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POWERING A GREENER DIGITAL FUTURE:

Clean Energy Adoption in Data Centres

Position Paper by
the Sustainable Energy Association of Singapore (SEAS) and SGTech

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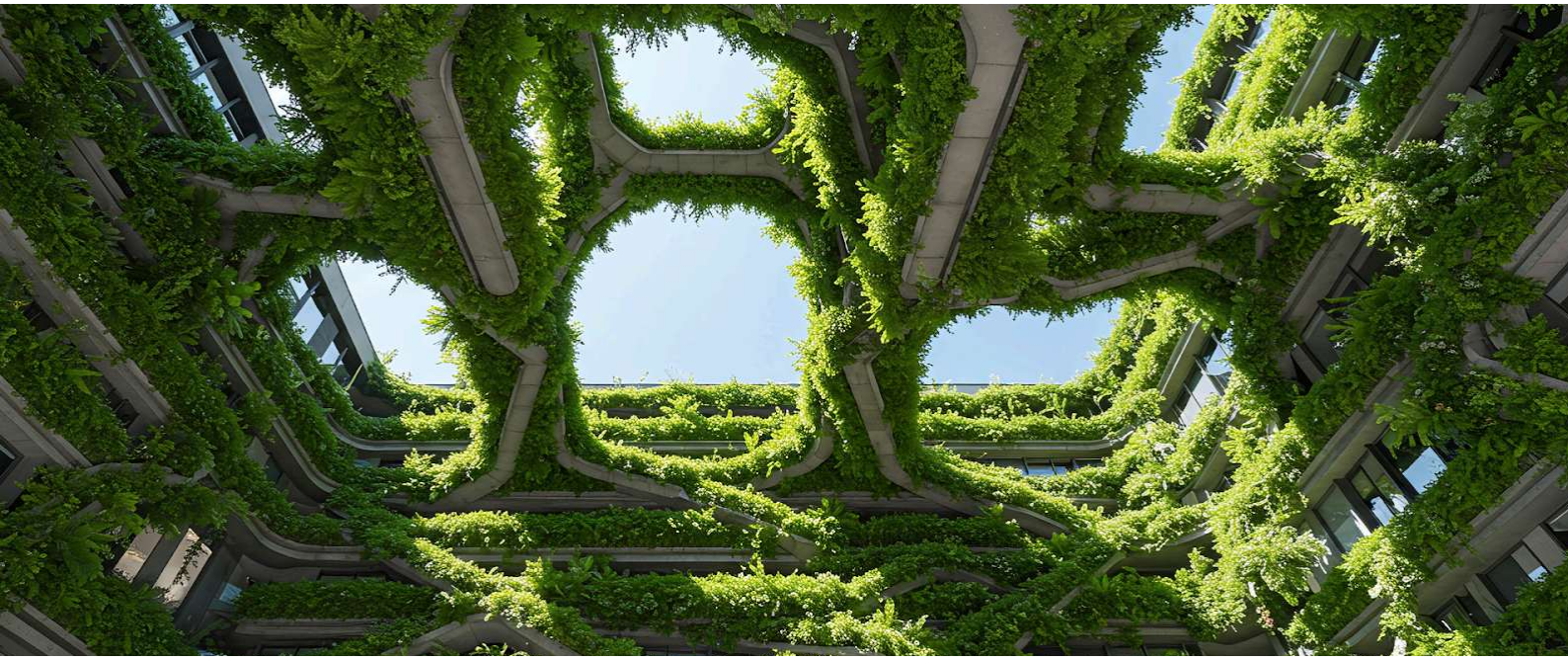
EXECUTIVE SUMMARY

Executive Summary

The Singapore government's Green Data Centre Roadmap (GDCR) provides a forward direction for the transition to a future of sustainable DCs, supported by key initiatives like the Future Energy Fund (FEF) and the establishment of Singapore Energy Interconnections (SGEI) to de-risk the shift to green energy. However, significant challenges to successful energy transition remain.

To better understand potential challenges, as well as identify ways that the government and private sector can collaborate to achieve the desired outcomes, the Sustainable Energy Association of Singapore[1] (SEAS) and SGTech (Data Centre Chapter)[2] convened a Roundtable Discussion on 2 July 2025. Participants included clean energy producers, DC operators, trade associations, and other key stakeholders. This Position Paper on Clean Energy Adoption in Data Centres captures the key discussion points and recommendations from the discussion.

The Singapore government has already put in considerable effort to support a successful energy transition. This Position Paper, synthesising insights from a Roundtable with key industry stakeholders, identifies further challenges to adopting clean energy. These include complex procurement processes, the high cost of imported green energy, nascent Power Purchase Agreement (PPA) frameworks, and the lack of commercially scalable low-carbon technologies.



[1] SEAS members comprise companies operating across the clean energy value chain, including developers, financiers, consultants, and educators. Through joint efforts, they advance technology innovation, facilitate project development and investment, build capacity and scale deployment. SEAS' collaboration with SGTech is one such effort to drive energy transformation and enable net zero ambitions.

[2] SGTech comprises over 1,400 members across the tech ecosystem and the SGTech Data Centre Chapter (DCC) is one of its key chapters. DCC members, including data centre operators, service providers, equipment vendors, solution providers, and consultants, collaborate to advance sustainable data centre solutions, improve energy efficiency, and explore innovative infrastructure for Singapore's growing digital economy.

To address these challenges, this paper puts forward five key recommendations for a collaborative public-private approach:

1. **Establish clear and coordinated government leadership:** Create a unified inter-agency body to provide clear, long-term strategic direction for the energy transition.

2. **Secure energy supply and strengthen infrastructure:** Deepen government-to-government engagement to de-risk energy imports and upgrade national infrastructure to better handle renewable energy.

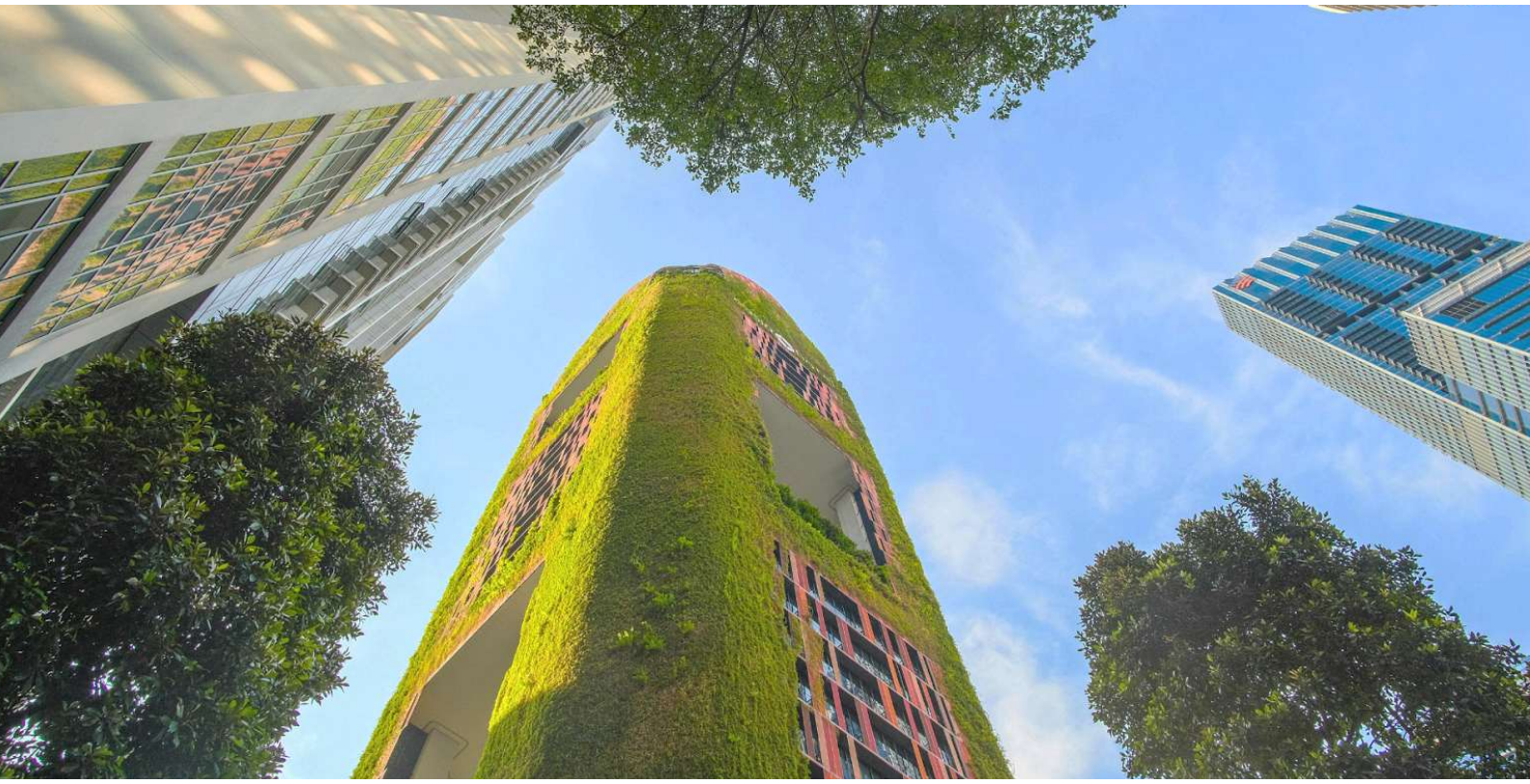
3. **Streamline procurement and standardise PPA agreements:** Develop risk-sharing mechanisms for early off-takers of imported energy and create standardised PPA frameworks to reduce complexity and cost. An optional aggregated purchasing model could also be established to support smaller players.

4. **Introduce innovative financing and cost-reduction strategies:** Explore public-private financing models to bridge the cost gap between low-carbon and conventional energy.

5. **Foster deeper industry collaboration and capability development:** Build a vibrant local SME ecosystem and establish a 'PPA Centre of Excellence' to enhance industry expertise and position Singapore as a regional leader in green energy contracting.

A robust public-private partnership is crucial for Singapore to overcome clean energy barriers, aligning data centre growth with national climate goals. This secures the nation's leadership in both sustainability and the digital economy.

INTRODUCTION



Introduction

The Infocomm Media Development Authority (IMDA) launched the Green Data Centre Roadmap (GDCR) in 2024, which provides both opportunity and clear direction for the industry. Recognising the commercial risks and complexities, the government has put in place significant financial and structural support to de-risk the transition, including the:

- **Future Energy Fund (FEF)**, capitalised with $10 billion to provide direct financial support for nascent green technologies, and the
- **Singapore Energy Interconnections (SGEI)**, a government-linked entity tasked with developing crucial energy import infrastructure

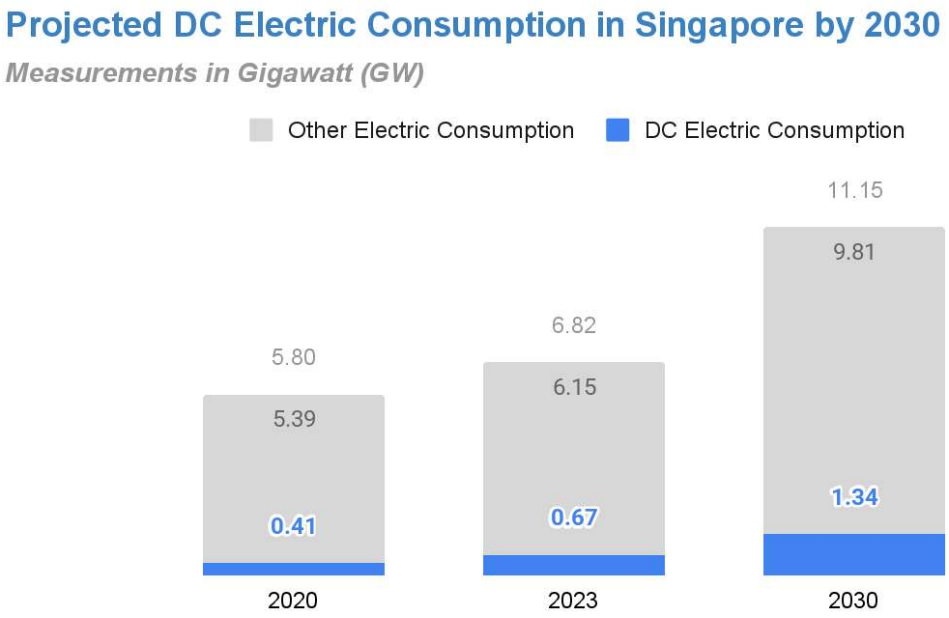
IMDA also announced that it would provide at least 300MW of capacity "in the near term", with much more "through green energy deployments". This represents an exciting opportunity, but is not without commercial risk, given the potential complexity surrounding green energy deployments in the new Data Centres (DCs).

To better understand potential challenges, as well as identify ways that the government and private sector can collaborate to achieve the desired outcomes, the Sustainable Energy Association of Singapore (SEAS) and SGTech (Data Centre Chapter) convened a Roundtable Discussion on 2 July 2025. Participants included clean energy producers, DC operators, trade associations, and other key stakeholders. This Position Paper on Clean Energy Adoption in Data Centres captures the key discussion points and recommendations from the discussion.

Digitalisation is increasingly central to our economy and our way of life - according to IMDA, around **17% of Singapore's Gross Domestic Product (GDP)** can be attributed to the Digital Economy.

DCs are a core foundational element of Singapore's digital economy, and Singapore has positioned itself as a regional DC hub with around 1.4 gigawatts of capacity as of 2024.

As the thermal density of advanced computing has increased, and with migration to the cloud aggregating previously distributed servers and workloads, DCs have accelerated the demand for water and power, leading to sustainability concerns as Singapore (and the world) tries to move towards Net Zero.



DCs consumed 7% of Singapore's total electricity output in 2020, rising to 9.8% in 2023, and is expected to grow to 12% of Singapore electricity by 2030. Reconciling the critical foundational layer that DCs provide to cement Singapore's position as a globally-recognised AI Hub and grow the Digital Economy, with the attendant resource implications, is a key area for public-private partnership to resolve.

The GDCR laid out two key thrusts to achieve this:

- Improve energy efficiency at both the hardware and software levels (DCs have limited influence in this space relative to chip manufacturers and software developers.)
- Accelerate DC adoption of low-carbon energy

Singapore's electricity mix remains dominated by natural gas, one of the cleanest fossil fuels, although the share of clean energy sources has been expanding. With the National Climate Change Secretariat (NCCS) leading the transition to a low-carbon energy future and achieving targets under our Green Plan 2030, vast opportunities such as renewable energy imports, regional power grids, and adopting low-carbon alternatives are available to not only play our part as a responsible member of the international community, but to also provide long-term energy diversification and security.

As part of our efforts to continually explore new options for energy supply, the GDCR views DC operators as "important catalysts for key partnerships"[3], an important lever by which Singapore can unlock low-carbon alternatives. The specific forms of low-carbon energy highlighted in the GDCR as a starting point are bioenergy, low-carbon hydrogen, and ammonia.

Other alternatives not stated in the GDCR, such as geothermal technology, are yet to be commercially deployed, and Singapore will continue to monitor the progress of nuclear technologies and build knowledge and capabilities to better understand nuclear science and technology.

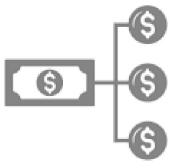
[3] Driving a Greener Digital Future: Singapore's Green Data Centre Roadmap, IMDA (2024)

All of these efforts, coupled with the geographic constraints we face, will continue to move Singapore towards achieving its commitment of net zero emissions by 2050.

The Singapore government has already put in considerable effort to support successful energy transition. While DC operators are keen to be part of Singapore's sustainable development, this needs to be balanced against potential challenges. This Position Paper identifies some of the key challenges to accelerating the adoption of low-carbon energy and recommends opportunities for collaboration between the sector and the government. These are clustered into 4 thematic pillars:

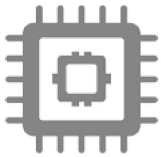
4 THEMATIC PILLARS FOR COLLABORATION

Procurement Processes



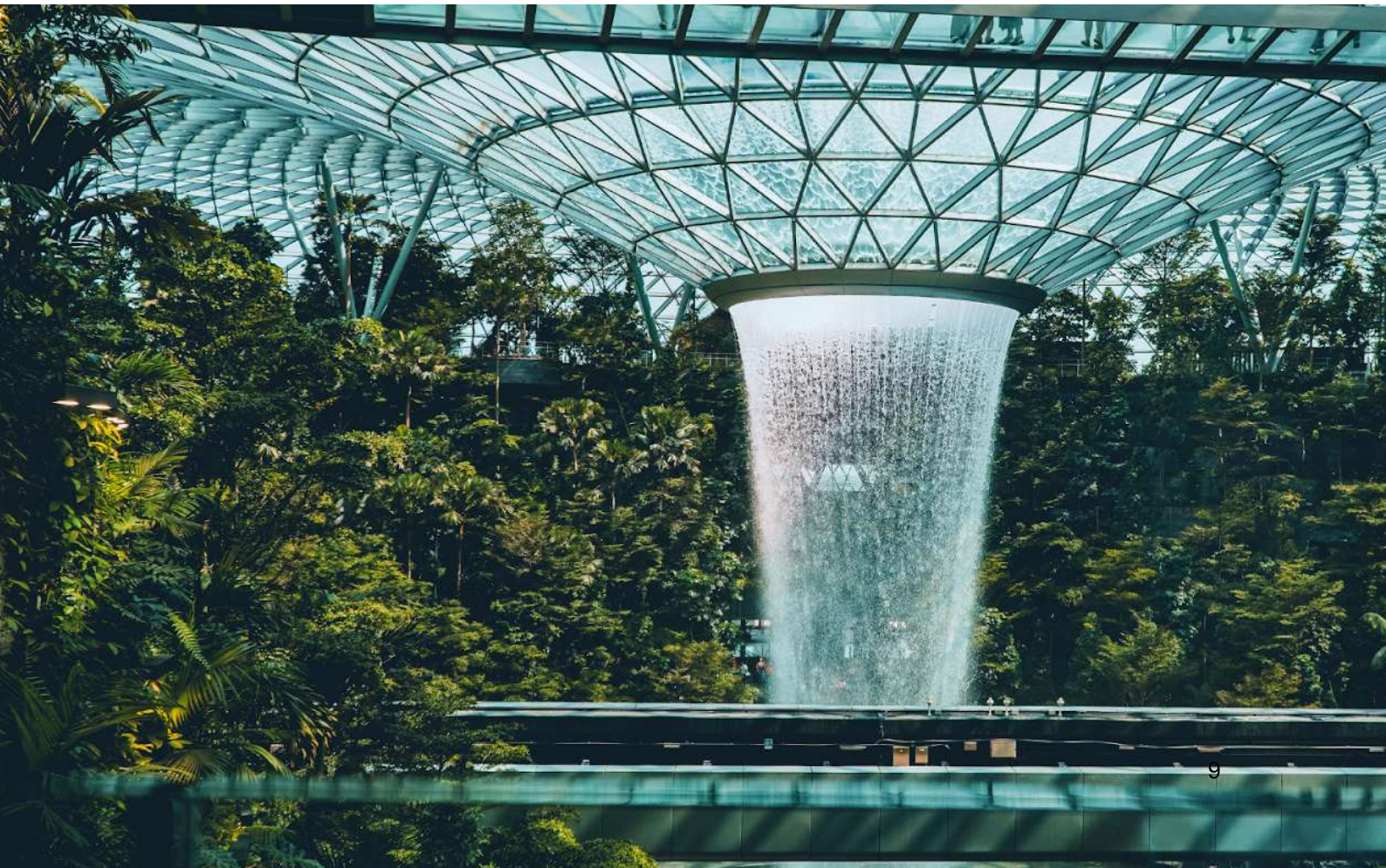
Pricing Structures

Power Purchase Agreement Frameworks



Green Energy Solutions

The Position Paper then concludes with a synthesis of recommendations.



PROCUREMENT PROCESSES

Procurement Processes

Procurement processes have been identified as a potential impediment to achieving the ambitious targets for low-carbon energy adoption.

Lack of transparency in low-carbon energy sourcing and procurement

Given the relative novelty of low-carbon energy in the region, there is a lack of transparency in sourcing and procurement, relative to brown energy contracts. The potential opacity around key areas such as double counting, project evaluation methodologies, decision-making criteria and vendor selection can create uncertainty for both purchaser and supplier and lead to sub-optimal outcomes. The lack of clear price benchmarks, especially against a backdrop of volatile energy prices and rapid but uneven technological advancement, compounds the challenge.

Procurement mechanisms for low-carbon energy need streamlining

Procurement mechanisms in many organisations were designed for traditional energy procurement, and have not evolved to address the particular requirements of low-carbon energy, such as rapid technological evolution.

Lack of expertise on power purchase agreements (PPAs)

A related challenge is the comparative novelty of low-carbon energy PPAs. There are multiple possible structures, e.g., traditional energy PPA, on-site PPA, off-site PPA, virtual PPA, lease-to-own, and more, each with its own risks and benefits. However, many organisations need more education on PPAs in order to choose the best structure for their needs, streamline negotiations, and avoid disputes later on.

Complex governance structures creating barriers to low-carbon energy adoption

Complex governance structures are another potential barrier to low-carbon energy adoption, particularly for more innovative or novel sources of energy. The need for clearances from multiple agencies (e.g., NEA, IMDA, EMA, BCA, etc.) creates additional uncertainty and potential delay. This could further reduce the viability and attractiveness of low-carbon energy solutions, particularly where timelines are tight.

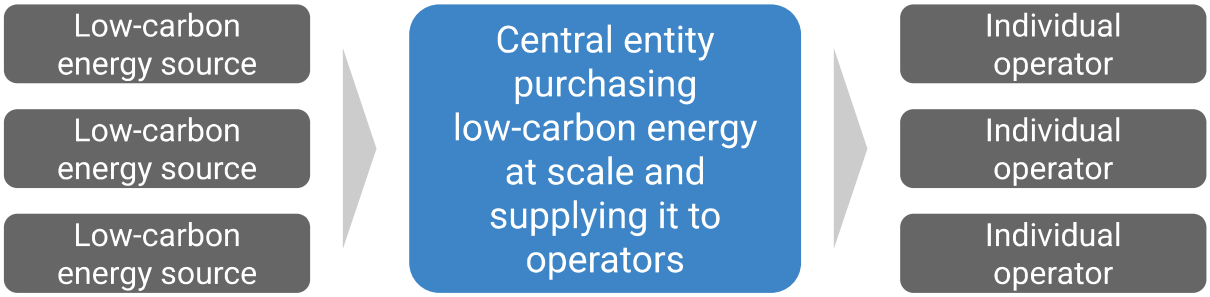
Challenges in securing early off-take agreements for import projects

Apart from Malaysia, energy import projects are at a relatively early stage, e.g., Conditional Licenses for Indonesian sources, and Conditional Approval for Australia's SunCable. While some projects could be operational as early as 2028, others have longer horizons, extending into the mid-2030s. This transfers significant risk to the private sector, both buyers and sellers. Buyers, in particular, will be exposed to multiple risk factors, such as project delays, regulatory changes or other shocks that are beyond their control.

However, this challenge also presents a crucial opportunity for collaboration. To secure the early offtake agreements needed for these projects to move forward, a **balanced approach to risk is essential**. Instead of discouraging early commitments, this is the time to co-develop pathways for risk-sharing between the public and private sectors. Targeted policy backstops, for example, could help mitigate specific, uncontrollable risks for first movers, building the market confidence needed to secure Singapore's future green energy imports.[4,5]

Proposed solutions

Implement aggregated purchasing models for low-carbon energy to address cost barriers



There is an opportunity to reduce cost and risk for industry players by setting up a central entity to procure low-carbon energy and supply it to individual operators. This could be conceptually similar to GasCo, the government-owned entity set up to procure and supply gas to electricity generation companies. The benefits would also be similar to GasCo - economies of scale that would enable diversification of energy sources, pricing power, the ability to enter long-term contracts, and so on.

Establish early engagement protocols for import projects

Given the potential risks identified with being early off-takers for import projects, there is an opportunity for the government to step in to help balance risks for private buyers and suppliers. While some risks can be contractually managed, others, such as regulatory or policy changes, or *force majeure* events affecting completion timelines, can cripple private sector players. There may be a need for the government to work with industry to co-develop risk-sharing mechanisms instead.

Develop clear guiding principles with policy flexibility for energy transition

Clear guiding principles on low-carbon energy procurement would help improve transparency across the industry. These would, however, need to build in some policy flexibility, given the inherent uncertainty of energy transition. Therefore, beyond economic and financial factors, the guiding principles would need to address issues such as technical performance, innovation, and carbon reduction impact over the full lifecycle of the project.

[4] UK's Contracts for Difference (CfD) scheme (2024)

[5] The H2Global mechanism

Streamline procurement mechanisms for low-carbon energy in Singapore

Procurement of low-carbon energy could be streamlined through a combination of standardisation and simplification, building off the guiding principles described above. For example, standardised evaluation scorecards that take into account the specific circumstances and issues around different forms of low-carbon energy could make it easier for industry players to procure green energy. Simplification of procurement processes, e.g., through modularisation or vendor pre-qualification, could also help. This would also improve the transparency and governance of low-carbon energy procurement.

PRICE GAPS

Price gaps

High transmission costs add to overall green energy price for imports

The cost barrier will likely be even higher for imported green energy, where the costs of transmission will need to be added to generation costs. The high infrastructure costs, including wheeling costs to transport electricity, and backup costs to ensure reliability, will need to be recovered through higher prices for imported green energy. Current cost estimates for solar imports from Indonesia, for example, are around $300/MWh[6] or higher, a significant premium over the fully-stacked brown energy alternative.

Bridging the price and value gap between conventional and imported green energy

A topline comparison of energy costs shows that electricity from natural gas, even when stacked with Renewable Energy Certificates (RECs) and carbon taxes, is currently more affordable than green energy alternatives.

> The stacked cost of conventional energy has recently remained below **$200/MWh**, while initial estimates for imported solar, which include significant transmission and infrastructure costs, are around **$300/MWh**.

However, this price comparison overlooks the total risk-adjusted value that long-term green energy imports provide. Corporate and industrial buyers increasingly value attributes that go beyond the spot price per MWh. These include:

- **Long-term Price Stability:** A multi-year PPA for imported energy acts as a hedge against the price volatility of the global natural gas market, offering budget certainty.
- **Energy Firmness and Diversification:** Large-scale imports can provide a higher load factor and a more consistent supply ("firmed energy") than intermittent local renewables, while diversifying Singapore's energy mix.
- **System Benefits:** These projects contribute to national energy security and grid resilience.

Therefore, viewing imported green energy as having a simple "cost premium" does not fully represent its value proposition. New financial models and policies will be required to recognise and price-in these benefits.

[6] S'pore consumers unlikely to see big hike in electricity prices from clean imports: Observers | The Straits Times

Proposed solutions

Investigate innovative financing and risk-sharing models to bridge the brown-green energy cost gap

There are a range of interventions that can help reduce the cost of capital for green energy projects, and hence ultimately reduce the energy cost gap. These include private-public partnerships, where the government or green investors co-invest in green energy projects and help mitigate the regulatory or policy risks and reduce the cost of capital. Governments or green-energy focused NGOs will also typically be better placed than individual private sector players to pool and diversify risks across exporting countries, technologies, and even weather variability.

Develop aggregated demand mechanisms to achieve economies of scale

To complement the growing private PPA market, an aggregated purchasing model could be established as an optional pathway for green energy procurement. This could be conceptually similar to GasCo, the government-owned entity set up to procure and supply gas to electricity generation companies.

Such a model can offer significant benefits, particularly for industry players that lack the scale to negotiate favorable PPA terms independently. It can help achieve economies of scale that would enable diversification of energy sources, increase pricing power, and offer the ability to enter long-term contracts.

Address transmission cost challenges through national-level interventions

Given that energy import deals are bilateral or multilateral government agreements, it would make sense for issues relating to the cost of infrastructure and transmission to also be handled at the national level. The establishment of government-linked entity Singapore Energy Interconnections[7] (SGEI) is a step in the right direction, but more will need to be done to fully address transmission cost challenges over the longer-term.

Reduce cost for green energy projects through government support e.g., Future Energy Fund

The government could also provide direct financial support for projects involving nascent low-carbon energy technologies, or which require high upfront capital expenditures, in order to lower the cost for private sector players. The Future Energy Fund (FEF) was set up in 2024, and in 2025 had its capital doubled to $10 billion. It will have a critical role to play in supporting cost-reduction strategies, and much will depend on how nimble and pro-active the FEF proves to be in the coming years.

[7] SGEI was set up in 2025 with a mandate to invest in, develop, own, and operate interconnectors to import electricity.

Explore energy mix approaches including on-site generation and low-carbon solutions

Prescribing the specific types of green energy that can be used increases costs and risks for industry players. Instead, allowing industry to determine the optimal mix of energy sources should help lower the overall cost of green energy. This is because industry players will be better able to mitigate against risks such as technology failure and intermittency, especially as each individual site may be too small to set up on-site generation in an optimal way.

Given the intermittent nature of green energy (from renewable power sources such as solar and wind, which depend on varying conditions such as sunlight and wind speed), this poses challenges for the power grid which requires a constant balance of energy supply and demand. Hence, the adoption of grid-forming inverters for the power grid supporting the data centre "campus" would improve the resilience of the data centres by providing a stable voltage and frequency signal, and provide black-start capability (in the event of power grid failure) without needing an external grid signal.

POWER PURCHASE AGREEMENT FRAMEWORKS

Power Purchase Agreement Frameworks

Limited understanding of PPA structures among stakeholders

Low-carbon PPAs are relatively new, and there are more variables and options to consider relative to normal agreements. Therefore, there is currently a need to improve understanding of PPAs among stakeholders. Stakeholders need to understand the legal and financial implications of the different types of PPAs, and design PPAs that are fit for their particular circumstances. This should also extend beyond solar to other low-carbon PPAs.

Lack of standardised frameworks for green energy PPAs

The relative novelty of low-carbon energy PPAs also means that there are few standardised frameworks for industry players to use as templates or references. For example, law firm Bird & Bird observed that many onsite PPAs are adapted from UK or US templates, resulting in PPAs that are "highly convoluted and not fit for the Singapore solar regime"[8]. This increases the cost and uncertainty for individual players who need to negotiate each and every aspect of the PPA, instead of relying on tried-and-tested templates that are in tune with Singapore's laws and operating environment.

Complexity in negotiating long-term agreements

A related challenge is the complexity of negotiating long-term agreements when there is significant additional uncertainty. Apart from the typical concerns around energy prices or geopolitical risks, green energy agreements may also need to take into account technological risks and 'unknown unknowns'. Applying standard discounting methods to address such long-term uncertainty could make green energy unattractive, or even unfeasible.

Challenges in securing favourable terms for green energy projects

Individual green energy buyers looking to enter PPAs may also find it challenging to secure favourable terms. Buyers, especially new ones, will likely be small relative to the market and to the supplier, which puts them at a negotiating disadvantage. They will often also lack the expertise to be able to move terms in their favour.

[8] Solar Energy & Corporate PPAs in Singapore (2024)

Proposed solutions

Develop standardised PPA frameworks for different energy types

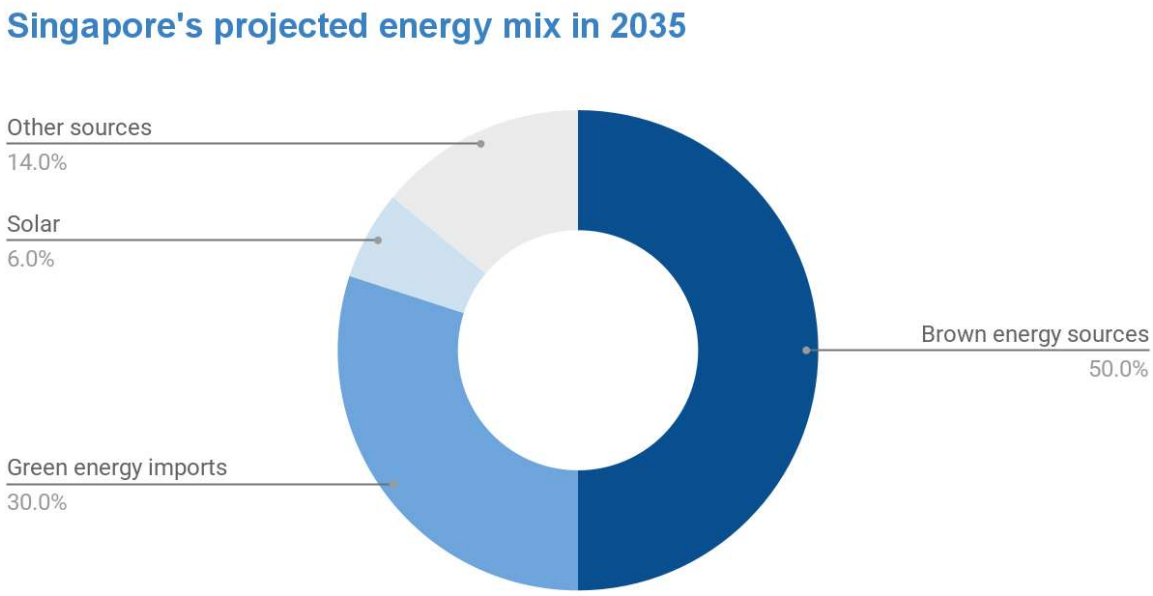
It is imperative for the industry to work together with stakeholders, including the government and other interested parties, to develop standardised PPA frameworks for different energy types, project types and scale of deployment. Model clauses should be developed for key terms and risk areas, with the pros and cons of different formulations clearly understood by all parties. This could also be supplemented by an enhanced regulatory and dispute settlement regime tailored to PPAs

Provide deeper education and training on PPA mechanisms

Associations like SGTech and SEAS can jointly establish a PPA Centre of Excellence that could provide training and thought leadership, and also help Singapore build a reputation as a thought leader in the area of PPAs, especially in the South-east Asian region. It could help drive broad education and training on PPAs, as well as establish collaborative platforms for PPA knowledge sharing.

GREEN ENERGY SOLUTIONS

Green Energy Solutions



There remains a strong imperative for Singapore to have both energy security and diversity, with a focus on green energy going forward, to meet Singapore's net zero emissions commitment. This is reflected in Singapore's projected energy mix in 2035[9], where 30% of energy will be from imported green energy, 6% from solar, and 14% from other sources[10]. New green energy solutions will need to be both technologically and commercially viable to be sustainable in the long-run.

Singapore has identified several emerging green energy technologies to support the commitment above. However, each technology face challenges to scalability, as described below:

Biomethane: Viable gas alternative that will immediately be compatible with existing generation infrastructure. Some commercial contracts have been signed[11], but processing and transport costs will probably keep prices above natural gas in the absence of subsidies. Furthermore, a lack of total feedstock means long-term reliance on Malaysia and Indonesia, and potential seasonal variability in output based on the agricultural calendar.

[9] What could Singapore's energy mix look like in 2035? (EDB, 2024)

[10] Regional grids key to Singapore's energy future (Ember, 2024)

[11] PGN set to supply biomethane for Singapore data centres (gasworld, 29 Aug 2025)

Green Hydrogen and Ammonia: Recognised as critical long-term solutions for deep decarbonisation. While widespread commercial viability is not expected before 2030, the groundwork for their adoption must be laid today to overcome current barriers like high production and transport costs.

Instead of deferring engagement, a proactive strategy focused on **pilot-to-scale pathways** is needed. This involves encouraging early-stage, pre-commercial projects that can help build local expertise, test supply chains, and drive down costs through practical application.

To guide this development, clear guardrails should be established by policymakers and industry. These would include setting cost-reduction targets, establishing robust safety standards, and developing clear frameworks for Guarantees of Origin to certify the fuel's green credentials. Leveraging synergies with other sectors, such as maritime, can also help accelerate the development of infrastructure and drive the necessary economies of scale.

Green Energy Imports: Green energy imports, particularly from Indonesia and regional partners, are likely to be the most viable option in the near term, and are expected to make up 30% of the energy mix in 2035. However, there are financial concerns around the cost of transmission infrastructure and currency risks, and geopolitical concerns around the stability of various import partners. Early adopters are likely to bear the brunt of these risks

Singapore's evolving nuclear energy strategy

Nuclear energy must also be seriously considered as a long-term solution to meet Singapore's future energy needs and climate commitments beyond 2050. While traditional nuclear power plants may not be feasible due to Singapore's limited land space and high population density, Small Modular Reactors (SMRs) are a promising option due to their compact size, scalability, and factory-assembled design. These advanced reactors are designed with robust safety features, generate significantly less nuclear waste, and are versatile enough to be deployed in space-constrained urban environments.

To build foundational expertise through international partnerships, the Singapore government has signed cooperation agreements with the United States, France, and the United Arab Emirates, and also established the Singapore Nuclear Research and Safety Institute (SNRSI) in 2025 to lead in nuclear research and develop regulatory frameworks. Additionally, the Energy Market Authority (EMA) appointed Mott MacDonald to conduct a comprehensive study of the safety and feasibility of advanced nuclear technologies.

This initiative aligns with Singapore's broader energy transition goals. As part of its net-zero ambitions, nuclear energy could supply up to 10% of the country's electricity needs by 2050. This would help to decarbonise the power sector, which accounts for about 40% of national emissions. Although no decision has been made to deploy nuclear energy, these efforts underscore Singapore's commitment to assessing low-carbon technologies while addressing challenges like safety, waste management, security, and public perception.

Implementation considerations

Address technical issues like rotational inertia early in green energy deployment

The increase in reliance on variable renewable energy sources such as solar and wind will create stability challenges for the grid. These will need to be addressed early on to ensure overall grid stability is maintained, and pre-empt concerns from users.

Focus on SME involvement in green energy sector development

An additional consideration in green energy sector development is the importance of building a vibrant small medium enterprise (SME) ecosystem across key steps in the value chain. This will help build capability and capacity within the green energy sector in Singapore, and reduce reliance on overseas suppliers. Capacity building and capability transfers will likely be needed in the early phases to kickstart the development of such SMEs.

RECOMMENDATIONS

Recommendations

Based on industry feedback, this set of recommendations seeks to accelerate the adoption of clean energy within Singapore's data centre sector. These recommendations are clustered into five themes, aimed at creating a facilitative environment for successful green energy transition.

1. Establish clear and coordinated government leadership

Coordinated government leadership and transparent governance structures and processes are fundamental to guiding the significant long-term investments required for the energy transition.

- **Establish clear strategic policy direction from government leadership:** Long-term planning and commitment to strategic direction is one of Singapore's greatest assets, and will be particularly important in the green energy transition, given the uncertainty and large upfront investments. Clearer direction from all levels of the Singapore government and an integrated whole of government approach will be essential for Singapore to become a leader in green energy.

- **Create a unified inter-agency body:** A centralised "one-stop shop" should be formed to harmonise and streamline coordination across agencies with overlapping jurisdictions—such as JTC, EDB, IMDA, EMA, PUB, BCA, and NEA—on energy transition matters. This body would mitigate bureaucratic bottlenecks, conflicting requirements, and lengthy approval processes. A designated lead should be appointed to actively monitor and understand emerging technological advancements, enabling the integration of such innovations into the power ecosystem in a timely and effective manner.

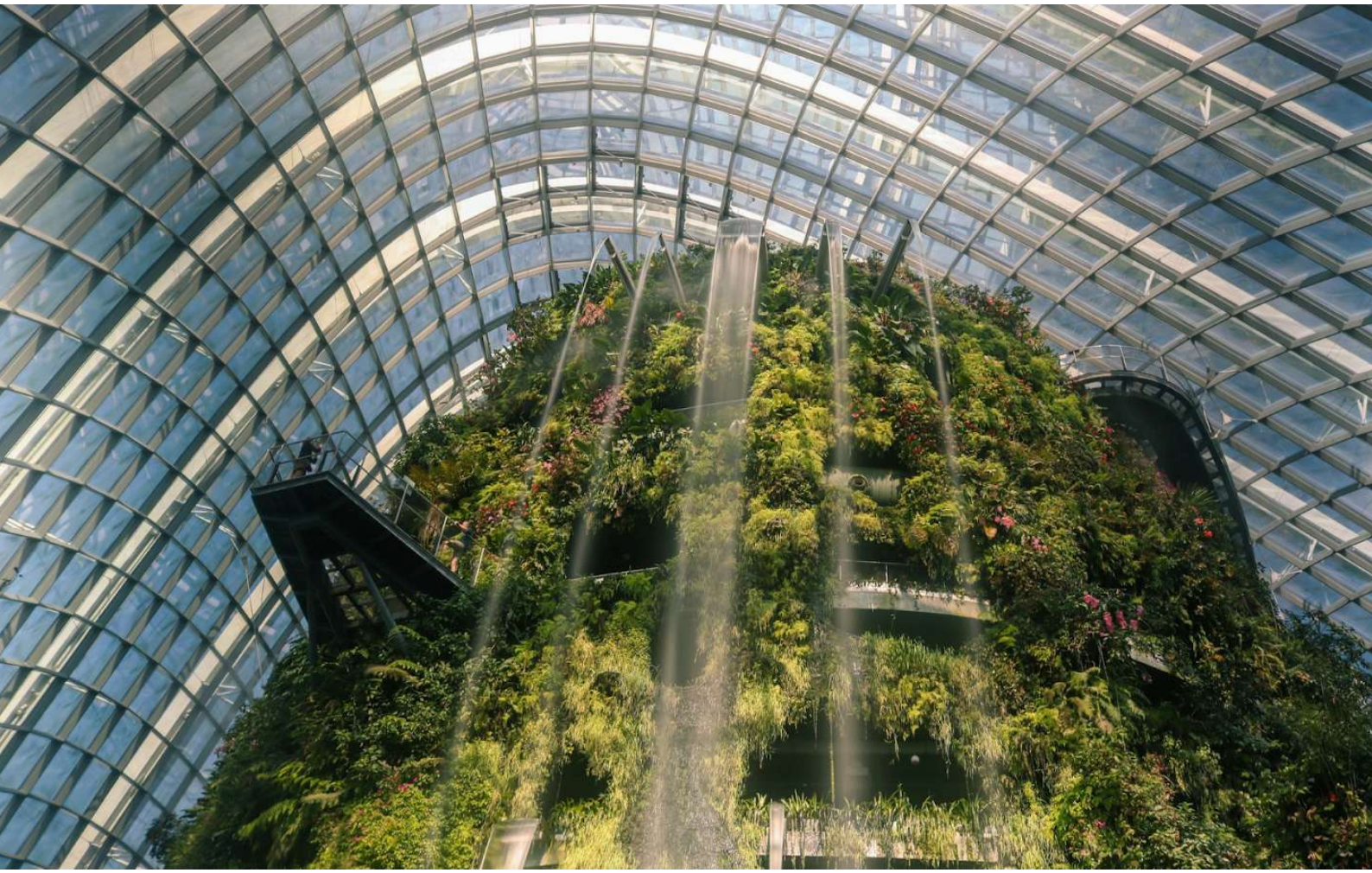
- **Assign dedicated personnel to drive green energy initiatives:** Key positions leading the energy transition in Singapore should be viewed as long-term appointments to help reduce uncertainty. Most top officials in the Singapore public service only serve for 3-5 years in their role. For long-cycle infrastructure investments in green energy, predictability, stability and availability of deep expertise is paramount. Developing and retaining institutional knowledge and competencies will be key success factors to manage these rapidly-evolving issues.

- **Develop flexible regulatory frameworks:** While a clear strategic direction is essential for a successful energy transition, excessive rigidity in implementation can hinder progress. To navigate the unpredictable twists and turns on the path to Singapore's green energy future, policies must remain adaptable and responsive. This calls not only for flexible regulatory frameworks, but also for proactive development of skillsets across the workforce to support emerging technologies and evolving industry needs. Striking the right balance between clarity, flexibility, and continuous capability-building will require close collaboration between government and industry stakeholders.

2. Secure energy supply and strengthen infrastructure

Addressing both domestic infrastructure and cross-border cooperation is essential for securing a diverse and resilient supply of green energy.

- **Strengthen government-to-government (G2G) engagement:** Successful cross-border energy import projects require more than Singapore government policies and initiatives. It is imperative to strengthen G2G engagement to navigate geopolitical and regulatory risks that cannot be borne by the private sector alone.
- **Drive national-level grid and transmission solutions:** The government should lead a national effort to address technical challenges at the transmission layer and in the power grid, especially to manage the grid stability issues that arise from an increased reliance on variable renewable energy sources.
- **Promote a diverse and future-ready energy mix:** The government should promote a diverse energy mix that includes mature technologies like solar and imports, while also actively cultivating future solutions. For long-term technologies like green hydrogen and ammonia, policies should move toward more pro-active facilitation by encouraging pilot-to-scale pathways tied to clear developmental guardrails such as cost-reduction targets, safety standards, robust certification (e.g., Guarantees of Origin), and carbon capture requirements where applicable.



3. Streamline procurement and standardise PPA agreements

Simplifying procurement and contractual processes that are designed for green energy pathways will lower barriers to entry and reduce transaction costs for industry players.

- **Co-develop risk-sharing mechanisms for early import projects:** To de-risk and encourage the early offtake agreements needed for large-scale import projects, the government should partner with industry to co-develop risk-sharing mechanisms. Rather than the public sector absorbing all the risk, this could involve targeted policy backstops for specific, uncontrollable risks (e.g., major regulatory changes or *force majeure* events). This collaborative approach will build confidence and enable corporate buyers to make early commitments, helping projects reach financial close.

- **Implement aggregated purchasing models as a complementary option**: To help smaller players overcome cost barriers and achieve economies of scale, a central entity for aggregated green energy procurement could be established, similar to the GasCo model. This should be positioned as a complementary pathway to support, not replace, the growing private market for direct and virtual PPAs. Preserving a dynamic market for private contracting is essential for fostering innovation and speed.

- **Streamline green energy procurement mechanisms:** To reduce uncertainty on key steps in the value chain, there is a need to develop clear transmission methodology and charging structures, for example, as well as for efforts at the national level to address challenges at the transmission layer and in the power grid. Procurement processes should be streamlined through standardisation and simplification. The use of standardised evaluation scorecards for different green energy types and vendor pre-qualification could improve transparency and efficiency.

- **Develop standardised Power Purchase Agreement (PPA) frameworks:** The government should work with industry to develop standardised PPA frameworks and model clauses suited to Singapore's legal environment. This will reduce the complexity and cost that arise from adapting foreign templates that are often not fit for purpose.

4. Introduce innovative financing and cost-reduction strategies

Direct financial interventions and innovative models are needed to bridge the current cost gap between green and conventional energy.

- **Investigate innovative financing and risk-sharing models:** Public-private partnerships and other innovative models should be explored to reduce the cost of capital for green energy projects. Government or green-focused entities will be better placed to pool and diversify risks across technologies and geographies.
- **Address high transmission costs:** Issues relating to the high infrastructure costs of energy imports should be handled at the national level. The establishment of Singapore Energy Interconnections (SGEI) is a positive step, and Singapore should continue to build on this.
- **Deploy government support to lower project costs:** Direct financial support should be provided for projects involving nascent technologies or high upfront capital expenditures. The Future Energy Fund (FEF), with its $10 billion in capital, will have a critical role to play in these cost-reduction strategies.

5. Foster deeper industry collaboration and capability development

A successful transition requires a whole-of-ecosystem approach that builds local capabilities and ensures long-term competitiveness.

- **Foster collaboration among key stakeholders:** The government should encourage open conversations and collaboration among all stakeholders across the value chain, from energy suppliers to consumers and technology providers. Engaging with platforms like SEAS and SGTech can provide consolidated and actionable industry feedback.
- **Provide deeper education on PPA mechanisms:** To address the limited understanding of complex green energy PPAs, a dedicated "Singapore PPA Centre of Excellence" could be established to drive broad education and training on PPAs, as well as provide a platform for PPA knowledge sharing. This could position Singapore as a domain leader, especially in the ASEAN region.
- **Focus on local ecosystem and SME development:** Emphasis should be placed on building a vibrant SME ecosystem within the green energy sector to develop local capacity and reduce reliance on overseas suppliers. This will help ensure Singapore's long-term competitiveness in the technology and sustainability sectors.

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