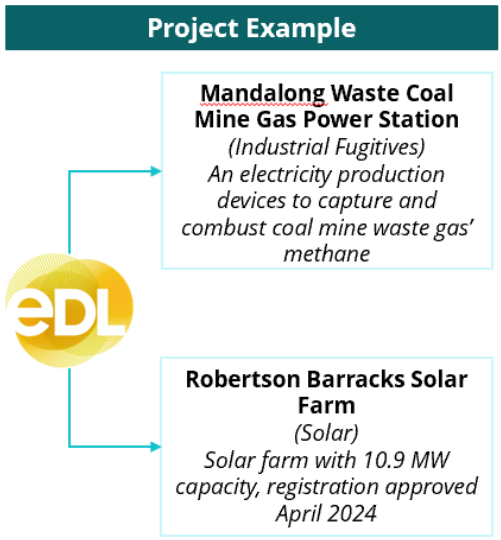

Figure 3 | EDL example of ACCU and REC generation

Source: Clean Energy Regulator

8. REC Demand Drivers and Market Dynamics

Even with guaranteed demand in the mandatory market, jurisdictions must actively implement policies to stimulate REC demand in the voluntary market to accelerate national climate goals. This can be achieved through penalty-driven or incentive-driven policies, each targeting the three key REC market participants—corporations, producers, and consumers—as outlined in Table 2 below.

	Penalty-Driven Policies	Incentive-Driven Policies
Corporations	Legally binding mandates including penalties such as fines and exclusion from public contracts	Governmental support such as tax breaks and subsidies for corporations that adopt sustainability commitments
Producers	Corporations required to purchase emission allowances of pay increased taxes for non-renewable energy production	Feed-In Tariffs, market premiums or other programs to reduce barriers to entry for new producers
Consumers	Additional surcharge for non-environmentally friendly goods	Training courses, curriculum and projects to promote sustainability awareness

Table 2 | Summary of entities and applications of penalty and incentive driven policies

While penalty-driven policies ensure compliance and sustain REC demand and supply, they may not always be the most efficient approach. These policies can undermine consumer and investor confidence, raising concerns about greenwashing, lower-quality RECs, and rising costs, which may trigger resistance and backlash.

Conversely, incentive-based policies encourage corporations to exceed national sustainability targets, fostering long-term market growth. However, this approach comes with trade-offs, including a delayed impact between implementation and results, as well as increased reliance on government funding. While incentive-driven policies offer greater potential benefits, their effectiveness remains uncertain, as success hinges on their ability to drive meaningful behavioral change among market participants.

Germany exemplifies the use of incentives to drive renewable energy transformation. The country has implemented several initiatives both before and after the launch of its Guarantee of Origin (GO) market to support renewable energy growth. Table 4 outlines the pre-GO market subsidies that helped foster renewable energy generation.

Subsidies	Information
Feed-in Tariffs	• For small-scale renewable energy producers • Sell renewable electricity at guaranteed price set by government
Market Premiums	• For large-scale renewable energy producers • Receive premium payment if market price of electricity sold is below reference price set by government
Auction Participations	• Eligible renewable projects participate in competitive auctions to determine level of market premium

Table 3 | Summary of pre-GO market subsidies

The subsidies in Table 4 played a crucial role in driving initial growth in Germany's renewable energy market. Since the GO market launch, Germany has implemented additional measures to further accelerate renewable energy adoption, as highlighted in Table 4.

Policies	Information
Mandating Open Market Sales	• New wind and solar power plants to sell electricity at market prices
Enhancing Energy Storage Infrastructure	• Expanding storage infrastructure to help renewable energy producers balance supply and demand
One-off Investment Cost Subsidies	• State guarantees of approximately €16 billion, supporting wind energy production by addressing sector-wide challenges

Table 4 | Summary of post-GO market policies

Germany has transitioned from a per-MWh financial support model to sector-wide initiatives, reducing reliance on government subsidies while promoting market-driven development and increasing GO issuance. GOs now play a crucial role in furthering renewable energy growth.

In contrast, Viet Nam faces a different challenge. Limited buyer engagement and oversupply have led to suppressed REC prices, particularly for hydroelectric-based RECs, as shown in Figure 4.

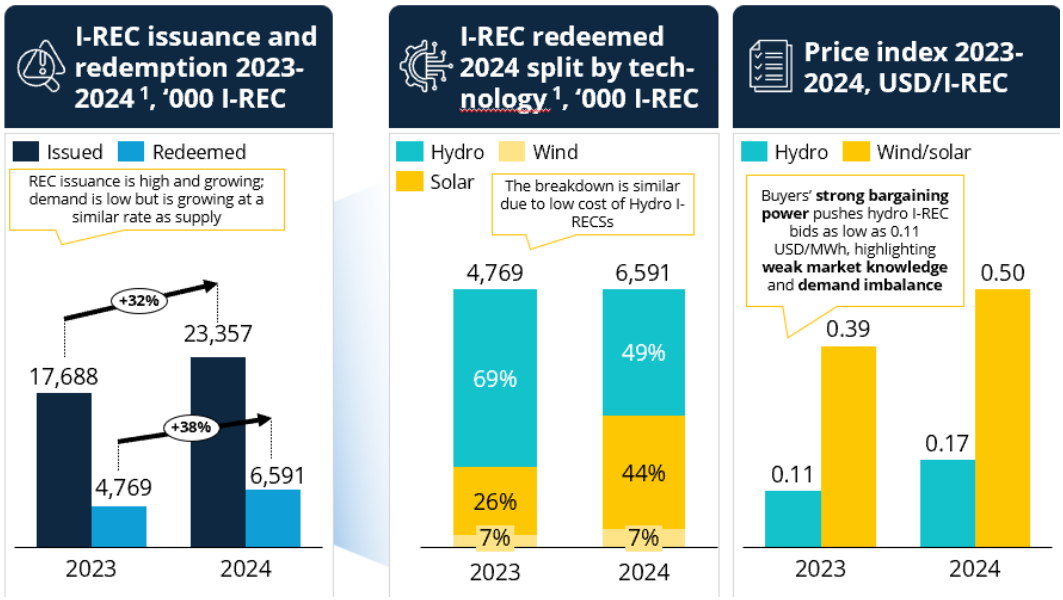

Figure 4 | Summary of Viet Nam supply and demand dynamics

Source: I-REC, S&P Global

Viet Nam's oversupply stems from several factors, including the rapid expansion of renewable energy alongside limited domestic demand. The voluntary nature of the market, low awareness, and the absence of mandatory regulations have led to excessive domestic REC production.

Beyond Germany and Viet Nam's REC market dynamics, Singapore presents a unique case. With limited land for large-scale renewable energy projects, it faces a consistent undersupply of local RECs and relies heavily on imports. As shown in Figure 5, REC redemptions significantly exceed local issuance.

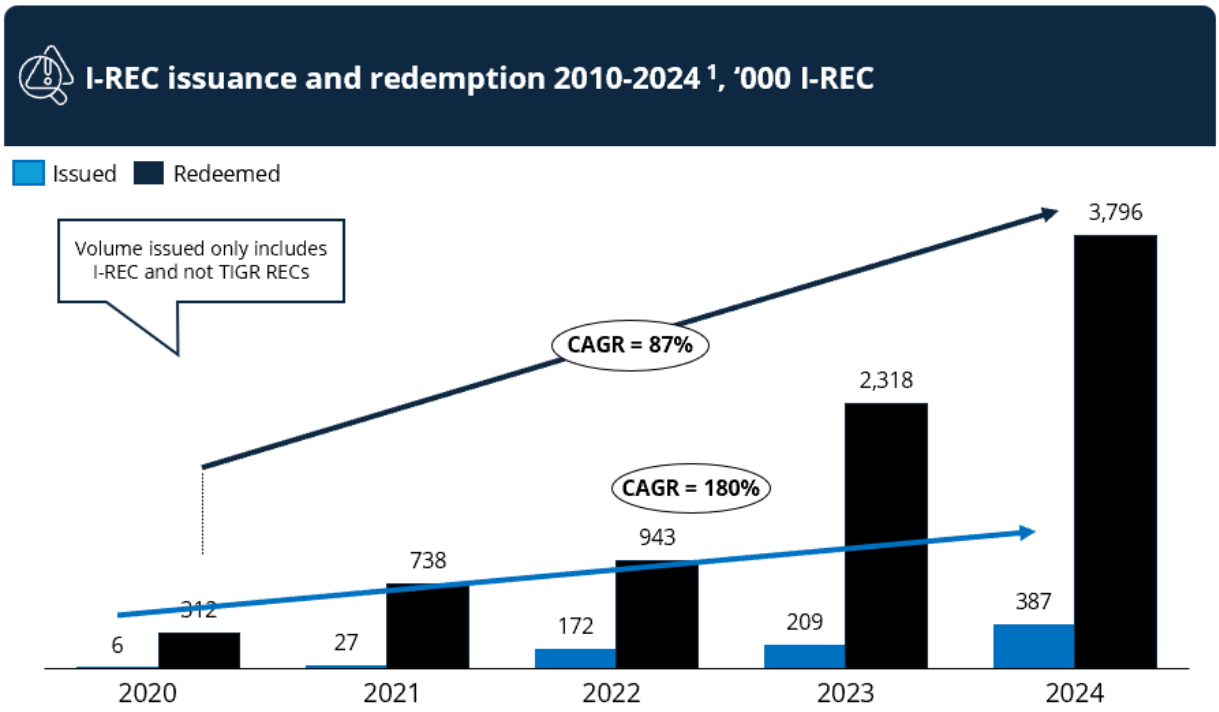

Figure 5 | Singapore REC Issuance and Redemption from I-REC

Source: I-REC

Singapore's REC demand far exceeds its local supply, resulting in a price premium of $30–50 SGD per REC. To address this shortage, Singapore plans to leverage cross-border electricity imports. However, this approach presents several challenges, including REC eligibility, transaction security, increased energy dependence, and reduced energy security.

9. Stimulate REC Supply

REC supply and renewable energy generation share a synergistic relationship, underscoring the need for continuous support for renewable energy development. This not only boosts REC issuance but also strengthens REC's role in expanding renewable energy capacity. Renewable energy growth can be driven through local or international initiatives, particularly via grid-connected projects.

Local Initiatives:

- **Public-Private Collaboration –** Joint investments between the government and private sector to accelerate RE project development
- **Infrastructure & Technology Support –** Enhancing grid capacity and integrating advanced RE technologies to increase generation efficiency of domestic producers
- **Financing & Investment Incentives –** Offering subsidies, low-interest loans, and tax benefits to encourage RE project expansion

International Initiatives:

- **International Frameworks –** Align with globally-recognized frameworks, such as I-REC, to ensure credibility and interoperability of RECs across different countries
- **Emerging Technology –** Develop cross-border trading platforms utilizing blockchain technology for increased accessibility

Local initiatives play a vital role in driving economic growth, enhancing operational capacity, and ensuring self-sustainability while meeting national renewable energy targets. For example, California-based Meta actively partners to support renewable energy generation. However, these initiatives often face challenges such as limited international expertise and operational guidance, leading to inefficiencies that could be mitigated through global collaboration. Additionally, they frequently require significant government funding, typically offset by higher consumer taxes, as seen in jurisdictions like California and Germany.

While leveraging international expertise, investment capital, and surplus supply can strengthen local REC markets, it also introduces risks of economic and operational dependency on foreign partners. A clear example is Singapore, which, due to limited land capacity, relies heavily on international sources for renewable energy and REC supply. This dependency highlights the trade-off between local self-sufficiency and international reliance in renewable energy strategies.

Beyond partnerships, governments can explore additional approaches to expand REC supply and meet domestic demand, as demonstrated in the following examples.

Distributed Renewable Energy:

- RECs from decentralized generation sources such as rooftop solar, industrial cogeneration, and microgrids

Waste-to-Energy & Industrial Byproducts:

- RECs from facilities converting waste, landfill gas, or industrial byproducts into renewable electricity

Corporate PPAs with Embedded RECs:

- Private Power Purchase Agreements (PPAs) where RE generation is bundled with RECs

Carbon-Abatement Linked RECs:

- RECs from projects tied to carbon markets, such as Clean Development Mechanism (CDM), Sustainability Development Mechanism (SDM), Joint Crediting Mechanism (JCM), or other carbon offset mechanisms

International REC Imports:

- RECs sourced from global markets (I-REC, TIGR, GO, etc.), allowing access to diverse supply

While these options expand REC sources and accessibility to the REC market, it comes at the cost of additional frameworks and regulations to overcome complications such as sustainability and double counting concerns.

10. Pricing Dynamics

Accessibility to REC trading is a key success factor in the REC market, with pricing dynamics and dominant trading channels playing a crucial role. Analysis of various jurisdictions reveals three primary pricing models: Local Spot Pricing, Contract-Based Pricing, and Government-Regulated Pricing.

Local Spot Pricing:

- **Trading Channel** – Trading Platforms or Exchanges
- **Pricing -** Determined by **supply-demand relationships** in wholesale REC market
- May utilize emerging technology, e.g. blockchain

Contract Based Pricing:

- **Trading Channel –** Trading Contracts
- **Pricing** - Determined by **market players engaged in REC Trade**

Government-Regulated Pricing:

- **Trading Channel –** Government Regulations and Policies
- **Pricing -** Determined through measures such as **price floors and price ceilings**

Each pricing model influences market accessibility, price stability, and overall participation, shaping different jurisdictions' approach to REC trading.

Local spot pricing, adopted by Germany, Singapore, and Australia through online exchanges and trading platforms, offers real-time price discovery and flexibility. This model enables participants to respond dynamically to market signals but also introduces high price volatility, which can create financial risks that may deter buyers and sellers. Additionally, it requires advanced digital infrastructure to support necessary trading tools.

For example, price volatility and rising prices are evident in Australia's STC scheme. Influenced by supply and demand dynamics, excess demand—driven by a slowdown in new small-scale solar capacity amid strong market demand—has pushed STC prices up to the price cap.

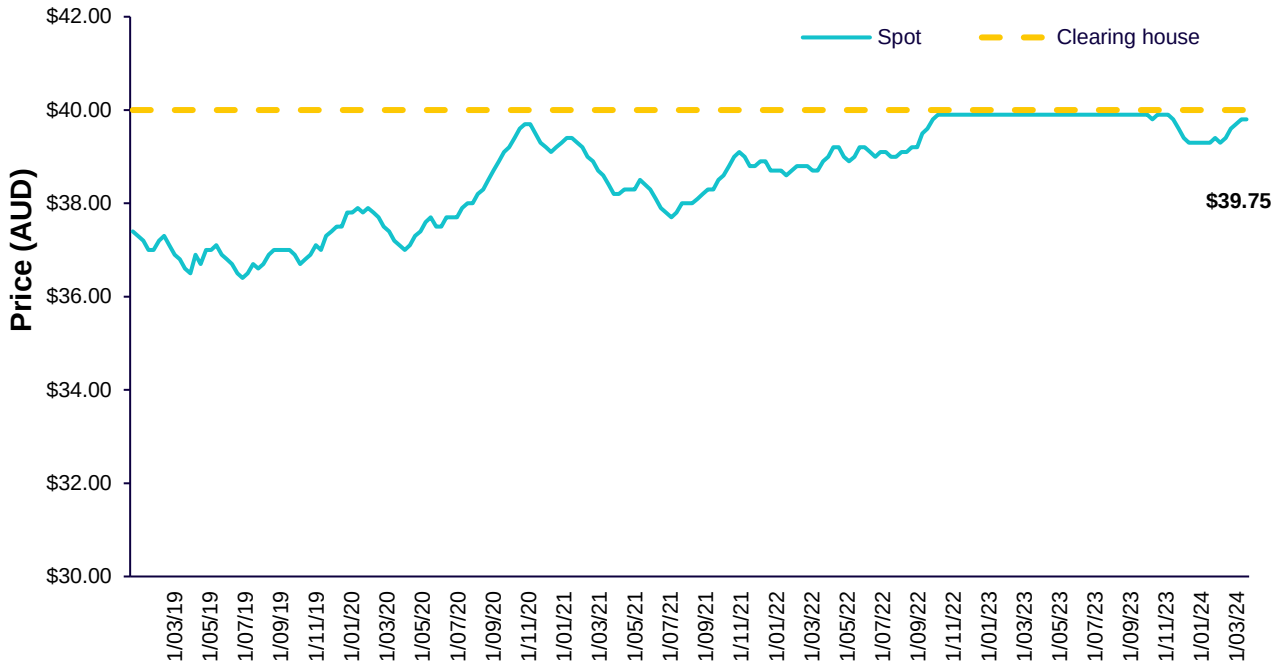

Figure 6 | Historical price of STC's and its price ceiling in AUD/MWh

Source: Clean Energy Regulator

In contrast, contract-based pricing, present in all jurisdictions, ensures greater price stability by allowing buyers and sellers to negotiate prices. While this reduces financial risk, it limits market flexibility, as long-term contracts prevent real-time responsiveness to price fluctuations. Furthermore, the lack of transparency in price trends and trading volumes can hinder overall market efficiency.

Despite their differences, both local spot pricing and contract-based pricing are driven by supply-demand dynamics, which can lead to price imbalances. For instance, Singapore experiences high price premiums due to insufficient REC issuance, while Vietnam faces low REC prices due to an oversupply of renewable energy.

To mitigate such imbalances, government-regulated pricing can be explored. This model provides a controlled framework, ensuring investment stability and cost predictability by setting defined price ranges. However, it requires strong regulatory oversight, adding administrative complexity. Among the analyzed jurisdictions, only Australia has adopted this model through a price ceiling on its STC scheme as seen in Figure 6, ensuring affordable REC prices for buyers.

11. Key Success Factors

Overall, the benchmarking analysis has identified 7 key success factors that contribute to a thriving and growing REC market, highlighting the crucial role of government in market development. Table 5 outlines these key factors and the necessary actions to ensure long-term REC market success.

Key Success Factors	Details	Action
Strong Policy and Regulatory Framework	• Clear and well-defined **regulatory guidelines** • Harmonization between **voluntary and mandatory** REM • Adoption of **international standards** • Well-structured **compliance** and enforcement mechanisms	• **Define clear rules** for REC issuance, trading, and verification • **Align VREM with REM policies** to prevent regulatory conflicts
Stable and Growing Market Demand	• **Government-led initiatives** to encourage corporate participation • **Incentives** for voluntary REC adoption • Engagement with **RE100 and selected non-RE100 companies**	• **Provide incentives** (tax breaks, subsidies) for REC adoption • **Partner with and support** RE100 firms and multinationals to boost demand
Efficient and Transparent Trading Platform	• **Centralized and automated** REC trading platform • Integration with **blockchain or digital tracking systems** • Compatibility with **global REC platforms** • **Simplify market** participation	• **Enhance PREMS** for seamless REC tracking and trading • **Integrate with I-REC and TIGR** for global market access
Price Stability and Market Liquidity	• Mechanisms to **prevent price volatility**, such as price floors, auction-based pricing, or long-term PPAs • **Balanced supply-demand** dynamic • Incentives for **long-term REC purchase**	• Introduce **auction-based pricing and price floors** • Promote **long-term PPAs** for REC price security
Robust Renewable Energy Supply Pipeline	• Investments in **renewable energy infrastructure** • **Financial support** for new RE projects • **Grid enhancements** for efficient transmission and distribution	• Offer **grants and loans** for RE project development • **Upgrade grid capacity** to support higher RE integration
Stakeholder Engagement and Awareness	• Active **participation of stakeholders** in VREM discussions • Nationwide **awareness campaigns** • **Public-private partnerships** • Technical Working Groups to **refine VREM policies**	• **Organize TWGs to align VREM policies** with market needs • **Launch awareness campaigns** to drive REC adoption
International Market Integration	• Recognition and compatibility with **international REC trading systems** • Develop **cross-border REC trading** agreements • Align with **global carbon markets** • **Leverage Singapore** as a key REC buyer	• **Secure bilateral trading** deals with high-demand countries • **Align with JCM, ITMOs, and carbon markets** for expansion

Table 5 | Key Success Factors for VREM Development

ENERGY TRANSITION PARTNERSHIP

Powering Prosperity and Enabling Sustainability in South East Asia

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ARTHUR D LITTLE